Chapter 3
Cooling system (liquid-cooled engines)

Refer to the beginning of Chapter 1 for model identification details

Contents

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

Thermostat

Opening temperature	69.5 to 72.5°C
Valve lift	3.5 mm at 80°C

Torque settings

Temperature gauge sender	6 to 8 Nm
Thermostat housing screws	3 to 4 Nm
Water pump mounting bolts (LEADER models)	3 to 4 Nm

1 General information

The cooling system uses a water/anti-freeze coolant to carry excess energy away from the engine in the form of heat. The cylinder is surrounded by a water jacket through which the coolant is circulated by thermo-syphonic action in conjunction with a water pump. On early models, the pump is mounted inside the crankcases and is driven by a shaft running off the oil pump. On LEADER engined models, the water pump is mounted externally on the alternator cover.

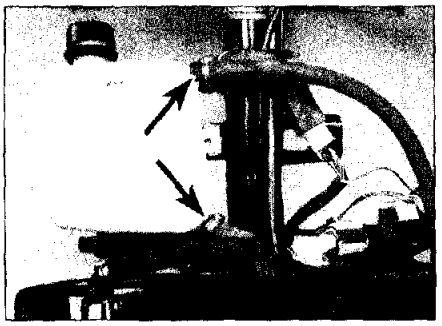
The heated coolant passes upwards to the thermostat and through to the radiator. The coolant then flows across the radiator core, where it is cooled by the passing air, to the water pump and back to the engine where the cycle is repeated.

A thermostat is fitted in the system to prevent the coolant flowing through the radiator when the engine is cold, therefore accelerating the speed at which the engine reaches normal operating temperature. A coolant temperature sender mounted in the cylinder head transmits information to the temperature gauge on the instrument panel. On Hexagon and LEADER engined models, a thermostatically-controlled cooling fan is fitted behind the radiator to aid cooling in extreme conditions. On liquid-cooled LEADER engined models, a coolant circuit from the thermostat housing supplies the heater mounted on the right-hand side of the carburettor (see Chapter 4).

Warning: Do not remove the reservoir cap when the engine is hot. Scalding hot coolant and steam may be blown out under pressure, which could cause serious injury.

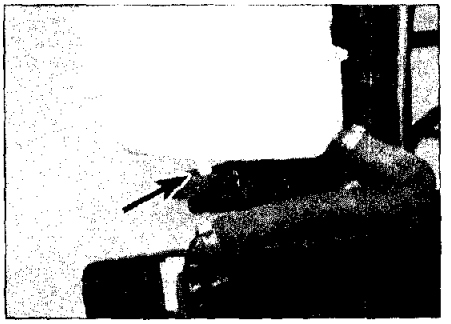
Warning: Do not allow anti-freeze to come in contact with your skin or painted or plastic surfaces of the scooter. Rinse off any spills immediately with plenty of water. Anti-freeze is highly toxic if ingested. Never leave anti-freeze lying around in an open container or in puddles on the floor; children and pets are attracted by its sweet smell and may drink it. Check with the local authorities about disposing of used anti-freeze. Many communities will have collection centres which will see that anti-freeze is disposed of safely.

Caution: At all times use the specified type of anti-freeze, and always mix it with distilled water in the correct proportion. The anti-freeze contains corrosion inhibitors which are essential to avoid damage to the cooling system. A lack of these inhibitors could lead to a build-up of corrosion which would block the coolant passages, resulting in overheating and severe engine damage. Distilled water must be used rather than tap water to avoid a build-up of scale which would also block the passages.



2.2 Detach the hoses (arrowed) and drain the reservoir

2.4a Remove the seal from the reservoir neck



2.4b Note how the lugs locate in the grommets (arrow)

2 Coolant reservoir – removal and installation

Removal

Warning: Ensure that the engine is cold before working on the coolant reservoir.

1 The coolant reservoir is located at the front of the scooter and is housed within the front bodywork panels. Remove the panels for access (see Chapter 7).

2 Release the clip securing the hose to the top of the reservoir and detach the hose **(see illustration)**.

3 Place a suitable container underneath the reservoir, then release the clip securing the hose to the base of the reservoir. Detach the hose and allow the coolant to drain into the container **(see illustration 2.2)**.

4 Unscrew the reservoir mounting screw (where fitted). If not already done, unscrew the reservoir cap and remove the seal around the reservoir neck **(see illustration)**. Lift out the reservoir, noting how the lugs locate in the bracket **(see illustration)**.

Installation

5 Installation is the reverse of removal. Make sure the hoses are correctly installed and secured with their clips. On completion, refill the reservoir as described in Chapter 1.

3 Cooling fan, motor and switch – check and renewal

Cooling fan and motor

Check

1 If the engine is overheating and the cooling fan isn't coming on, first check the cooling fan circuit fuse (see Chapter 9) and then the fan switch as described in Steps 8 and 9 below.

2 If the fan does not come on (and the fan switch is good), the fault lies in either the cooling fan motor or the relevant wiring. Test all the wiring and connections as described in Chapter 9.

3 To test the cooling fan motor, remove the front bodywork panels (see Chapter 7), and disconnect the fan wiring connector **(see illustration)**. Using a 12 volt battery and two jumper wires, connect the battery positive (+ve) lead to the red/black wire terminal and the battery negative (-ve) lead to the green wire terminal on the fan motor side of the connector. Once connected the fan should operate. If it does not, and the wiring is all good, then the fan motor is faulty. Individual components are not available for the fan assembly.

Renewal

Warning: The engine must be completely cool before carrying out this procedure.

4 Disconnect the battery negative (-ve) lead.

5 If required, remove the radiator (see Section 6). Remove the screws securing the fan assembly to the radiator and separate them, noting how they fit **(see illustration)**. If fitted, slacken the clamp securing the fan shroud to the motor and draw the shroud off.

6 Installation is the reverse of removal.

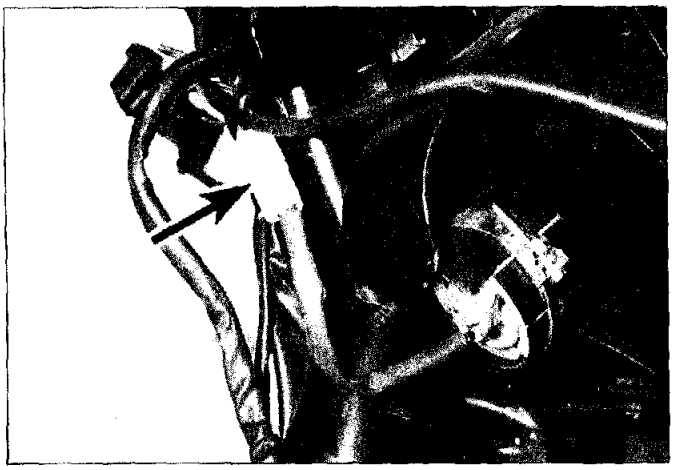
7 Install the radiator (see Section 6). Reconnect the battery (-ve) lead.

Cooling fan switch

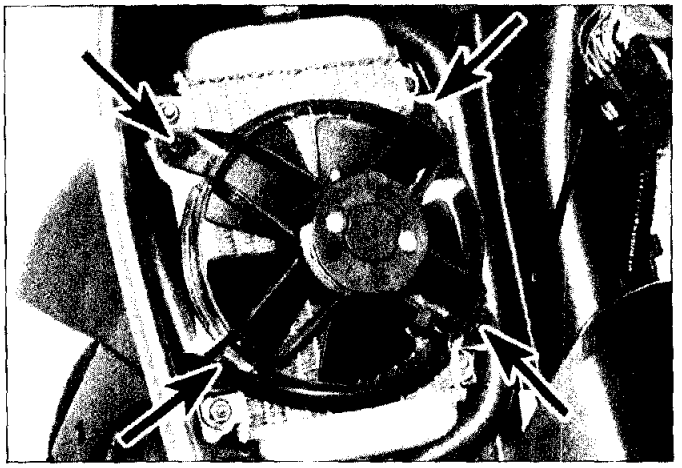
Check

8 If the engine is overheating and the cooling fan isn't coming on, first check the cooling fan circuit fuse (see Chapter 9). If the fuse is blown, check the fan circuit for a short to earth (see the wiring diagrams at the end of this book).

9 If the fuse is good, remove the front bodywork panels (see Chapter 7), and disconnect the wiring connectors from the fan switch. On all scooters except GT125/200 models, the switch is on the side of the



3.3 Disconnect the fan wiring connector (arrowed)



3.5 Fan assembly is secured by four screws (arrowed) – GT200 shown

radiator **(see illustration)**. On all GT models, the switch is located on the coolant union underneath the floor panel below the right-hand radiator **(see illustration)**. Using a jumper wire, connect the wiring connector terminals together. The fan should come on when the ignition is turned ON. If it does, the fan switch is confirmed faulty and must be renewed. If it does not come on, the fan should be tested (see Step 3).

10 If the fan is on the whole time, even when the engine is cold, disconnect the wiring connectors and keep them apart. The fan should stop. If it does, the fan switch is defective and must be renewed. If it keeps running, check the wiring between the switch and the fan motor for a short to earth.

Renewal

Warning: The engine must be completely cool before carrying out this procedure.

11 Disconnect the battery negative (-ve) lead. Drain the cooling system (see Chapter 1).

12 Remove the front bodywork panels to access the fan switch (see Chapter 7). Disconnect the wiring connectors from the switch, then unscrew it and withdraw it from the radiator or coolant union, as applicable. Discard the seal, as a new one must be used.

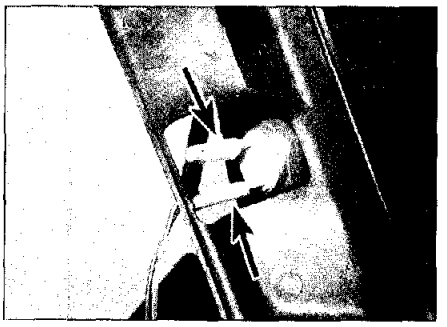
13 Apply a suitable sealant to the switch threads, then install the switch using a new seal and tighten it securely. Take care not to overtighten the switch as the radiator could be damaged.

14 Reconnect the switch wiring and refill the cooling system (see Chapter 1). Reconnect the battery (-ve) lead.

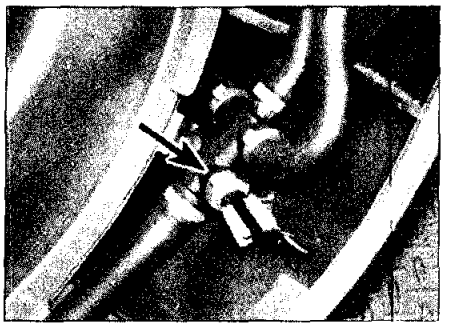
4 Coolant temperature gauge/ warning light and sender – check and renewal

Check

1 The circuit consists of the sender mounted on the cylinder head and the gauge assembly or coolant warning light (as applicable) mounted in the instrument panel. If the system malfunctions, check first that the battery is fully-charged and that the fuses are all good. In the case of models with a warning light check that the bulb has not blown (see Chapter 9).



3.9a Disconnect the fan switch wiring connectors (arrowed)



3.9b Location of the fan switch on GT models

2 If the gauge is not working, or to test the warning light circuit, remove the access panel for the engine (see Chapter 7). Pull the rubber cover off the terminal and disconnect the wire from the sender, then turn the ignition switch ON **(see illustrations)**. The temperature gauge needle should be on the (C) on the gauge, or the bulb should be extinguished. Now earth the sender wire on the engine. The needle should swing immediately over to the (H) on the gauge or the bulb should illuminate. If the gauge or warning light operate as described above, the sender is proven defective and must be renewed.

Caution: Do not earth the wire for any longer than is necessary to take the reading, or the gauge may be damaged.

3 If the needle movement is still faulty, or if it does not move at all, the fault lies in the wiring or the gauge itself. Check all the relevant wiring and wiring connectors (see Chapter 9). If all appears to be well, the gauge is defective and must be renewed. If the bulb does not illuminate and has not blown, check the bulb wiring and wiring connectors.

Renewal

4 The temperature gauge is integral with the instrument cluster, for which individual instruments are not available. If the gauge is faulty, the entire cluster must be renewed (See Chapter 9). For warning light bulb renewal refer to Chapter 9.

Warning: The engine must be completely cool before carrying out this procedure.

5 To renew the sender, first drain the cooling system (see Chapter 1). Disconnect the battery negative (-ve) lead.

6 Disconnect the sender wiring connector **(see illustrations 4.2b)**. Unscrew the sender from the cylinder head.

7 Apply a smear of sealant to the threads of the new sender, then install it into the cylinder head and tighten it to the specified torque. Connect the sender wiring.

8 Refill the cooling system (see Chapter 1). Reconnect the battery negative (-ve) lead.

5 Thermostat – removal, check and installation

Warning: The engine must be completely cool before carrying out this procedure.

Removal

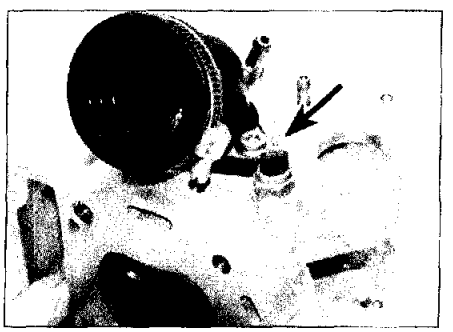
1 The thermostat is automatic in operation and should give many years service without requiring attention. In the event of a failure, the valve will probably jam open, in which case the engine will take much longer than normal to warm-up. Conversely, if the valve jams shut, the coolant will be unable to circulate and the engine will overheat. Neither condition is acceptable, and the fault must be investigated promptly.

2 Remove the access panel to the engine (see Chapter 7) and drain the cooling system (see Chapter 1).

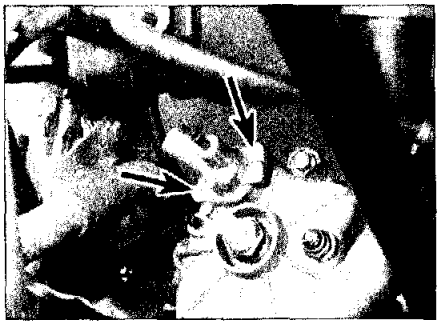
3 The thermostat is located in the cylinder head. Detach the hoses from the thermostat housing if required, though it is not necessary.

4.2a Lift off the rubber cover (arrowed) . . .

4.2b . . . and disconnect the wiring connector from the sender



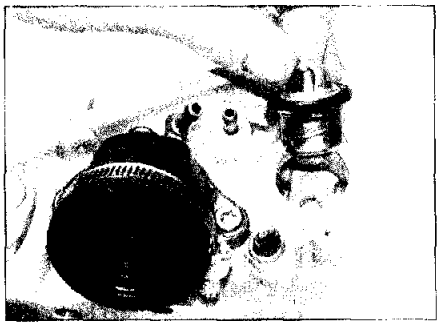
4.2c Location of the sender (arrowed) on the LEADER cylinder head



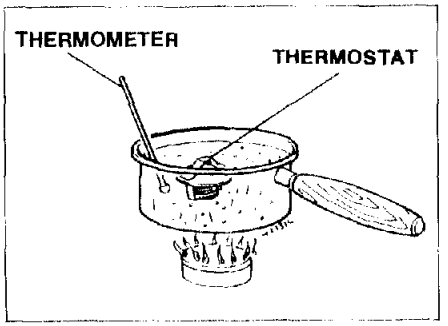
5.3a On two-stroke engines remove the screws (arrowed)

5.3b On LEADER engines remove the screws (arrowed)

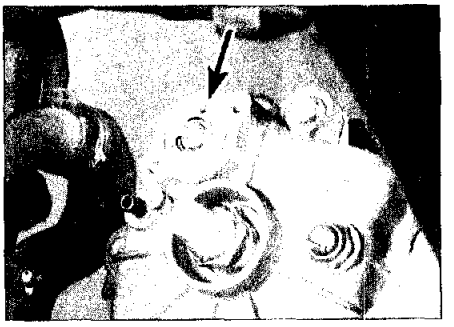
5.3c Removing the thermostat on two-stroke engines



5.3d Removing the thermostat on LEADER engines



5.5 Set-up for testing the thermostat



5.7 On two-stroke engines, locate the cut-out over the lug (arrowed)

Remove the two screws securing the housing and remove the housing **(see illustrations)**. Lift out the thermostat, noting how it fits **(see illustrations)**. Discard the cover O-ring, if fitted, as a new one must be used.

Check

4 Examine the thermostat visually before carrying out the test. If it remains in the open position at room temperature, it should be renewed.

5 Suspend the thermostat in a container of cold water. Place a thermometer capable of reading temperatures up to 100°C in the water so that the bulb is close to the thermostat **(see illustration)**. Heat the water, noting the temperature when the thermostat opens, and compare the result with the specifications given at the beginning of this Chapter. Also check the amount the valve opens after it has been heated at 80°C for a few minutes and compare the measurement to the specifications. If the readings obtained differ from those given, the thermostat is faulty and must be renewed.

6 In the event of the thermostat jamming closed, ***as an emergency measure only***, it can be removed and the machine used without it. **Note:** *Take care when starting the engine from cold, as it will take much longer than usual to warm-up.* Ensure that a new unit is installed as soon as possible.

Installation

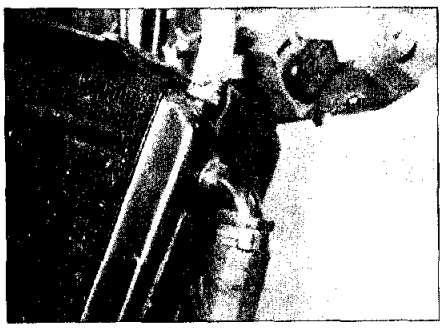
7 Fit the thermostat into the cylinder head. On two-stroke engines, locate the cut-out around the lug, making sure that the thermostat seats correctly **(see illustration)**.

8 If applicable, fit a new O-ring onto the housing, using a dab of grease to keep it in place if required **(see illustration)**.

9 Fit the housing, then install the two screws and tighten them to the specified torque **(see illustrations 5.3a or 5.3b)**.

10 Refill the cooling system (see Chapter 1).

5.8 Fit a new O-ring into the groove in the housing



6.3 Release the clips and detach the hoses

6 Radiator – removal and installation

Warning: The engine must be completely cool before carrying out this procedure.

Removal

1 Disconnect the battery negative (-ve) lead. Remove the front bodywork panels (see Chapter 7) and drain the cooling system (see Chapter 1).

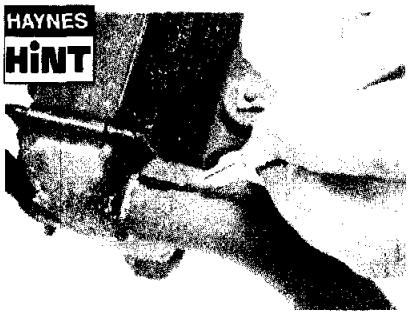
2 If applicable, disconnect the fan motor wiring connector and the wiring connectors from the fan switch in the radiator **(see illustrations 3.3 and 3.9a)**.

3 Slacken the clips securing the radiator hoses to the radiator and detach them from the radiator **(see illustration and Haynes hint)**.

Caution: The radiator unions are fragile. Do not use excessive force when attempting to remove the hoses.

4 Remove the screws securing the radiator to the frame **(see illustration)**. Lift the radiator off; note that on some models, lugs on the bottom of the shroud or radiator body fit into grommets in the frame **(see illustration)**.

5 If necessary, separate the cooling fan from the radiator (see Section 3).



If a radiator hose is corroded in place on its union, slit it with a sharp knife and peel it off the union. A new hose will obviously be needed.

6 Check the radiator for signs of damage and clear any dirt or debris that might obstruct airflow and inhibit cooling (see Chapter 1, Section 9). If the radiator fins are badly damaged or broken the radiator must be renewed. Also check the rubber mounting grommets, and renew them if necessary.

Installation

7 Installation is the reverse of removal, noting the following.

a) Make sure the locating lugs fit correctly into the rubber grommets.

b) Make sure that the fan wiring is correctly connected.

c) Ensure the coolant hoses are in good condition (see Chapter 1, Section 9), and are securely retained by their clips; fit new clips if necessary.

d) On completion refill the cooling system as described in Chapter 1.

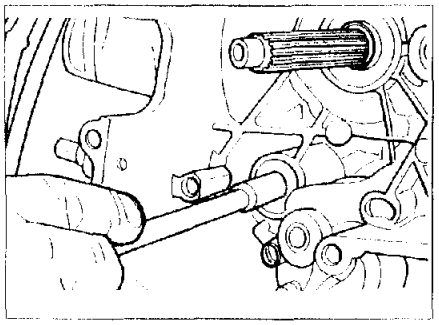
e) Reconnect the battery negative (-ve) lead.

7 Water pump – check, removal and installation

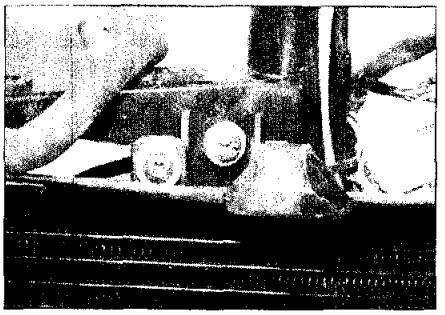
Non-LEADER engines

Check

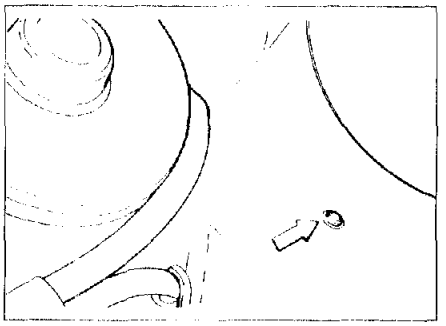
1 The water pump is located within the crankcase. The pump is driven by a shaft which is driven by the oil pump.



7.7a Water pump shaft must be unscrewed clockwise



6.4a Remove the screw securing the assembly to the frame



7.2 Water pump seal drainage hole (arrowed) in crankcase left-hand half

2 A seal prevents leakage of coolant from the pump housing into the crankcase. A drainage hole on the left-hand crankcase half drains any coolant should the seal fail. If the drainage hole shows signs of leakage, the pump shaft must be removed and the seal renewed **(see illustration)**.

Removal

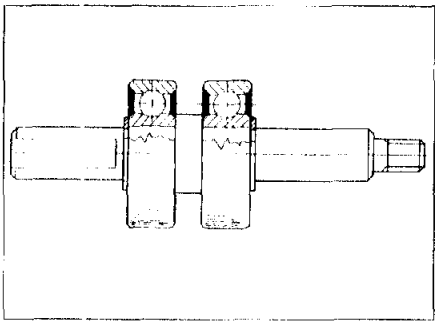
Note: *If the crankcase halves are being separated, the water pump assembly can be removed afterwards (see Chapter 2B).*

3 Drain the coolant (see Chapter 1) and remove the alternator cover (see Chapter 2B).

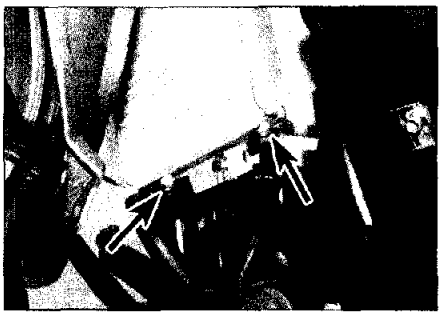
4 Remove the screw or screws securing the coolant pipe bracket and pull the pipe out of its bore in the right-hand crankcase half, below the alternator **(see illustration)**. Discard the pipe O-ring as a new one must be used.

5 Remove the oil pump and its drivebelt and driven pulley (see Chapter 2B).

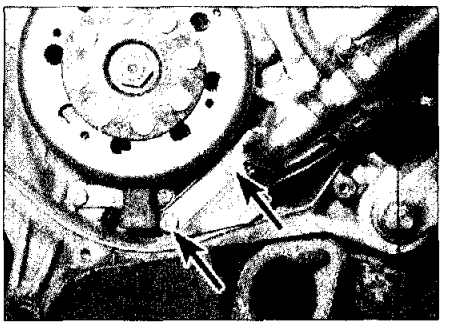
6 Remove the water pump driveshaft star clip



7.7b Cross-section of water pump shaft complete with bearings



6.4b Radiator is supported in rubber grommets – X8 shown

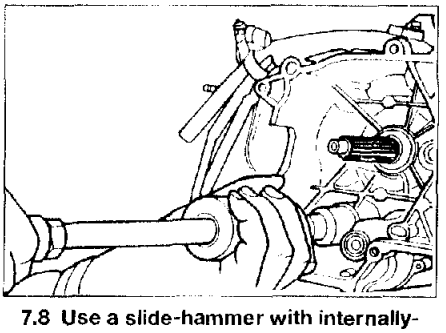


7.4 Remove the screws (arrowed) and pull the coolant pipe out of its bore

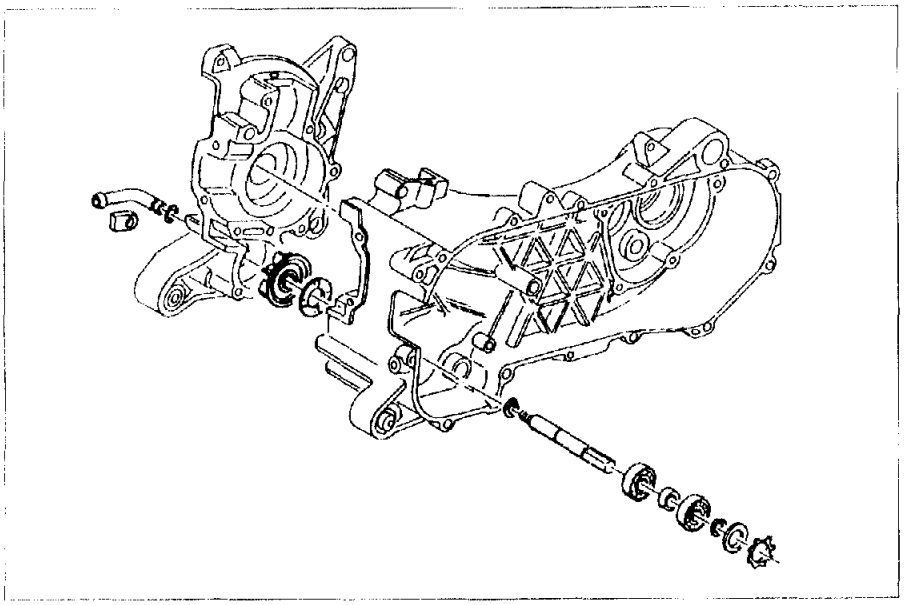
and discard it, as a new one must be used, then remove the washer from behind the star clip **(see illustration 7.9)**.

7 Locate an 8 mm socket wrench through the water pipe bore in the right-hand crankcase half and locate it on the hexagon in the centre of the pump impeller. Hold the left-hand end of the pump shaft to prevent it turning, then unscrew the impeller, noting that it has a **left-hand thread** and must therefore be unscrewed in a clockwise direction **(see illustration)**. Draw the shaft, complete with its bearings, out of the crankcase. Check the condition of the bearings on the shaft. If they do not run smoothly and freely the shaft must be renewed as the bearings are not available individually. The new shaft will be supplied with the bearings already in place **(see illustration)**.

8 Using an expanding bearing/seal puller and slide-hammer attachment, remove the water pump seal and discard it **(see illustration)**.



7.8 Use a slide-hammer with internally-expanding attachment to extract the water pump seal



7.9 Water pump assembly for liquid-cooled two-stroke engines

9 To remove the water pump impeller, the crankcase halves must be separated (see Chapter 2B). The impeller can then be lifted out of its housing **(see illustration)**.

Installation

10 If the crankcases have been split, install the water pump assembly before joining the crankcase halves (see Chapter 2B).

11 If the crankcases have not been disassembled, first ensure the seal housing is clean, then oil the seal and fit it into the housing, making sure it fits squarely. Use a drift which bears on the outer edge of the seal to drive it into the crankcase; ensure that the drainage hole in the crankcase remains uncovered.

12 Press the pump shaft and bearings into the crankcase. Support the impeller with the 8 mm socket as on removal and locate the impeller onto the end of the shaft. Hold the shaft to prevent it turning and thread on the impeller, not forgetting that it has a **left-hand thread** and must therefore be tightened anti-clockwise.

13 Fit the washer onto the end of the shaft, then fit a new star clip.

14 Install the oil pump and its drivebelt and gear (see Chapter 2B).

15 Fit a new O-ring onto the water pipe and fit it into its bore, then fit the bracket screw(s) **(see illustration 7.4)**.

16 Fit the alternator cover and refill the cooling system (see Chapter 1).

LEADER engines

Check

17 The water pump is located on the alternator cover **(see illustration)**. The pump is driven via dampers on the alternator rotor **(see illustration 7.29)**.

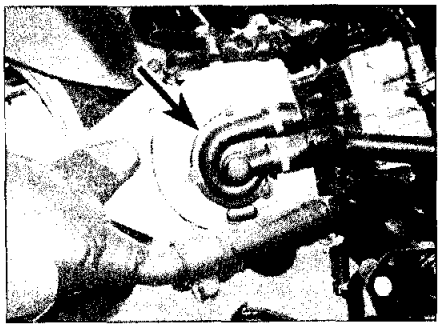
18 The pump body to alternator cover joint is sealed by an O-ring. A ceramic seal and rubber gasket in the alternator cover prevents coolant leaking down the pump impeller shaft into the cover. A hole in the bottom of the cover drains any coolant should the seal fail. If the drainage hole shows signs of leakage, the pump impeller must be removed and the seal renewed.

Removal

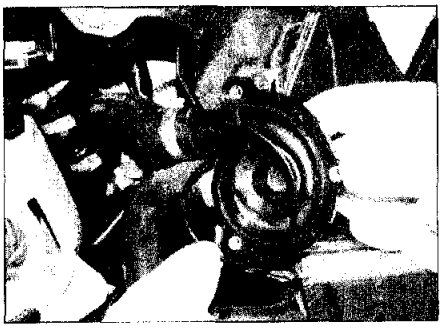
19 Drain the cooling system and disconnect the coolant hoses from the water pump (see Chapter 1). Undo the screws securing the pump body and lift it off; discard the O-ring, as a new one must be used **(see illustrations)**.

20 Remove the alternator cover (see Chapter 2F).

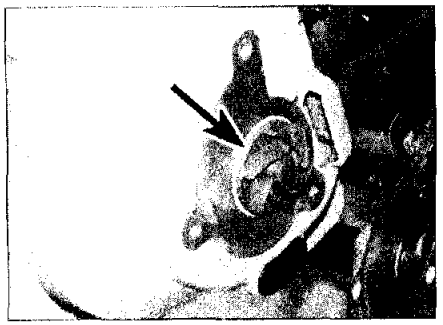
21 The impeller is a press-fit in the pump bearings **(see illustration)**. The remove the impeller, support the alternator cover upside down on the work surface with sufficient clearance below it to allow the impeller to be driven out **(see illustration)**. **Note:** *Take great care not to damage the sealing surface of the*



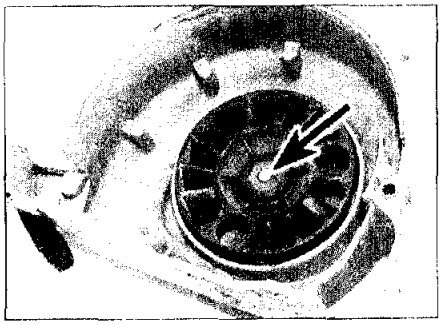
7.17 Location of the water pump on LEADER engines



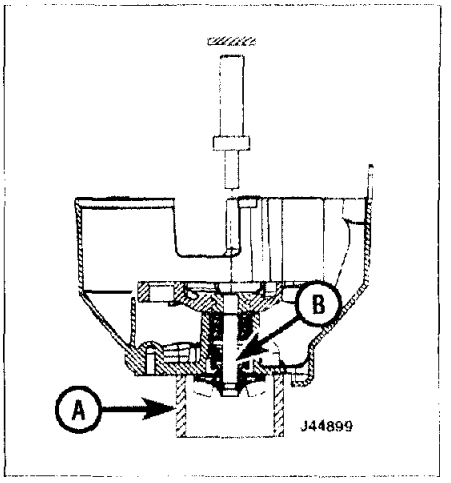
7.19a Note how the O-ring locates in the pump body



7.19b Pump impeller (arrowed) is located in the alternator cover



7.21a Location of the pump impeller shaft (arrowed)



7.21b Place a suitable support (A) under the cover to drive out the impeller (B)

alternator cover. Use a soft drift (preferably aluminium or brass) to carefully drive the impeller out.

22 Turn the cover over and carefully lever out the seal **(see illustration)**. Take care not to damage the edge of the seal housing. Lift out the rubber gasket. **Note:** *Once the seal and gasket are removed new ones must be fitted; do not re-use the old seal and gasket.*

23 Check the condition of the two bearings in the alternator cover. If they do not run smoothly they must be renewed. Note the position of the bearings; the innermost bearing is fitted flush with the inside lip of the bearing housing in the cover. Support the cover so that it is level, then use a suitable drift to drive the bearings out **(see illustration)**. If the bearings are a tight fit, heat the housing inside the cover with a hot air gun. **Note:** *Heat the cover gently to avoid damaging the paint finish.*

24 Ensure the bearing housing is clean and free from corrosion, then heat the housing again to aid fitting the new bearings. Install the bearings from the inside of the cover and ensure that the first (outermost) bearing fits against its seat before driving in the second bearing with a suitable socket or bearing driver.

25 Check the impeller for wear and damage. If the shaft is corroded, fit a new impeller.

Installation

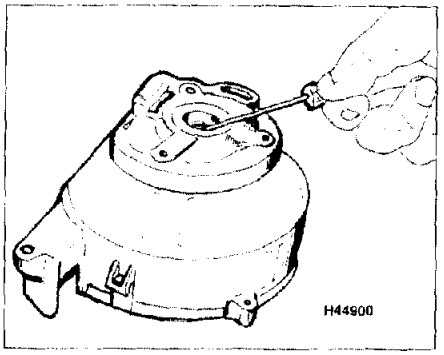
26 Lubricate the new gasket and ceramic seal with anti-freeze and press them carefully into place with a suitably-sized socket.

27 To prevent the bearings being displaced when the impeller is fitted, support them from the inside of the cover, leaving sufficient space for the impeller shaft when it is installed. Carefully press the impeller shaft into the bearings from the outside. Ensure the impeller turns freely once fitted.

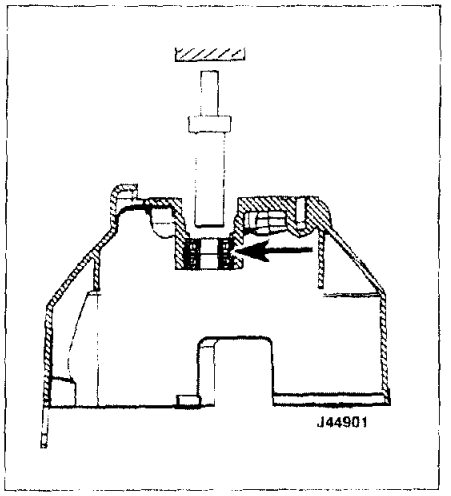
28 Fit a new O-ring into the groove in the pump body, then install the pump body and tighten the screws to the specified torque setting.

29 Align the dampers on the alternator rotor with the pump drive and install the alternator cover **(see illustration)**.

30 Refill the cooling system (see Chapter 1).



7.22 Lever out the impeller seal



7.23 Location of the water pump bearings (arrowed)

8 Coolant hoses – removal and installation

Removal

1 Before removing a hose, drain the coolant (see Chapter 1).

2 Release or slacken the hose clips, either with a screwdriver or pliers depending upon the design of the clip, then slide them back along the hose and clear of the union spigot **(see illustrations)**. **Note:** *Some clips cannot be re-used – check before removing a coolant hose and be prepared to fit new clips of the correct size.*

3 Pull the hose off its union. If a hose proves stubborn, release it by rotating it on its union before working it off. If all else fails, slit the hose with a sharp knife at each union (see ***Haynes hint*** in Section 6).

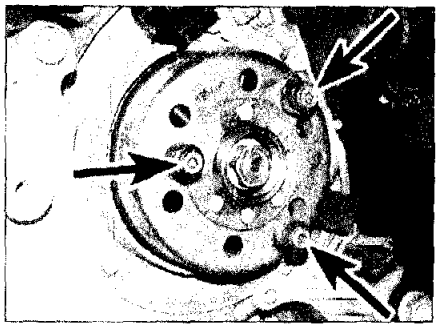
Caution: The radiator unions are fragile. Do not use excessive force when attempting to remove the hoses.

Installation

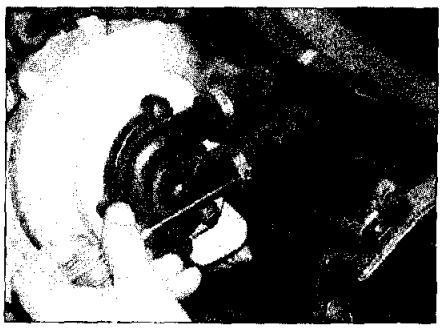
4 Slide the clips onto the hose and then work it on to its respective unions.

> **HAYNES HiNT** ***If the hose is difficult to push on its union, it can be softened by soaking it in very hot water, or alternatively a little soapy water can be used as a lubricant.***

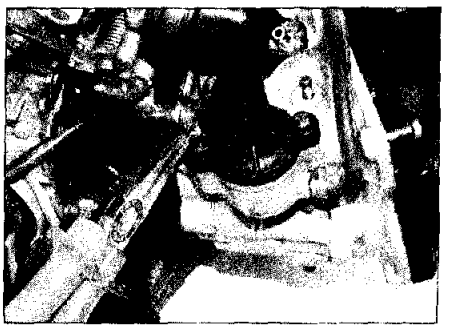
5 Rotate the hose on its unions to settle it in position before sliding the clips into place and tightening them securely.



7.29 Align the pump drive dampers (arrowed)



8.2a Release the clip with a screwdriver . . .



8.2b . . . or with pliers as required

Notes

Chapter 4
Fuel and exhaust systems

Refer to the beginning of Chapter 1 for model identification details

Contents

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

Fuel

Fuel type and tank capacity	see Chapter 1

Automatic choke

Resistance @ 20°C	
Keihin carburettor	20 ohms
All others	30 to 40 ohms
Plunger protrusion	
Walbro carburettor	
Initial @ 20°C	12.5 to 13.0 mm
Final (after 5 minutes constant power)	18.5 to 19.0 mm
Keihin carburettor	10.0 mm
All others	
Initial @ 22°C	10.9 to 11.5 mm
Final (after 5 minutes constant power)	14.0 to 15.0 mm

Sfera 50 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12
Pilot screw setting (turns out)	
With 0.8 mm thread pitch	2 to 2 1/4 turns out
With 0.5 mm thread pitch	3 1/2 to 4 turns out
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	56
Needle (clip position)	SA2 (3rd notch from top)

Sfera 50 (RST model) with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	36
Main jet	70
Needle (clip position)	A12 (2nd notch from top)

Sfera 50 (RST model) with Weber carburettor

Type/ID no.	Weber 12 OM
Pilot screw setting (turns out)	not available
Fuel level	3.5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	78
Needle (clip position)	F (3rd notch from top)

Sfera 80 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 17.5
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	65
Needle (clip position)	A7 (3rd notch from top)

Sfera 125 with Mikuni carburettor

Type/ID no.	Mikuni BS24-1J
Pilot screw setting (turns out)	not available
Float height	12.2 mm
Idle speed	see Chapter 1
Starter jet	40
Pilot jet	20
Main jet	87.5
Needle (clip position)	4CZ6 (3rd notch from top)

Typhoon 50 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	36
Main jet	70
Needle (clip position)	A12 (2nd notch from top)

Typhoon 80 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 17.5
Pilot screw setting (turns out)	4 1/2
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	34
Main jet	62
Needle (clip position)	A7 (4th notch from top)

Typhoon 125 with Mikuni carburettor

Type/ID no.	Mikuni VM 20-325
Pilot screw setting (turns out)	1 3/8
Fuel level	3.5 ± 0.5 mm
Idle speed	see Chapter 1
Starter jet	40
Pilot jet	35
Main jet	82.5
Needle (clip position)	3CK01 (3rd notch from top)

Zip and early Zip RST with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12 DD
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	38
Main jet	70 (Zip), 72 (Zip RST)
Needle (clip position)	A15 (2nd notch from top)

Later Zip RST with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12 DD
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	35
Main jet	72
Needle (clip position)	A29 (3rd notch from top)

Zip SP with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHV12 QD
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	75
Needle (clip position)	SA2 (3rd notch from top)

Zip 50 and Typhoon 50 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 17.5 RD
Pilot screw setting (turns out)	1 1/2
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	32
Main jet	56 (Zip), 53 (Typhoon)
Needle (clip position)	A22 (1st notch from top)

ET4 50, Liberty 50 4T and Zip 50 4T with Keihin carburettor

Type/ID no.	Keihin CVK 18
Pilot screw setting (turns out)	not available
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	35
Main jet	75
Needle (clip position)	NACA (not adjustable)

Zip 100 4T and Fly 100 4T with Keihin carburettor

Type/ID no.	Keihin CVK 20
Pilot screw setting (turns out)	2 3/8
Float height	not available
Idle speed	see Chapter 1
Starter jet	48
Pilot jet	45
Main jet	75
Needle (clip position)	4REEG (not adjustable)

Skipper with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVB 20.5
Pilot screw setting (turns out)	2 to 2 1/4
Fuel level	5.0 ± 0.5 mm
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	45
Main jet	86
Needle (clip position)	M6 (2nd notch from top)

Skipper with Mikuni carburettor

Type/ID no.	Mikuni VM 20
Pilot screw setting (turns out)	1 3/8
Fuel level	3.5 ± 0.5 mm
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	35
Main jet	82.5
Needle (clip position)	3CK01 (3rd notch from top)

Skipper ST125 and Zip 125 with Walbro carburettor

Type/ID no.	Walbro WVF/6A
Pilot screw setting (turns out)	not available
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	48
Pilot jet	34
Main jet	82
Needle (clip position)	52K (2nd/3rd notch from top)

NRG MC² with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 12DD
Pilot screw setting (turns out)	not available
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	60
Pilot jet	38
Main jet	66
Needle (clip position)	A15 (2nd notch from top)

NRG MC³ DT and DD, NRG Power DT and DD, Fly 50, LX2 50, and LXV 50 with Dell'Orto carburettor

Type/ID no.	Dell'Orto PHVA 17.5RD
Pilot screw setting (turns out)	1 1/2
Fuel level	5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	32
Main jet	53
Needle (clip position)	A22 (1st notch from top)

Zip RST, Zip SP/RS and NRG MC² with Weber carburettor

Type/ID no.	Weber 12 OM
Pilot screw setting (turns out)	not available
Fuel level	3.5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	75
Needle (clip position)	S (3rd notch from top)

Hexagon with Mikuni carburettor

Type/ID no.	Mikuni VM 20-315
Pilot screw setting (turns out)	1 3/8
Fuel level	3.5 ± 0.5 mm
Idle speed	see Chapter 1
Starter jet	40
Pilot jet	35
Main jet	82.5
Needle (clip position)	3CK01 (3rd notch from top)

Super Hexagon with Walbro carburettor

Type/ID no.	Walbro WVF/7A
Pilot screw setting (turns out)	3
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	108
Needle (clip position)	51c (2nd notch from top)

Liberty 50 with Weber carburettor

Type/ID no.	Weber 12 OM
Pilot screw setting (turns out)	not available
Fuel level	3.5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	38 L
Main jet	63
Needle (clip position)	V (2nd notch from top)

Liberty 125 with Walbro carburettor

Type/ID no.	Walbro WVF/6B
Pilot screw setting (turns out)	not available
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	48
Pilot jet	33
Main jet	84
Needle (clip position)	52K (2nd/3rd notch from top)

ET2 with Weber carburettor

Type/ID no.	Weber 12 OM
Pilot screw setting (turns out)	2 1/2 to 3 1/2
Fuel level	3.5 mm (not adjustable)
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	34
Main jet	76
Needle (clip position)	V (2nd notch from top)

Fly 50 4T and LX4 50 with Keihin carburettor

Type/ID no.	Keihin CVK 18
Pilot screw setting (turns out)	1 3/4
Float height	not available
Idle speed	see Chapter 1
Starter jet	40
Pilot jet	35
Main jet	75
Needle	NGBA

ET4 125 with Mikuni carburettor

Type/ID no.	Mikuni BS24-J
Pilot screw setting (turns out)	not available
Float height	12.2 mm
Idle speed	see Chapter 1
Starter jet	35
Pilot jet	20
Main jet	87.5
Needle (clip position)	4CZ6 (2nd notch from top)

Fly 125, LX4 125 and Liberty 125 up to 2007 with Keihin carburettor

Type/ID no.	Keihin CVEK 26
Pilot screw setting (turns out)	1 3/4
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	35
Main jet	82
Needle	NELA

LX4 125 Euro 3 and LXV125 with Keihin carburettor

Type/ID no.	Keihin CVEK 26
Pilot screw setting (turns out)	2 ½ (2 on LXV)
Float height	not available
Idle speed	see Chapter 1
Starter jet	35
Pilot jet	42
Main jet	82
Needle (clip position)	NJHA (NELA on LXV)

Liberty 125 (2008-on) with Keihin carburettor

Type/ID no.	Keihin CVEK 27
Pilot screw setting (turns out)	2 1/2
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	42
Main jet	82
Needle (clip position)	NJHA (not adjustable)

X8 125 and GT125 with Walbro carburettor

Type/ID no.	Walbro WVF/7R
Pilot screw setting (turns out)	2 7/8
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	48
Pilot jet	38
Main jet	103
Needle (clip position)	653 (2nd notch from top)

X8 125 Euro 3 with Keihin carburettor

Type/ID no.	Keihin CVK 30
Pilot screw setting (turns out)	1 1/2
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	38
Main jet	105
Needle	305 D

X9 125 with Walbro carburettor

Type/ID no.	Walbro WVF/7C
Pilot screw setting (turns out)	not available
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	36
Main jet	110
Needle (clip position)	51C (2nd notch from top)

X9 125 Euro 3 with Keihin carburettor

Type/ID no.	Keihin CVK 30
Pilot screw setting (turns out)	2
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	35
Main jet	105
Needle (clip position)	NDYA (not adjustable)

B125 with Walbro carburettor

Type/ID no.	Walbro WVF/7G
Pilot screw setting (turns out)	2 5/8
Float height	see text
Idle speed	see Chapter 1
Starter jet	50
Pilot jet	36
Main jet	108
Needle (clip position)	51c (2nd notch from top)

GT125, GTV125 and B125 with Keihin carburettor

Type/ID no.	Keihin CVEK 30
Pilot screw setting (turns out)	2
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	38 (35 on B125)
Main jet	98 (105 on B125)
Needle	NDVA (304 D on B125)

GTS125 with Keihin carburettor

Type/ID no.	Keihin CVEK 30
Pilot screw setting (turns out)	1
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	38
Main jet	108
Needle	NDYB

GT200 with Keihin carburettor

Type/ID no.	Keihin CVEK 30
Pilot screw setting (turns out)	2 1/4
Float height	not available
Idle speed	see Chapter 1
Starter jet	42
Pilot jet	38
Main jet	92
Needle	NDAA

GT200 with Walbro carburettor

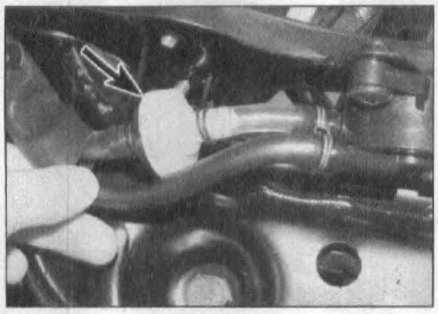
Type/ID no.	Walbro WVF/7P
Pilot screw setting (turns out)	2
Float height	see Section 8
Idle speed	see Chapter 1
Starter jet	45
Pilot jet	36
Main jet	95
Needle (clip position)	495 (2nd notch from top)

1 General information and precautions

The fuel system consists of the fuel tank, fuel tap with filter, carburettor, fuel hoses and control cables. Due to the position of the fuel tank, Hexagon, B125, X8, X9, NRG Power, GT125/200, GTS125, GTV125, S125 and later Liberty 125 models have a fuel pump.

The fuel tap is automatic in operation and is opened by engine vacuum. The fuel filter is fitted inside the fuel tank and is part of the tap. On some models, an additional fuel filter is fitted in the fuel line.

Typhoon 80 and 125 models have two fuel tanks; the main tank is located beneath the rear bodywork and an auxiliary tank is located behind the fairing. A balance pipe links the two fuel tanks, and a vacuum-operated pump located under the footboard pumps fuel from the auxiliary tank to the main fuel tank.



2.1 Location of non-return valve – X8 125 shown

For cold starting, an electrically-operated automatic choke is fitted in the carburettor. Some models also have an electrically-operated carburettor heater.

Air is drawn into the carburettors via an air filter which is housed above the transmission casing.

The exhaust system is a two-piece design.

Many of the fuel system service procedures are considered routine maintenance items and for that reason are included in Chapter 1.

Precautions

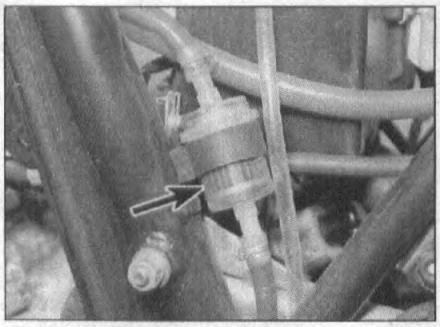
Warning: Petrol is extremely flammable, so take extra precautions when you work on any part of the fuel system. Don't smoke or allow open flames or bare light bulbs near the work area, and don't work in a garage where a natural gas-type appliance is present. If you spill any fuel on your skin, rinse 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.

- Always perform service procedures in a well-ventilated area to prevent a build-up of fumes.
- Never work in a building containing a gas appliance with a pilot light, or any other form of naked flame. Ensure that there are no naked light bulbs or any sources of flame or sparks nearby.
- Do not smoke (or allow anyone else to smoke) while in the vicinity of petrol or of components containing it. Remember the possible presence of vapour from these sources and move well clear before smoking.
- Check all electrical equipment belonging to the house, garage or workshop where work is being undertaken (see the *Safety first!* section of this manual). Remember that certain electrical appliances such as drills, cutters, etc, create sparks in the normal course of operation and must not be used near petrol or any component containing it. Again, remember the possible presence of fumes before using electrical equipment.
- Always mop-up any spilt fuel and safely dispose of the rag used.
- Any stored fuel that is drained off during servicing work must be kept in sealed containers that are suitable for holding petrol, and clearly marked as such; the containers themselves should be kept in a safe place.
- Read the *Safety first!* section of this manual carefully before starting work.

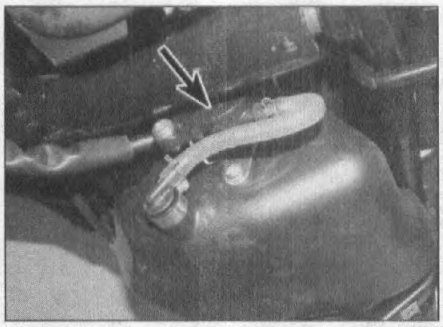
2 Fuel tap and filter – check, removal and installation

Hexagon, B125, X8, X9, NRG Power, S125 and later Liberty 125 models

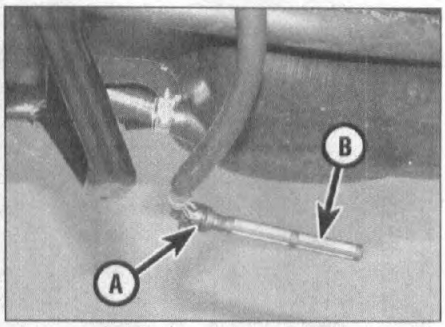
1 These models do not have a separate fuel tap – instead the fuel pump acts as a tap, only allowing fuel to flow when the engine is turning over. Some models are fitted with a non-return valve which prevents fuel draining back into the tank when the engine is not running **(see illustration)**. See Section 13 for fuel pump check and renewal.



2.2 The fuel filter (arrowed) is secured by two hose clips



2.7 Disconnect the fuel supply hose from the pump (arrowed)



2.8 Withdraw the hose union from the tank – note the O-ring (A) and filter gauze (B)

2 On Hexagon, X9, X8 and B125 models, the fuel filter is fitted in the fuel line and is secured by two clips **(see illustration)**. Remove any body panels as required by your model and trace the fuel hose from the carburettor to the filter (see Chapter 7). Note that on some machines, a filter element is also fitted to the outlet union inside the fuel tank **(see illustration 2.8)**.

3 Check the filter for signs of sediment or a clogged element. The filter is a sealed unit – if it is dirty or clogged, fit a new one.

4 To remove the filter, loosen the clips securing the fuel hoses to each end, being prepared to catch any residual fuel, and detach the hoses. Withdraw the filter from its clamp, noting which way up it fits.

5 Install the new filter in its clamp, making sure it is the correct way up – there should be an arrow marked on the body denoting direction of fuel flow. Attach the fuel hoses and secure them with the clips. If the old clips are corroded or deformed, fit new ones **(see illustration 2.2)**.

6 On NRG Power, Liberty 125 and S125 models, the fuel filter is integral with the outlet union on the fuel tank – remove any body panels as required to access the tank (see Chapter 7).

7 Before removing the union, disconnect the fuel supply hose from the tank to the fuel pump at the fuel pump and insert its end in a container suitable and large enough for storing the petrol **(see illustration)**. Allow the tank to drain.

8 Slacken the clamp securing the union and withdraw it from the tank **(see illustration)**. Check the condition of the O-ring. If it is in good condition it can be re-used, though it is better to use a new one. If it is in any way deteriorated or damaged it must be renewed.

9 Clean the gauze filter to remove all traces of dirt and fuel sediment. Check the gauze for holes. If any are found, a new union should be fitted as the filter is not available individually.

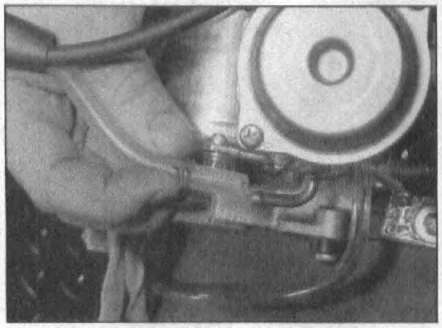
10 Install the union into the tank, preferably using a new O-ring, and tighten the clamp securely. Connect the fuel supply hose and secure it with the clips – if the old clips are corroded or deformed, fit new ones.

All other models – fuel tap

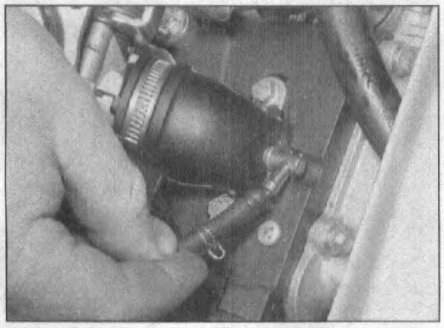
Check

11 The fuel tap is located on the underside of the fuel tank **(see illustration 2.15)**. Remove any body panels as required by your model for access (see Chapter 7). The tap is automatic, operated by a vacuum created when the engine is running which opens a diaphragm inside the tap. If the tap is faulty, it must be renewed – it is a sealed unit for which no individual components are available. The most likely problem is a hole or split in the tap diaphragm.

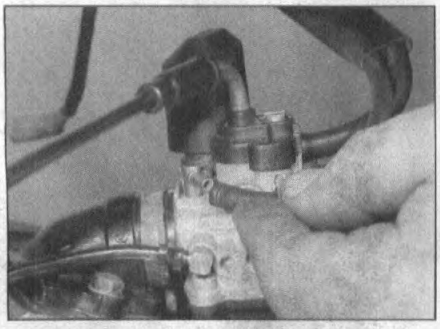
12 To check the tap, detach the fuel hose from the carburettor and place the open end in a small container **(see illustration)**. Detach the vacuum hose from the intake manifold or carburettor, according to model **(see illustrations)**, and apply a vacuum to it (suck on the pipe end) – if you are not sure which hose is which on your model, trace the hoses from the tap **(see illustration 2.15)**. Fuel should flow from the tap and into the container – if it doesn't, the diaphragm is probably split **(see illustration)**.



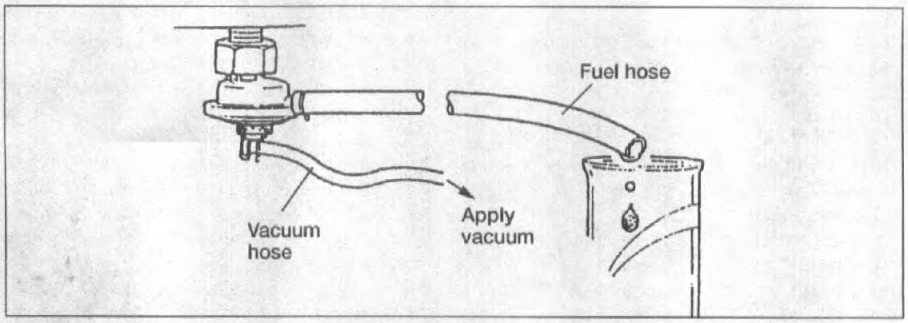
2.12a Detach the fuel hose from the carburettor



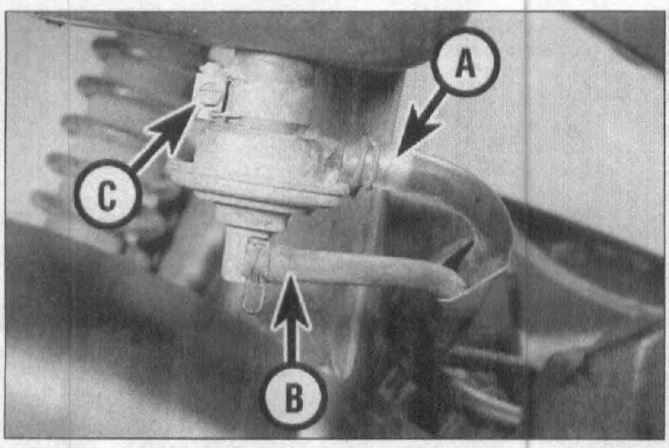
2.12b Detach the vacuum hose from the intake manifold . . .



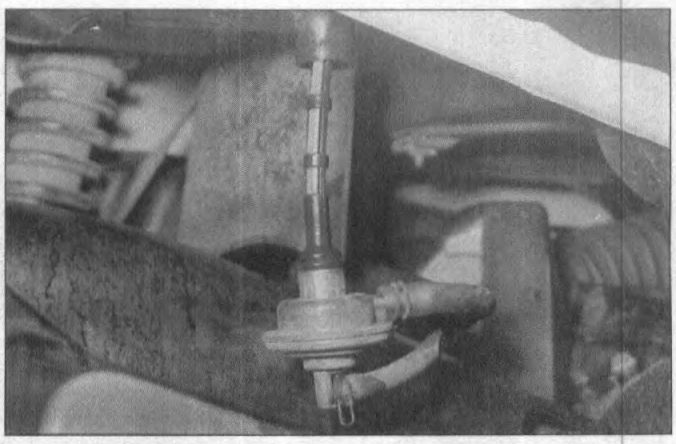
2.12c . . . or from the carburettor, as applicable



2.12d Place the fuel hose in a container and apply suction to the vacuum hose



2.15 Fuel hose (A), vacuum hose (B), tap retaining clamp (C)



2.16 Withdraw the fuel tap and filter from the tank

13 Before renewing the tap, check that the vacuum hose is securely attached, and that there are no splits or cracks in the hose. If in doubt, attach a spare hose to the vacuum union on the tap and again apply a vacuum. If fuel still does not flow, remove the tap and fit a new one.

Removal

14 The tap should not be removed unnecessarily from the tank otherwise the O-ring or filter may be damaged.

15 Before removing the tap, connect a drain hose to the fuel hose union and insert its end in a container suitable and large enough for storing the petrol **(see illustration)**. Detach the vacuum hose from the intake manifold and apply a vacuum to it, and allow the tank to drain.

16 Slacken the clamp securing the tap and withdraw the tap assembly **(see illustration)**. Check the condition of the O-ring. If it is in good condition it can be re-used, though it is better to use a new one. If it is in any way deteriorated or damaged it must be renewed.

17 Clean the gauze filter to remove all traces of dirt and fuel sediment. Check the gauze for holes. If any are found, a new tap should be fitted as the filter is not available individually.

Installation

18 Install the fuel tap into the tank, preferably using a new O-ring, and tighten the clamp securely.

19 Fit the fuel and vacuum hoses onto their respective unions and secure them with their clips.

GT, GTS and GTV models

20 In addition to the filter in the fuel tap (GT and GTV models) or pipe union on the tank (GTS model), a filter is fitted in the fuel line between the pump and carburettor.

21 On GT and GTV models remove the right-hand side panel to access the filter. Release the clip securing the fuel hose to the fuel tap and disconnect the hose, being prepared to catch any residual fuel **(see illustration)**. Remove the two screws securing the pump to the underside of the fuel tank and displace the pump – the fuel filter is attached to a bracket retained by the screws **(see illustration)**.

22 On GTS models remove the underseat storage compartment to access the fuel filter **(see illustration 13.15)**.

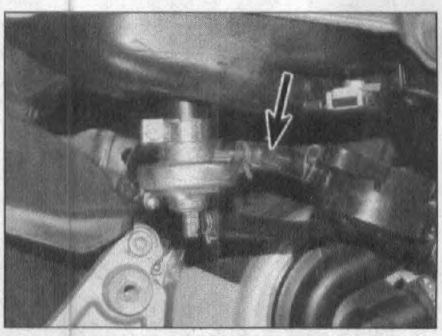
23 Check the filter for signs of sediment or a clogged element. The filter is a sealed unit – if it is dirty or clogged, fit a new one.

24 To remove the filter, loosen the clips securing the fuel hoses to each end and detach the hoses **(see illustration)**. Withdraw the filter from its clamp, noting which way up it fits.

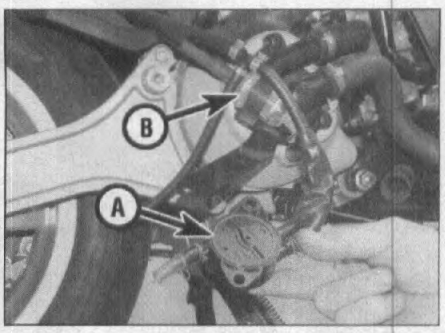
25 Install the new filter in its clamp, making sure it is the correct way up – there should be an arrow marked on the body denoting direction of fuel flow. Attach the fuel hoses and secure them with the clips. Note that some clips are reusable and only need be renewed if they are corroded or deformed on removal; crimp-type hose clips are not reusable and where these are fitted, new clips must be obtained and crimped in place when the clip has been installed on the hose.

26 Refit all components and bodywork in a reverse of the removal procedure.

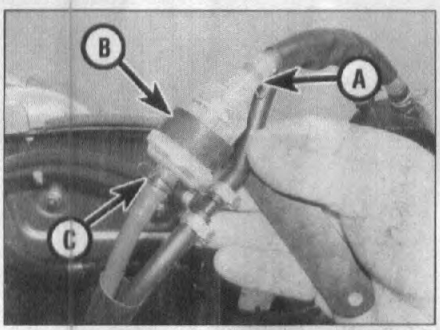
27 The GTS 125 has a non-return valve fitted in the hose between pump and tank **(see illustration)**.



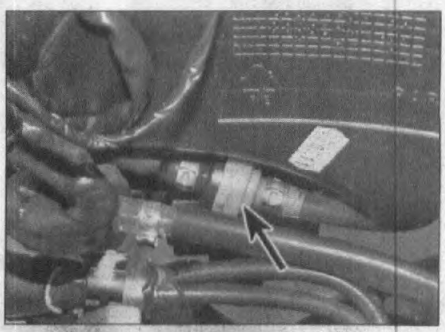
2.21a Disconnect the fuel hose (arrowed) from the tap



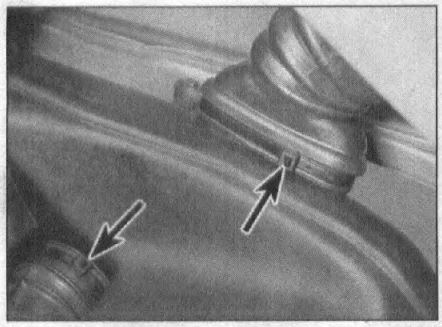
2.21b Displace the fuel pump (A) and in-line filter (B)



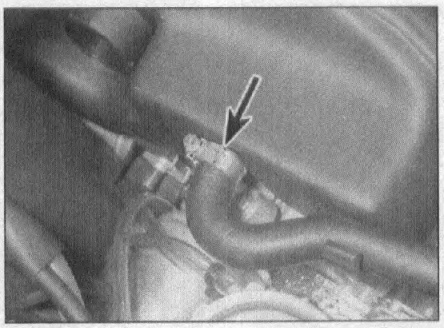
2.24 Fuel filter is secured by hose clips (A) and clamp (B)



2.27 Non-return valve (arrowed) on GTS125



3.1a Release the ties securing the air ducts (arrowed) . . .



3.1b . . . and the clamp securing the breather hose (arrowed), where fitted . . .

3 Air filter housing – removal and installation

Removal

1 Where applicable, remove the bodywork to access the filter housing, which is located above the drivebelt cover on the left-hand side of the scooter. Release the clips or cut the plastic ties securing the air inlet and outlet ducts and, where fitted, the breather hose, and detach them from the housing **(see illustrations)**. Where applicable, release the idle speed adjuster from its clip on the front of the housing.

2 Remove the bolts securing the air filter housing to the engine and manoeuvre the housing away, noting how it fits **(see illustrations)**.

Installation

3 Installation is the reverse of removal. Use new plastic cable ties to secure the air inlet and outlet ducts where the originals were cut free.

4 Idle fuel/air mixture adjustment – general information

Warning: Adjustment of the pilot screw is made with the engine running. To prevent accidents caused by the rear wheel contacting the ground, ensure that the scooter is on its centre stand and if necessary place a support under the scooter to prevent the rear wheel contacting the ground.

1 Idle fuel/air mixture is set using the pilot screw **(see illustration 7.1 or 8.1)**. Adjustment of the pilot screw is not normally necessary and should only be performed if the engine is running roughly, stalls continually, or if a new pilot screw has been fitted.

2 If the pilot screw is removed during a carburettor overhaul, record its current setting by turning the screw it in until it seats lightly, counting the number of turns necessary to achieve this, then unscrew it fully. On installation, turn the screw in until it seats lightly, then back it out the number of turns you've recorded. If fitting a new pilot screw, turn the screw in until it seats, then back it out the number of turns specified at the beginning of the Chapter.

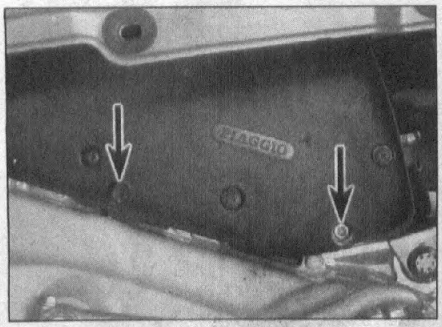
3 Pilot screw adjustment must be made with the engine running and at normal working temperature. Stop the engine and screw the pilot screw in until it seats lightly, then back it out the number of turns specified at the beginning of this Chapter. Start the engine and set the idle speed to the specified amount (see Chapter 1).

4 Now try turning the pilot screw inwards by no more than a 1/4 turn, noting its effect on the idle speed, then repeat the process, this time turning the screw outwards.

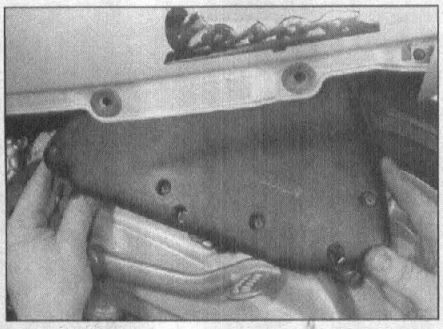
5 The pilot screw should be set in the position which gives the most consistent, even idle speed without the automatic transmission engaging, and so that the engine does not stall when the twistgrip is opened. **Note:** *It will not be possible to achieve an even idle speed if the spark plug needs adjustment or if the air filter element is dirty. On four-stroke engines, ensure the valve clearances are correctly set.*

6 Once a satisfactory pilot screw setting has been achieved, further adjustments to the idle speed can be made with the idle speed adjuster screw (see Chapter 1).

7 If it is not possible to achieve a satisfactory idle speed after adjusting the pilot screw, take the scooter to a Piaggio dealer and have the fuel/air mixture adjusted with the aid of an exhaust gas analyser.



3.2a . . . then unscrew the bolts (arrowed) . . .



3.2b . . . and remove the housing

5 Carburettor overhaul – general information

1 Poor engine performance, difficult starting, stalling, flooding and backfiring are all signs that carburettor maintenance may be required.

2 Keep in mind that many so-called carburettor problems can often be traced to mechanical faults within the engine or ignition system malfunctions. Try to establish for certain that the carburettor is in need of maintenance before beginning a major overhaul.

3 Check the fuel tap and filter, the fuel and vacuum hoses, the fuel pump (where fitted), the intake manifold joint clamps, the air filter, the ignition system and the spark plug before assuming that a carburettor overhaul is required.

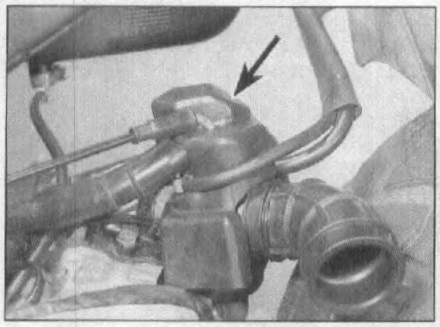
4 Most carburettor problems are caused by dirt particles, varnish and other deposits which build-up in and eventually block the fuel jets and air passages inside the carburettor. Also, in time, gaskets and O-rings deteriorate and cause fuel and air leaks which lead to poor performance.

5 When overhauling the carburettor, disassemble it completely and clean the parts thoroughly with a carburettor cleaning solvent. If available, blow through the fuel jets and air passages with compressed air to ensure they are clear. Once the cleaning process is complete, reassemble the carburettor using new gaskets and O-rings.

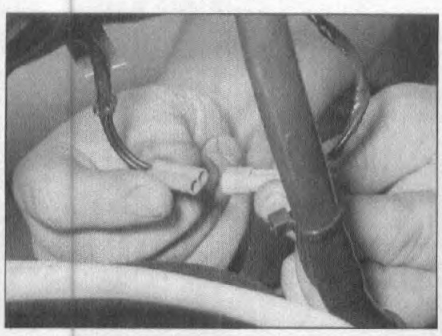
6 Before disassembling the carburettor, make sure you have the correct carburettor gasket set, some carburettor cleaner, a supply of clean rags, some means of blowing out the carburettor passages and a clean place to work.

6 Carburettor – removal and installation

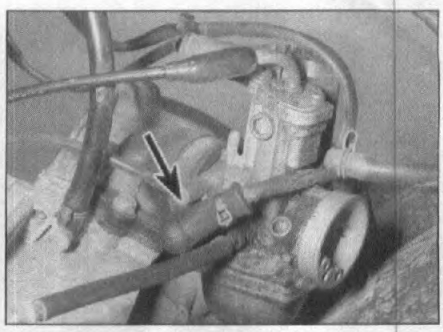
Warning: Refer to the precautions given in Section 1 before starting work.



6.1 Remove the cover (arrowed), noting how it fits



6.2a Disconnect the choke wiring at the connector



6.2b Trace the wiring from the carburettor heater (arrowed)

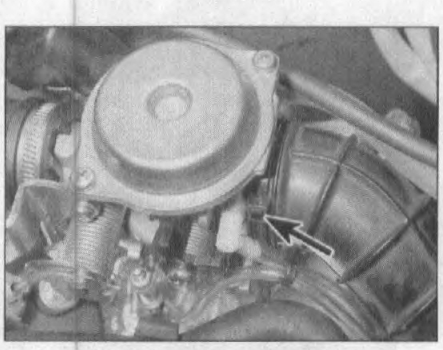
Removal

1 Remove the bodywork as required by your model to access the carburettor (see Chapter 7). Where fitted, remove the carburettor cover, noting how it fits **(see illustration)**.

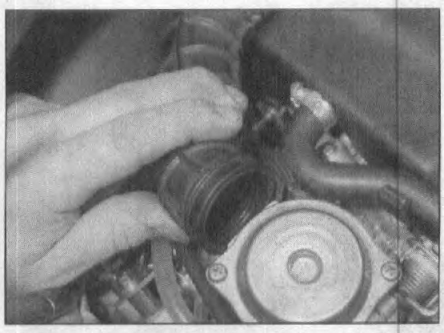
2 Trace the wiring from the automatic choke unit and disconnect it at the connector **(see illustration)**. Where fitted, trace the wiring from the carburettor heater and disconnect it at the connector **(see illustration)**. Free the wiring from any clips or ties. On NRG Power DD and liquid-cooled LEADER engined models, undo the bolt securing the heater union to the side of the carburettor.

3 To detach the throttle cable from the carburettor on two-stroke engines, first remove the screw securing the top cover, noting that the cover is under spring pressure, then lift the cover and withdraw the throttle slide **(see illustrations 10.5a and 10.5b)**. To detach the throttle cable on four-stroke engines, first unscrew the nut securing the outer cable in its bracket and lift the cable out of the bracket, then detach the cable nipple from the cam on the carburettor **(see illustrations 10.14a and 10.14b)**.

4 On Sfera 125 and ET4 models, release the idle speed adjuster from its clip on the front of the air filter housing and feed it through to the base of the carburettor.



6.5a Release the clamp or tie (arrowed) . . .



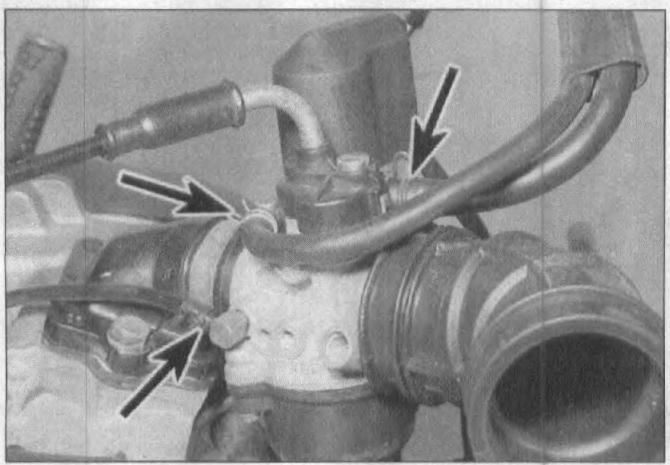
6.5b . . . and detach the air duct from the carburettor

5 Release the clip or cut the tie securing the air intake duct and detach it from the carburettor **(see illustrations)**.

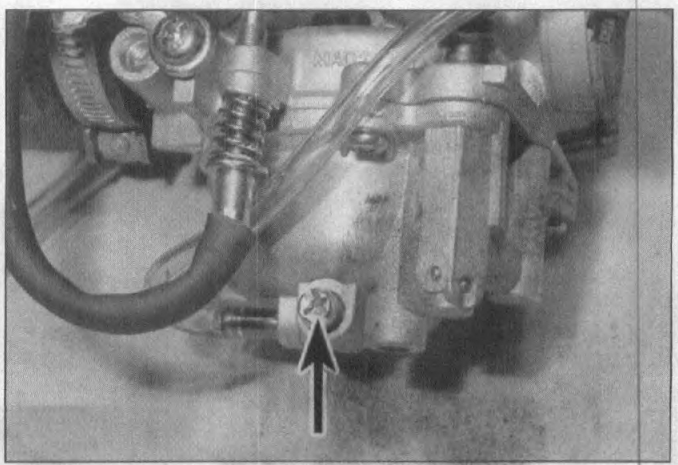
6 Release the clips securing the fuel hose and vacuum hose, and oil hose on two-stroke engines, noting which fits where **(see illustration and 2.7a and 2.7b)**. Be prepared to catch any residual fuel in a suitable container. The fuel and oil hoses should be clamped to prevent leakage using any of the methods shown (see Section 13 ***Tool Tips***). The breather and drain hoses can usually be left attached and withdrawn with the carburettor as their lower ends are not secured. Note their routing as they are withdrawn. **Note:** *The vacuum hose can be left attached to the manifold if the carburettor is being removed without it (see Step 8).*

7 Loosen the drain screw and drain all the fuel from the carburettor into a suitable container **(see illustration)**. Discard the drain screw O-ring, as a new one must be used. On installation, fit the new O-ring and tighten the drain screw securely. **Note:** *If a cleaning solvent is going to be used, fit the new O-ring after the cleaning process.*

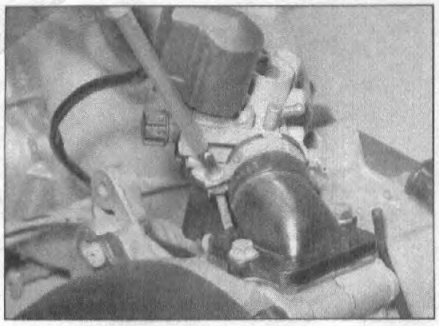
8 Either loosen the clamp securing the



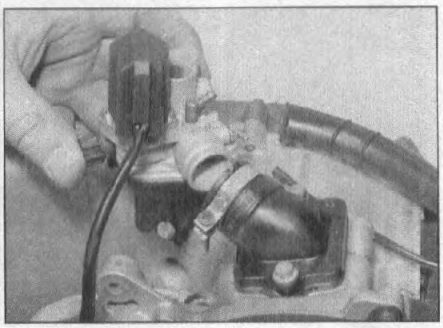
6.6 Detach the various hoses (arrowed) from the carburettor, as required



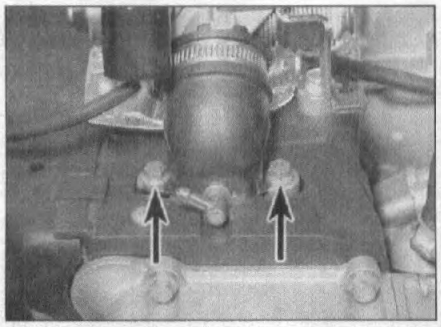
6.7 Carburettor drain screw (arrowed)



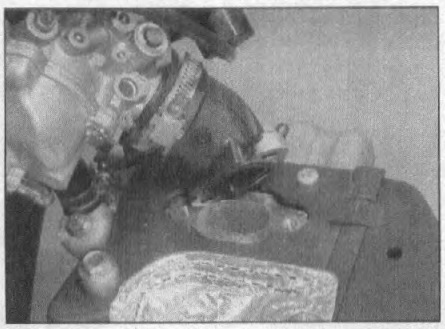
6.8a Either slacken the clamp . . .



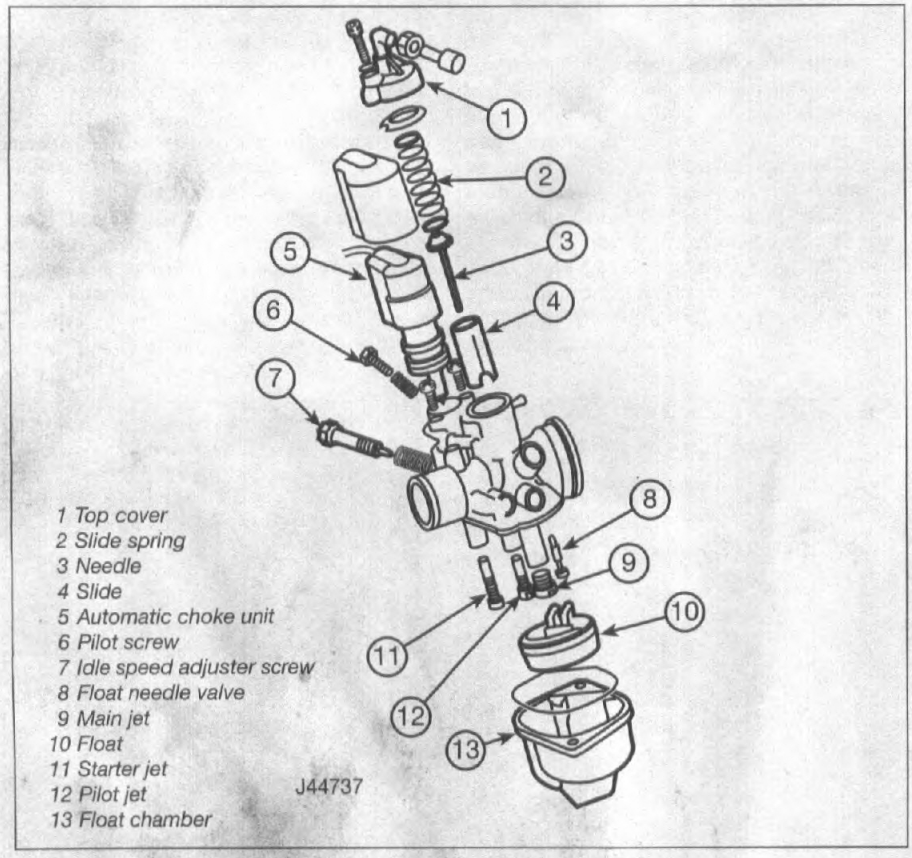
6.8b . . . and detach the carburettor from the manifold . . .



6.8c . . . or remove the manifold bolts (arrowed) . . .



6.8d . . . and remove the carburettor with it attached



1 Top cover
2 Slide spring
3 Needle
4 Slide
5 Automatic choke unit
6 Pilot screw
7 Idle speed adjuster screw
8 Float needle valve
9 Main jet
10 Float
11 Starter jet
12 Pilot jet
13 Float chamber

7.1 Slide type carburettor components

carburettor to the intake manifold on the engine and remove the carburettor, or undo the bolts securing the manifold to the engine and remove it and the carburettor together **(see illustrations)**.

Caution: Stuff clean rag into the intake after removing the carburettor to prevent anything from falling inside.

Installation

9 Installation is the reverse of removal, noting the following.

a) Make sure the carburettor is fully engaged with the intake manifold and the clamp is securely tightened.
b) Make sure all hoses are correctly routed and secured and not trapped or kinked.
c) Refer to Section 10 for installation of the throttle cable. Check the operation of the cable and adjust it as necessary (see Chapter 1).
d) On liquid-cooled models, top-up the cooling system if necessary.
e) Check the idle speed and adjust as necessary (see Chapter 1).

7 Carburettor (two-stroke engines) – overhaul

Note: *Carburettor design differs for 2-stroke and 4-stroke engines. Two-stroke engines use a slide type carburettor, whereas four-stroke engines use a constant-vacuum (CV) type – ensure that you follow the correct procedure in this Section or Section 8.*

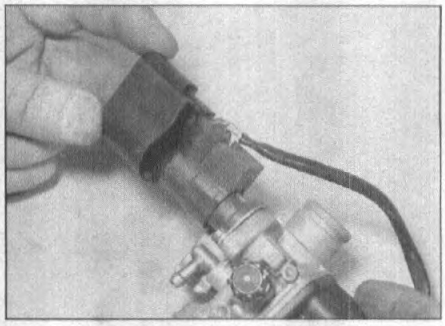
Warning: Refer to the precautions given in Section 1 before starting work.

Disassembly

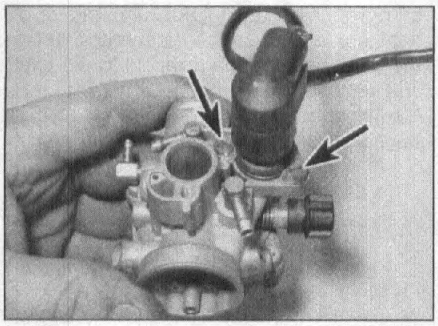
1 Remove the carburettor (see Section 6). Take care when removing components to note their exact locations and any springs or O-rings that may be fitted **(see illustration)**.

2 Where fitted, remove the cover on the automatic choke unit, then remove the clamp securing the choke in the carburettor **(see illustrations)**. Withdraw the choke, noting how it fits **(see illustration)**.

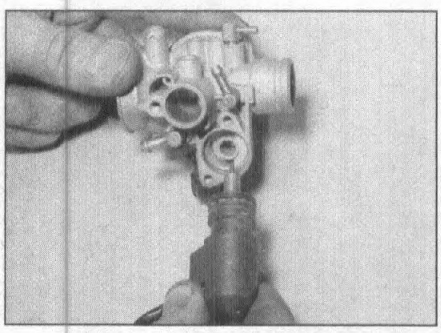
3 The carburettor top cover and throttle slide assembly will have already been removed to



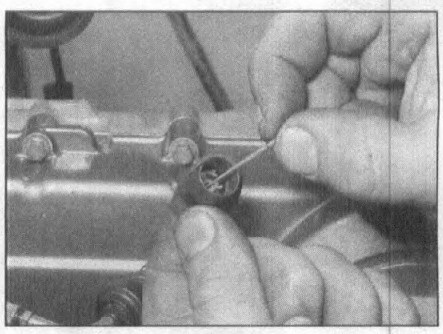
7.2a Remove the choke cover . . .



7.2b . . . then remove the clamp screws (arrowed) . . .



7.2c . . . and withdraw the choke unit



7.3 Remove the needle from the throttle slide if required

detach the throttle cable from the carburettor. Disconnect the cable from the slide, then remove the spring seat, spring and cover from the cable (see section 10). Lift the needle out of the throttle slide **(see illustration)**.

4 Undo the screws securing the float chamber to the base of the carburettor and remove it **(see illustrations)**. Discard the gasket, as a new one must be used.

5 Using a pair of thin-nose pliers, carefully withdraw the float pin **(see illustration)**. If necessary, displace the pin using a small punch or a nail. Remove the float and unhook the float needle valve, noting how it fits onto the tab on the float.

6 Unscrew and remove the pilot jet and the starter jet, then unscrew the main jet from the base of the needle jet **(see illustration)**.

7 The needle jet is a press-fit in the carburettor body; if required, displace the jet, noting how it fits.

8 The pilot screw can be removed if required, but note that its setting will be disturbed (see ***Haynes Hint***). Unscrew and remove the pilot screw along with its spring and O-ring, where fitted.

HAYNES HiNT

To record the pilot screw's current setting, turn the screw in until it seats lightly, counting the number of turns necessary to achieve this, then unscrew it fully. On installation, turn the screw in until it seats, then back it out the number of turns you've recorded.

Cleaning

Caution: Use only a petroleum-based solvent for carburettor cleaning. Don't use caustic cleaners.

9 Submerge the metal components in carburettor cleaning solvent for approximately thirty minutes (or longer, if the directions recommend it).

10 After the carburettor has soaked long enough for the cleaner to loosen and dissolve most of the varnish and other deposits, use a nylon-bristled brush to remove the stubborn deposits. Rinse it again, then dry it with compressed air.

11 If available, use compressed air to blow out all the fuel jets and the air passages in the carburettor body, not forgetting the passages in the carburettor intake.

Caution: Never clean the jets or passages with a piece of wire or a drill bit, as they will be enlarged, causing the fuel and air metering rates to be upset.

Inspection

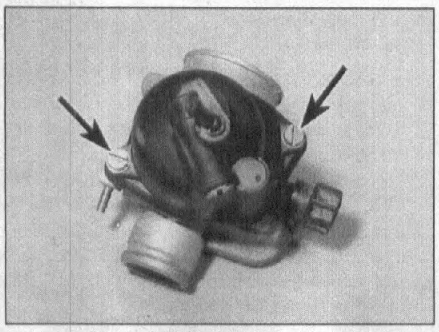
12 If removed, check the tapered portion of the pilot screw and the spring for wear or damage. Fit a new O-ring and renew the screw or spring if necessary.

13 Check the carburettor body, float chamber and top cover for cracks, distorted sealing surfaces and other damage. If any defects are found, renew the faulty component, although a new carburettor will probably be necessary (check with a Piaggio dealer on the availability of separate components).

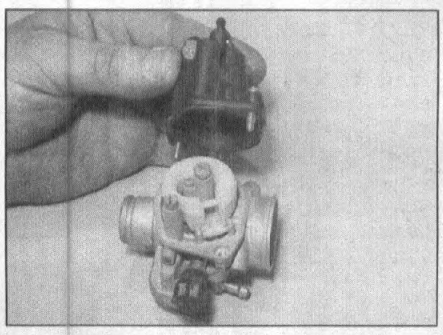
14 Insert the throttle slide in the carburettor body and check that it moves up-and-down smoothly. Check the surface of the slide for wear. If it's worn excessively or doesn't move smoothly, renew the components as necessary.

15 Check the needle for straightness by rolling it on a flat surface such as a piece of glass. Fit a new needle if it's bent or if the tip is worn. Check the position of the clip on the needle (see Specifications at the beginning of this Chapter).

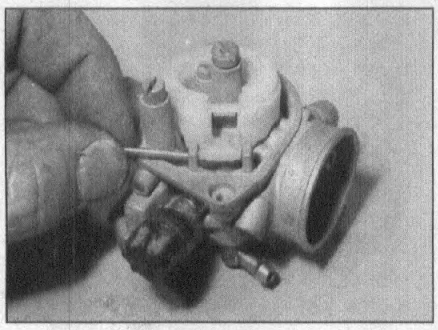
16 Inspect the tip of the float needle valve and the valve seat. If either has grooves or scratches in it, or is in any way worn, they must be renewed as a set. **Note:** *On Hexagon models with a pumped and pressurised fuel system, a worn or incorrectly-sized carburettor float needle valve seat will not be able to shut off the fuel supply*



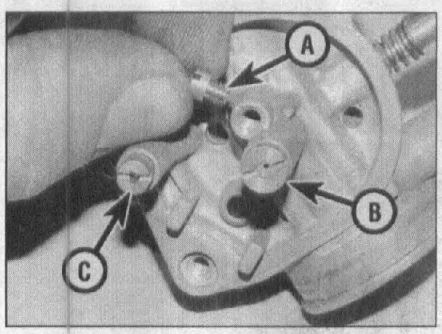
7.4a Undo the screws (arrowed) . . .



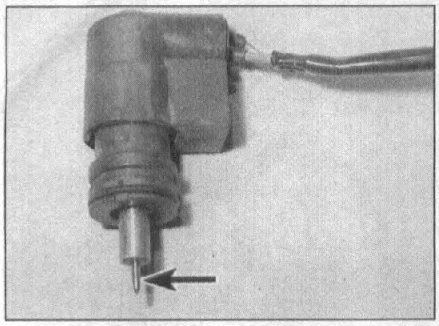
7.4b . . . and lift off the chamber



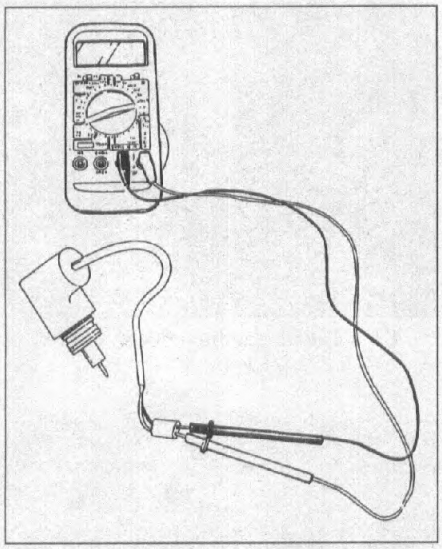
7.5 Withdraw the float pin



7.6 Pilot jet (A), main jet (B) and starter jet (C)



7.18a Check the automatic choke unit plunger and needle condition



7.18b Automatic choke unit operation check

sufficiently to prevent carburettor flooding and excessive use of fuel.

17 Check the float for damage. This will usually be apparent by the presence of fuel inside the float. If the float is damaged, it must be renewed.

18 Inspect the automatic choke unit plunger and needle for signs of wear and renew the unit if necessary **(see illustration)**. The resistance of the choke unit should be checked with a multi-meter after the engine has been warmed to normal operating temperature and then allowed to cool for ten minutes. With an ambient (air) temperature of 20°C, disconnect the choke unit wiring connector and measure the resistance between the terminals on the choke unit side of the connector **(see illustration)**. If the result is not as specified at the beginning of the Chapter, renew the choke unit. To check that the plunger is not seized in the choke body, first measure the protrusion of the plunger from the body. Next, use jumper wires to connect a good 12 V battery to the choke unit terminals and measure the protrusion again after 5 minutes. If the measurements are not as specified the unit is faulty and should be renewed.

Reassembly and fuel level check

Note: *When reassembling the carburettor, be sure to use new O-rings and gaskets. Do not overtighten the carburettor jets and screws as they are easily damaged.*

19 If removed, install the pilot screw, spring and O-ring; adjust the screw to the setting as noted on removal (see Step 8).

20 If removed, install the needle jet. Where applicable, ensure the flat in the bottom of the jet aligns with the pin in the carburettor. Screw the main jet into the end of the needle jet.

21 Install the pilot jet and the starter jet **(see illustration 7.6)**.

22 Hook the float needle valve onto the float tab, then position the float assembly in the carburettor, making sure the needle valve enters its seat. Install the float pin, making sure it is secure **(see illustration 7.5)**.

23 Fit a new gasket onto the float chamber, making sure it is seated properly in its groove, then install the chamber onto the carburettor and tighten the screws securely **(see illustrations 7.4b and 7.4a)**.

24 The carburettor fuel level should be checked at this point to ensure that the float and needle valve are working correctly. Support the carburettor upright in a vice and connect a length of clear fuel hose to the drain union on the base of the float chamber. Secure the hose up against the side of the carburettor and mark it level with the float chamber joint **(see illustration)**. Carefully pour a small amount of fuel into the carburettor via the fuel hose union, then undo the drain screw in the bottom of the float chamber enough to allow fuel to flow into the clear hose. Continue pouring fuel into the carburettor until the float needle valve shuts off the supply, at which point the level in the clear hose should be the specified distance below the mark (see Specifications at the beginning of the Chapter). If the fuel level is incorrect, and the float needle valve and the valve seat are good, check the float tab for wear or damage. If the float tab is metal it can be adjusted carefully to correct the fuel height, otherwise a new float will have to be fitted.

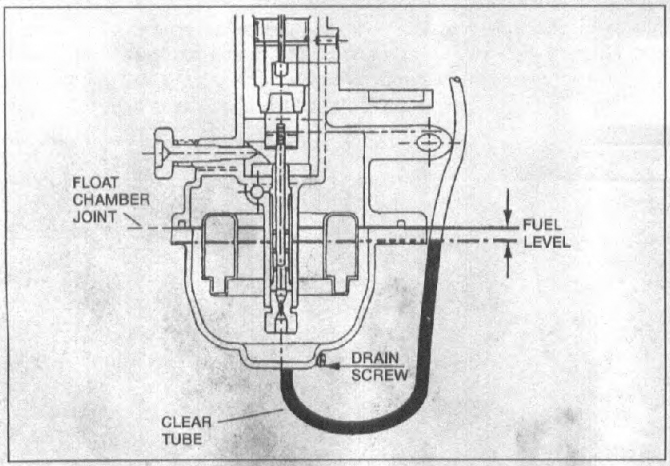
25 Install the choke unit and secure it with the clamp and screws **(see illustration)**. Install the choke unit cover, if fitted.

26 Install the carburettor (see Section 6). Install the jet needle in the throttle slide, then follow the procedure in Section 10 to install the throttle slide assembly onto the cable and fit the carburettor top cover.

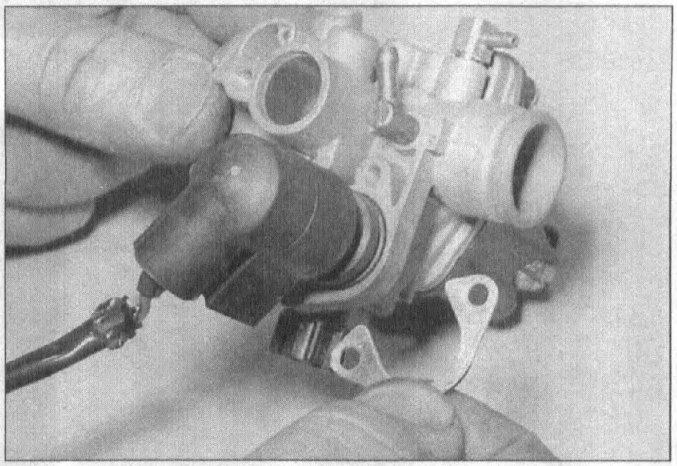
8 Carburettor (four-stroke engines) – overhaul

Note: *Carburettor design differs for 2-stroke and 4-stroke engines. Two-stroke engines use a slide type carburettor, whereas four-stroke engines use a constant-vacuum (CV) type – ensure that you follow the correct procedure in this Section or Section 7.*

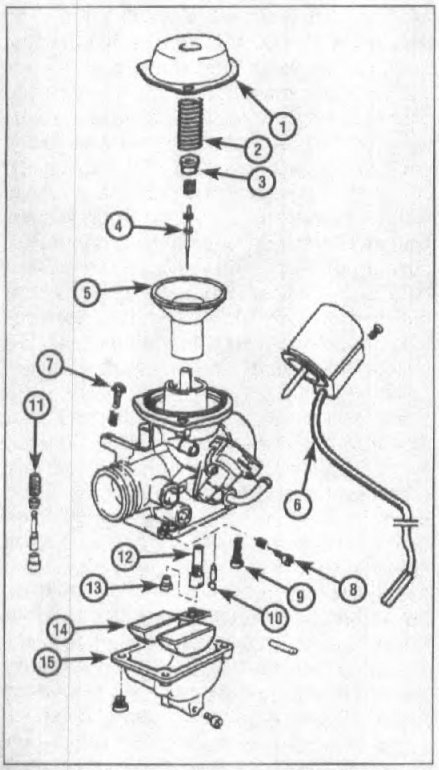
Warning: Refer to the precautions given in Section 1 before proceeding.



7.24 Set-up for measuring the fuel level



7.25 Secure the choke unit with the clamp



8.1 Constant vacuum (CV) type carburettor components

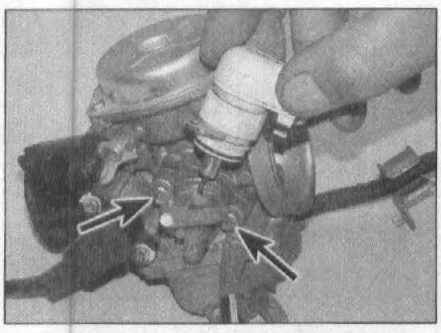
1 Top cover
2 Spring
3 Needle retainer
4 Needle
5 Diaphragm and piston assembly
6 Automatic choke unit
7 Idle speed adjuster screw
8 Pilot screw
9 Pilot jet
10 Float needle valve
11 Accelerator pump assembly
12 Needle jet
13 Main jet
14 Float
15 Float chamber

Disassembly

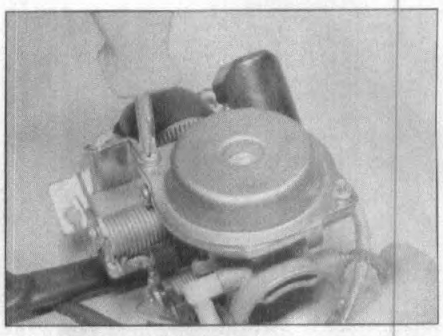
1 Remove the carburettor (see Section 6). Take care when removing components to note their exact locations and any springs or O-rings that may be fitted **(see illustration)**.

2 Where fitted, remove the cover on the automatic choke unit, then remove the clamp securing the choke in the carburettor **(see illustrations 7.2a and 7.2b)**. Withdraw the choke, noting how it fits **(see illustration)**. On Walbro and Keihin carburettors, undo the screws securing the choke unit mounting and remove it. Discard the gasket, as a new one must be fitted. If required, undo the screw securing the accelerator pump lever and remove the lever and return spring.

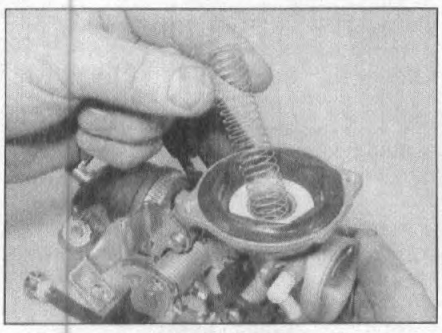
3 Unscrew and remove the top cover retaining screws, then lift off the cover and remove the spring from inside the piston **(see illustrations)**. Carefully peel the diaphragm away from its sealing groove in the carburettor and withdraw the diaphragm and piston assembly **(see illustration)**. Note how the tab on the diaphragm fits in the recess in the carburettor body.



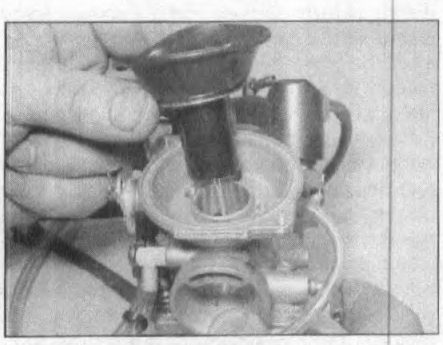
8.2 Remove the choke unit. Screws (arrowed) secure the mounting



8.3a Remove the screws and the cover . . .



8.3b . . . then withdraw the spring . . .



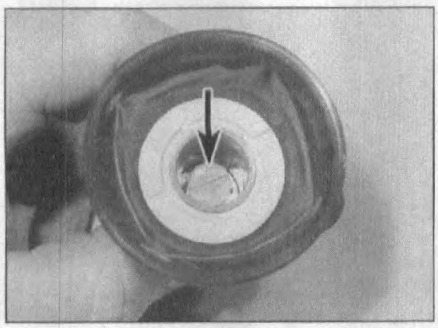
8.3c . . . and the diaphragm/piston assembly

Caution: Do not use a sharp instrument to displace the diaphragm as it is easily damaged.

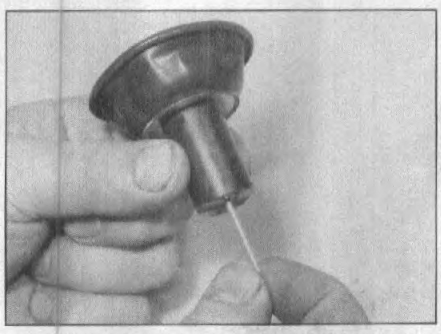
4 On Walbro and Mikuni carburettors, unscrew the jet needle retainer, then remove the retainer, the spring and spring seat (where fitted) **(see illustration)**. On Keihin carburettors, lift out the needle retainer. Push the needle up from the bottom of the piston and withdraw it from the top **(see illustration)**.

5 Undo the screws securing the float chamber to the base of the carburettor and remove it **(see illustration)**. Discard the gasket, as a new one must be used.

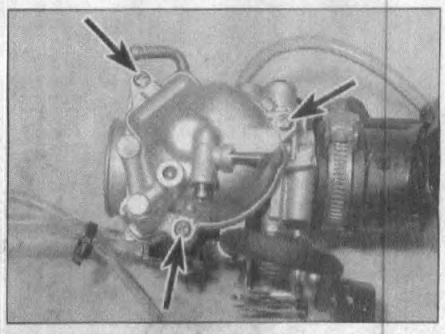
6 On Mikuni and Keihin carburettors, withdraw the accelerator pump spring and plunger from the carburettor body, noting how it fits **(see**



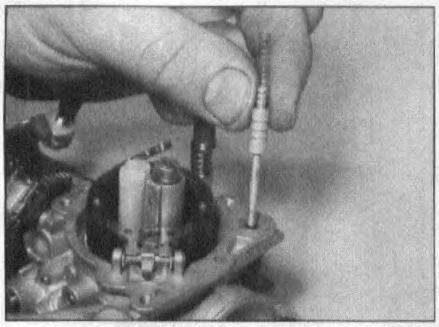
8.4a Remove the retainer (arrowed)



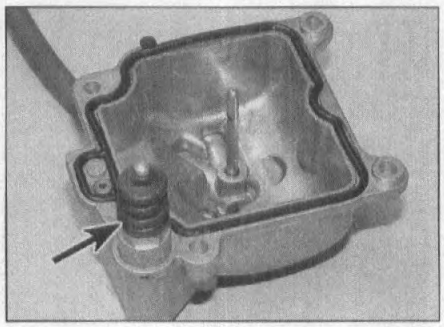
8.4b Push the needle up from the bottom



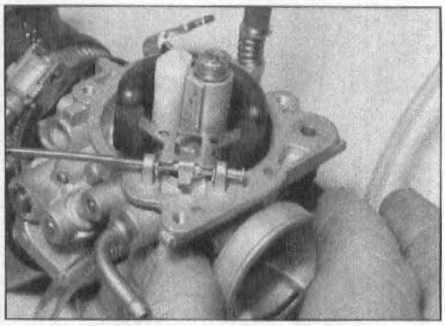
8.5 Float chamber screws (arrowed)



8.6a Withdraw the accelerator pump plunger . . .



8.6b . . . or unscrew the assembly (arrowed) from the float chamber



8.7a Remove the float pin

illustration). On Walbro carburettors, unscrew the accelerator pump assembly from the float chamber **(see illustration)**. Discard the O-ring, as a new one must be fitted.

7 Using a pair of thin-nose pliers, carefully withdraw the float pin; if necessary, displace the pin using a small punch or a nail **(see illustration)**. Remove the float and unhook the float needle valve, noting how it fits onto the tab on the float **(see illustrations)**.

8 Undo the screw securing the float needle valve seat clamp, then withdraw the valve seat **(see illustrations)**. Discard the O-ring, as a new one should be used.

9 Remove the plastic jet cover from the starter jet **(see illustration)**. **Note:** *The starter jet is a press-fit in the carburettor body and should not be removed.* Unscrew the pilot jet and the main jet **(see illustration)**. On Walbro and Keihin carburettors, unscrew the needle jet. The fuel atomiser is retained by the needle jet; if the atomiser is loose, remove it for safekeeping.

10 The pilot screw can be removed if required, but note that its setting will be disturbed (see ***Haynes Hint***). Unscrew and remove the pilot screw along with its spring and O-ring, where fitted.

> **HAYNES HiNT** ***To record the pilot screw's current setting, turn the screw in until it seats lightly, counting the number of turns necessary to achieve this, then unscrew it fully. On installation, turn the screw in until it seats, then back it out the number of turns you've recorded.***

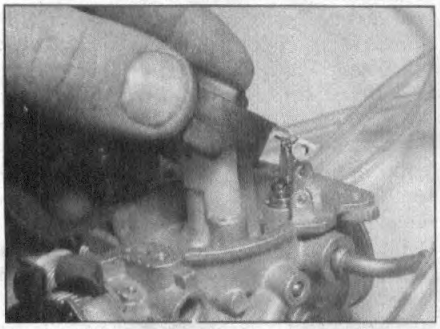
Note: *Do not remove the screws securing the throttle butterfly to the throttle shaft.*

Cleaning

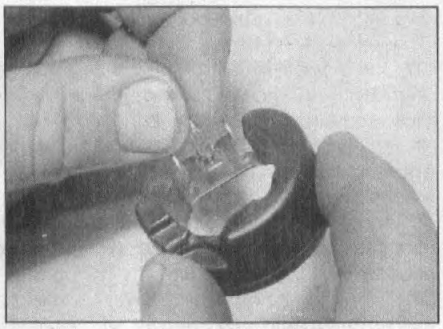
Caution: Use only a petroleum-based solvent for carburettor cleaning. Don't use caustic cleaners.

11 Follow Steps 9 to 11 in Section 7 to clean the carburettor body and internal components. Also unscrew the float chamber drain screw and clean the float chamber, paying particular attention to the fuel passage for the accelerator pump. The accelerator fuel passage is fitted with a one-way valve; blow through the fuel passage with compressed air from the bottom of the pump piston housing.

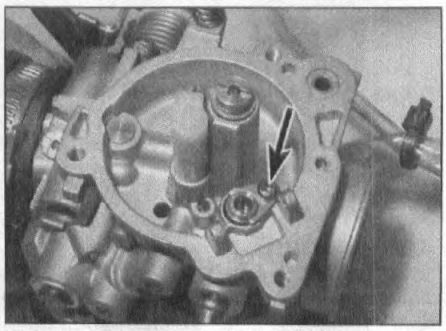
Caution: Never clean the jets or passages with a piece of wire or a drill bit, as they will be enlarged, causing the fuel and air metering rates to be upset.



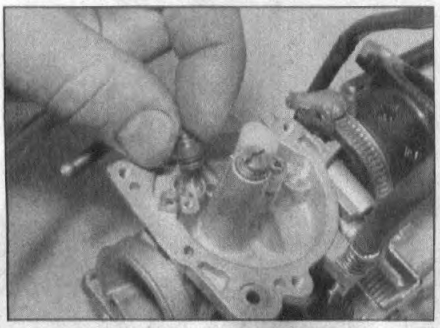
8.7b Lift out the float . . .



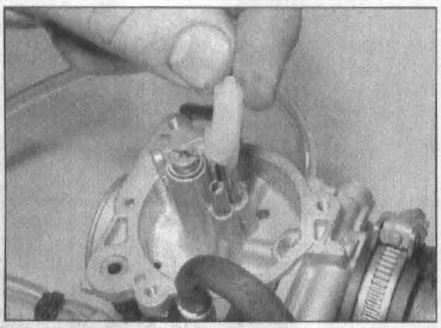
8.7c . . . and unhook the needle valve



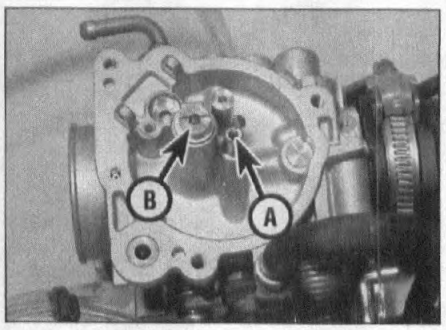
8.8a Remove the clamp screw (arrowed) . . .



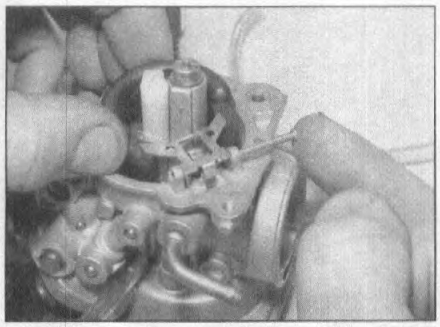
8.8b . . . and withdraw the valve seat



8.9a Remove the plastic jet cover

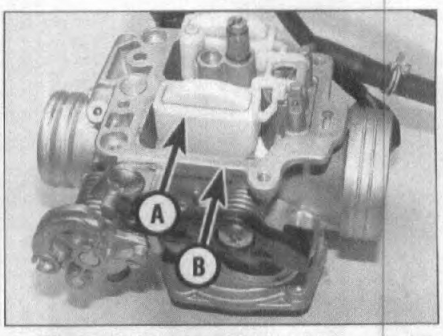


8.9b Pilot jet (A), main jet (B)



8.25 Install the float pin

8.26a Measuring the float height



8.26b Straight-edge (A) should be parallel with gasket face (B)

Inspection

12 If removed, check the tapered portion of the pilot screw and the spring for wear or damage. Fit a new O-ring and renew the screw or spring if necessary.

13 Check the carburettor body, float chamber and top cover for cracks, distorted sealing surfaces and other damage. If any defects are found, renew the faulty component, although renewal of the entire carburettor will probably be necessary (check with a Piaggio dealer on the availability of separate components).

14 Inspect the piston diaphragm for splits, holes and general deterioration. Holding it up to a light will help to reveal problems of this nature. Insert the piston in the carburettor body and check that the piston moves up-and-down smoothly. Check the surface of the piston for wear. If it's worn excessively or doesn't move smoothly, renew the components as necessary.

15 Check the needle for straightness by rolling it on a flat surface such as a piece of glass. Fit a new needle if it's bent or if the tip is worn.

16 Inspect the tip of the float needle valve and the valve seat. If either has grooves or scratches in it, or is in any way worn, they must be renewed as a set. **Note:** *On scooters with a pumped and pressurised fuel system, a worn or incorrectly-sized carburettor float needle valve seat will not be able to shut off the fuel supply sufficiently to prevent carburettor flooding and excessive use of fuel.*

17 Operate the throttle shaft to make sure the throttle butterfly valve opens and closes smoothly. If it doesn't, cleaning the throttle linkage may help. Otherwise, renew the carburettor.

18 Check the float for damage. This will usually be apparent by the presence of fuel inside the float. If the float is damaged, it must be renewed.

19 Follow the procedure in Section 7, Step 18, to check the automatic choke unit.

20 Inspect the accelerator pump piston and its seat in the float chamber for signs of wear. Ensure that the spring and the rubber boot are not damaged or deformed and renew them if necessary.

Reassembly and float height check

Note: *When reassembling the carburettor, be sure to use new O-rings and seals. Do not overtighten the carburettor jets and screws as they are easily damaged.*

21 If removed, install the pilot screw, spring and O-ring; adjust the screw to the setting as noted on removal (see Step 10).

22 On Walbro and Keihin carburettors, install the fuel atomiser if removed, then install the needle jet.

23 Install the main jet and the pilot jet and fit the plastic cover on the starter jet **(see illustrations 8.9b and 8.9a)**.

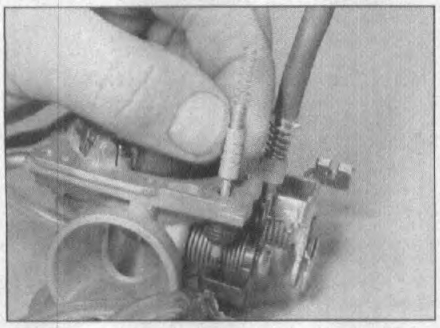
24 Install the float needle valve seat using a new O-ring, then fit the clamp and tighten the screw **(see illustrations 8.8a and 8.8b)**.

25 Hook the float needle valve onto the float tab, then position the float assembly in the carburettor, making sure the needle valve enters its seat **(see illustrations 8.7c and 8.7b)**. Install the pin, making sure it is secure **(see illustration)**.

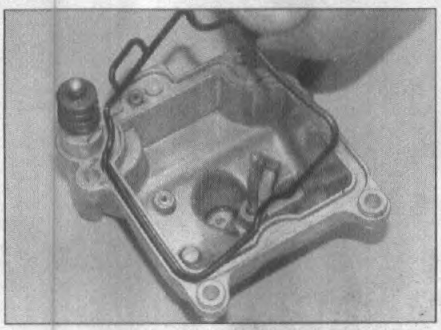
26 The carburettor float height should be checked at this point. Turn the carburettor upside-down and measure the distance between the gasket face and the bottom of the float with an accurate ruler **(see illustration)**. The correct measurement for Sfera and ET4 models is given in the Specifications at the beginning of the Chapter. For all LEADER engined models, the bottom straight-edge of the float should be parallel with the gasket face **(see illustration)**. If the float height is incorrect, it can be adjusted by carefully bending the metal float tab a little at a time until the correct height is obtained.

27 On Mikuni and Keihin carburettors, install the accelerator pump spring and plunger in the carburettor body **(see illustration)**. On Walbro carburettors, fit a new O-ring to the accelerator pump assembly, then screw the assembly into the float chamber **(see illustration 8.6b)**. Fit a new gasket onto the float chamber, making sure it is seated properly in its groove, then install the chamber onto the carburettor and tighten the screws securely **(see illustration)**.

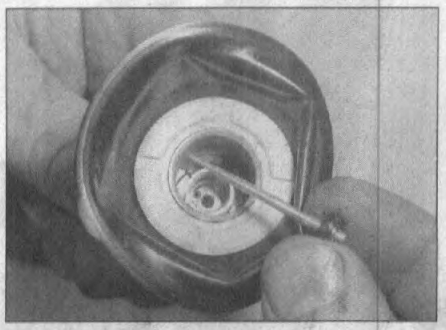
28 Check that the clip is correctly positioned on the jet needle (see Specifications at the beginning of the Chapter) then insert the jet needle into the piston **(see illustration)**. On Walbro and Mikuni carburettors, install the spring and spring seat (where fitted) and the



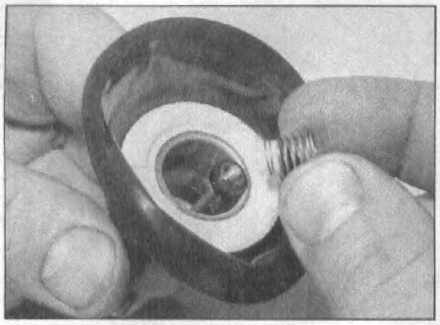
8.27a Install the plunger, making sure the spring is on its end



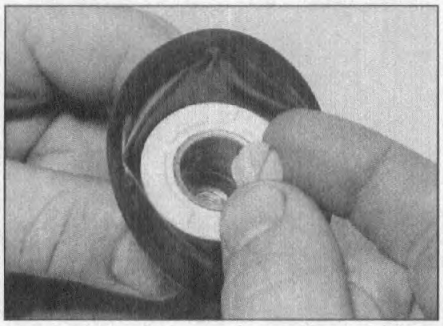
8.27b Ensure the float chamber gasket is correctly located



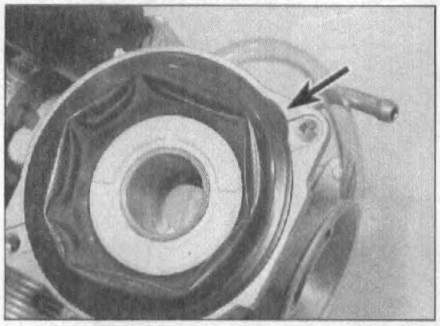
8.28a Install the jet needle . . .



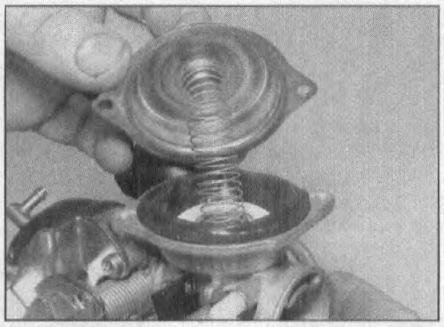
8.28b . . . the spring and spring seat . . .



8.28c . . . and the retainer



8.29 Make sure the diaphragm and its tab (arrowed) are correctly seated



8.30 Locate the cover onto the spring and fit it onto the carburettor

jet needle retainer **(see illustrations)**. On Keihin carburettors, install the needle retainer.

29 Insert the piston assembly into the carburettor body and push it down lightly, ensuring the needle is correctly aligned with the needle jet **(see illustration 8.3c)**. Align the tab on the diaphragm with the recess in the carburettor body, then press the diaphragm outer edge into its groove, making sure it is correctly seated **(see illustration)**. Check the diaphragm is not creased, and that the piston moves smoothly up-and-down in its bore.

30 Install the spring into the piston and fit the top cover to the carburettor, making sure the spring locates over the raised section on the inside of the cover, then tighten the cover screws securely **(see illustration)**.

31 On Walbro and Keihin carburettors, install the choke unit mounting with a new gasket.

32 Install the automatic choke unit and secure it with its clamp **(see illustration 7.25)**. If fitted, install the choke unit cover.

33 If removed, install the accelerator pump lever and return spring and secure them with the screw.

34 Install the carburettor (see Section 6).

9 Reed valve (two-stroke engines) – removal, inspection and installation

Removal

1 Remove the carburettor along with the intake manifold (see Section 6).

2 Withdraw the reed valve from the crankcase, noting which way round it fits **(see illustration)**.

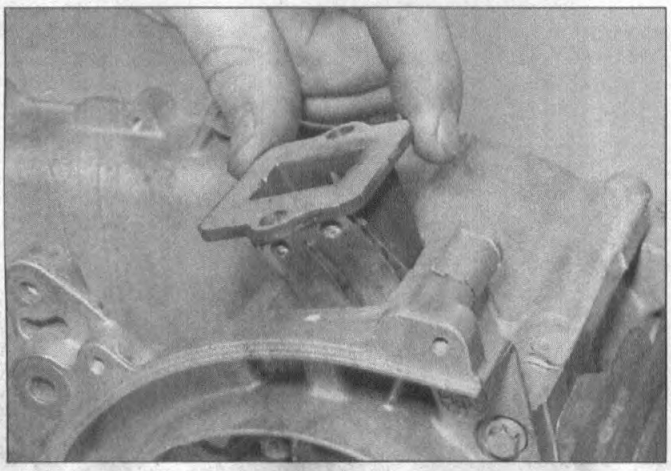
Inspection

3 Check the reed valve body closely for cracks, distortion and any other damage, particularly around the mating surfaces between the crankcase and the intake manifold – a good seal must be maintained between the components, otherwise crankcase pressure and therefore engine performance will be affected.

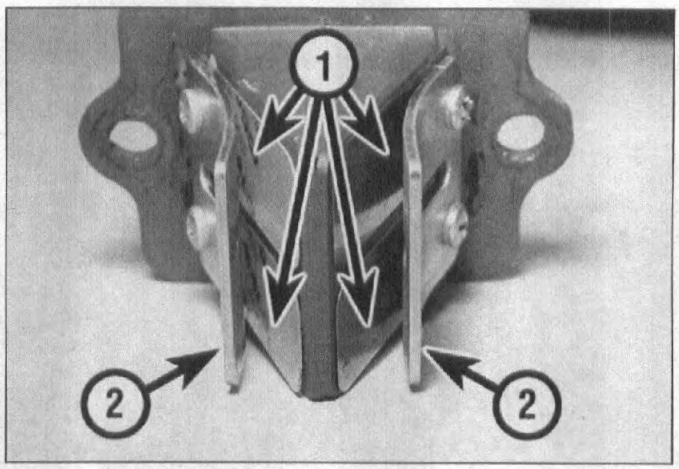
4 Check the reeds themselves for cracks, distortion and any other damage. Check also that there are no dirt particles trapped between the reeds and their seats. The reeds should sit flat against the valve body so that a good seal is obtained when the crankcase is under pressure **(see illustration)**. After prolonged use, the reeds tend to become bent and will not seal properly, in which case they should be renewed. A good way to check is to hold the valve up to the light – if light is visible between the reeds and the body they are not sealing properly. If the engine is difficult to start or idles erratically, this could be the problem. Check with your Piaggio dealer as to the availability of individual reeds – otherwise the complete valve must be renewed.

Installation

5 Installation is the reverse of removal. Ensure that the mating surfaces between the reed valve and crankcase, and between the reed valve and inlet manifold are clean and perfectly smooth. Check that the stopper plate retaining screws are tight; severe engine damage could result from a screw falling into the engine.



9.2 Withdraw the reed valve from the crankcase



9.4 Check that the reeds (1) sit flat against the valve body when the valve is closed. Stopper plates (2)

10 Throttle cable – removal and installation

Warning: Refer to the precautions given in Section 1 before proceeding.

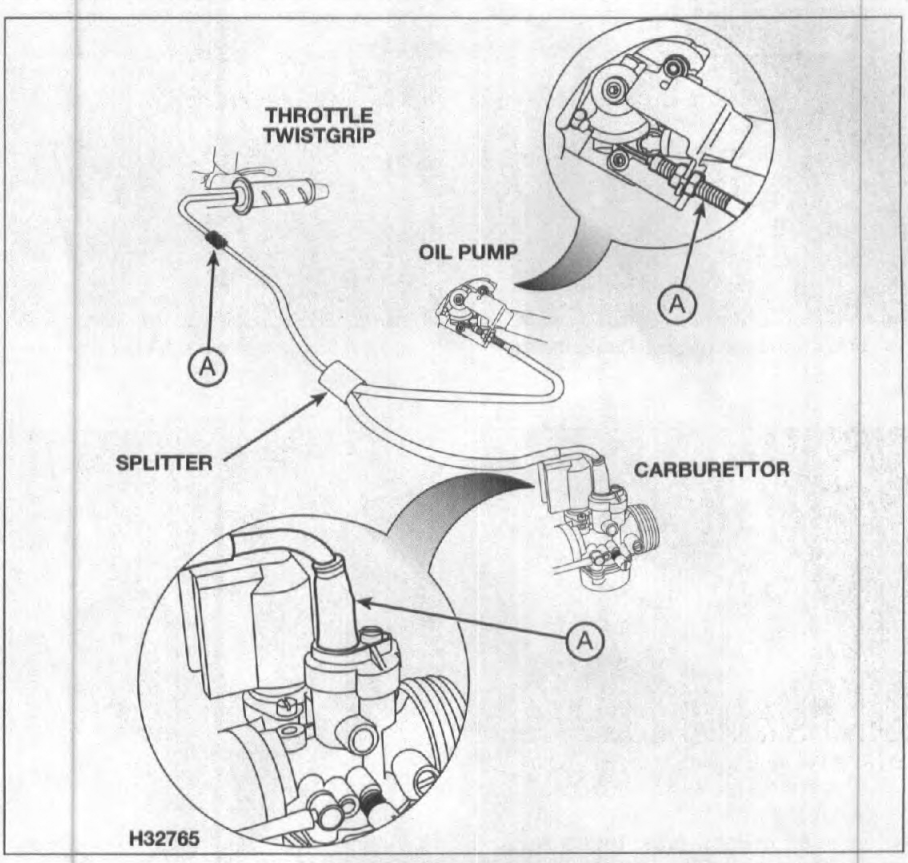
Two-stroke engines

Removal

1 Three separate cables are fitted – the main cable from the throttle twistgrip goes into a splitter located under the floorboard, with separate cables from this going to the carburettor and oil pump **(see illustration)**. If a cable problem is diagnosed, check which cable is faulty before renewing all three. Across the range of models, two types of throttle twistgrip and two types of cable splitter are used. On some models, a motorcycle-type throttle is used, where the nipple on the end of the inner cable fits into a socket in the twistgrip. On other models, a sliding type twistgrip is used, where the end of the inner cable is secured in a slider, which locates into a diagonal track inside the twistgrip. Of the two types of splitter, one operates with the main cable pulling on a pivoted cam, while the other operates with the main cable pulling on a slider. Be sure to correctly identify which type is fitted on your model before buying new cables. Before removing a cable, make a careful note of its routing to ensure correct installation.

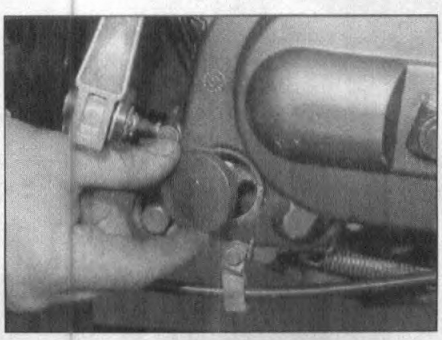
2 To access the cable at the throttle twistgrip, remove the handlebar front cover (see Chapter 7). To access the cable at the carburettor, remove the storage compartment and any bodywork as required according to model (see Chapter 7). To access the cable at the oil pump, remove the rubber plug in the transmission cover **(see illustration)**. To access the cable splitter, remove the floorboard (see Chapter 7).

3 On models with a motorcycle-type twistgrip, slacken the cable adjuster locknut and thread the adjuster fully into the housing **(see illustration)**. Pull back the twistgrip rubber, then remove the screws securing the cover plate and remove the plate, noting how it fits **(see illustration)**. Detach the cable nipple from its socket, then remove the cable elbow, noting how it fits **(see illustrations)**. Now

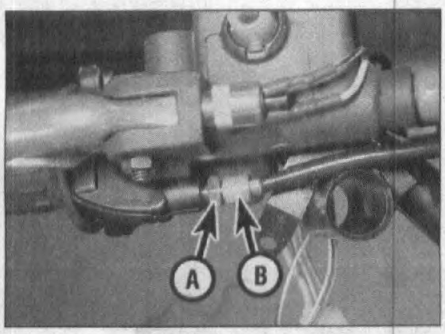


10.1 Throttle cable arrangement for two-stroke engines

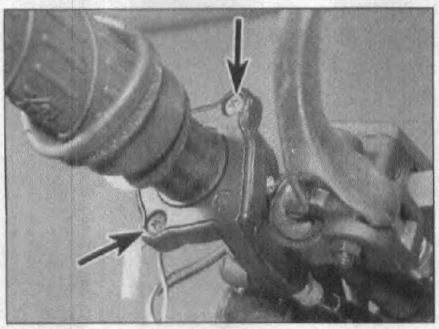
Location of cable adjusters (A)



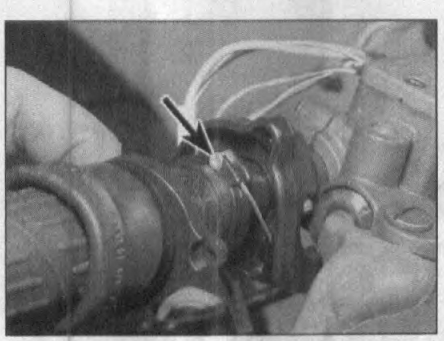
10.2 Remove the rubber plug to access the oil pump cable



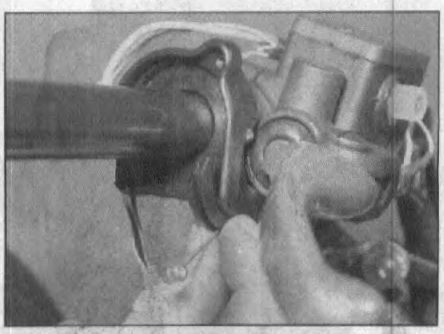
10.3a Slacken the locknut (A) and thread the adjuster (B) fully in



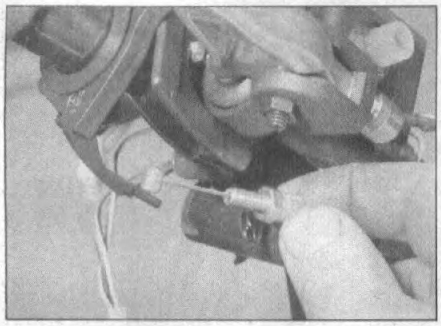
10.3b The plate is secured by two screws (arrowed)



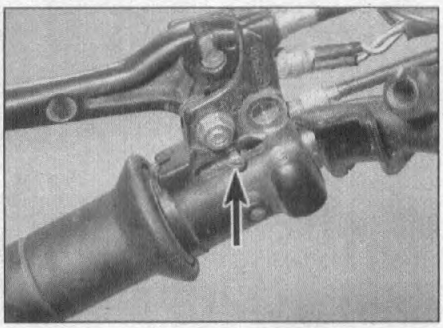
10.3c Detach the nipple (arrowed) from the twistgrip . . .



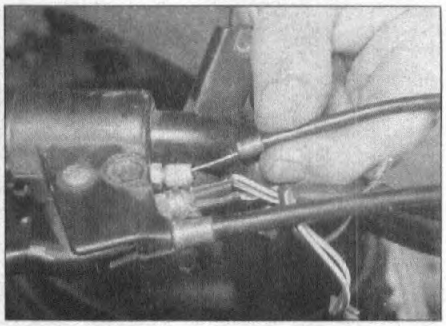
10.3d . . . then remove the elbow . . .



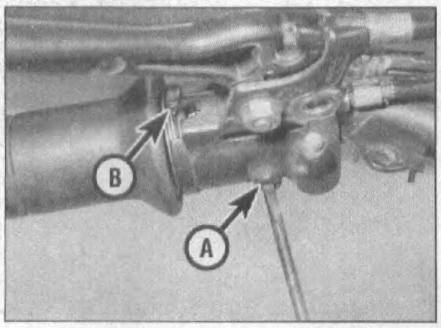
10.3e . . . and unscrew the adjuster



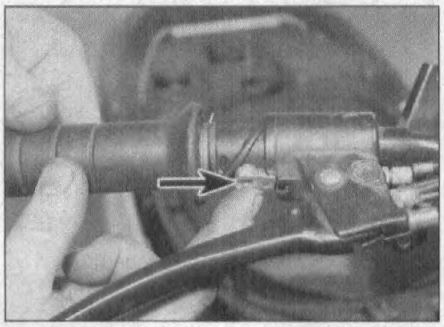
10.4a Slacken the cable clamp screw (arrowed) . . .



10.4b . . . and draw out the cable



10.4c Remove the grub screw (A), noting how the return spring end (B) locates . . .

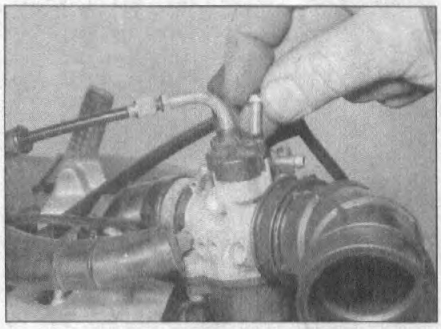


10.4d . . . then draw the twistgrip out, noting how the slider (arrowed) locates in its track

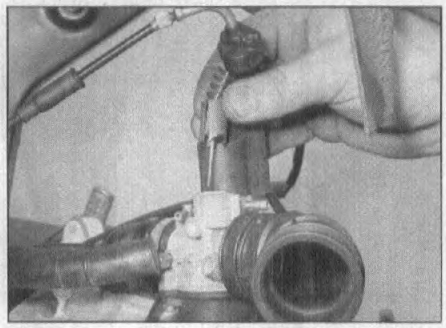
unscrew the cable adjuster from its housing and remove the cable via the slot in the housing **(see illustration)**.

4 On models with a sliding twistgrip, slacken the screw securing the end of the cable in the slider, then draw the cable out **(see illustrations)**. Make a note of the distance from the end of the cable where the screw located as an aid for correctly setting the new cable. Note that the inner cable is available separately from the outer cable. To remove the slider, remove the grub screw securing the twistgrip in the housing, then draw the twistgrip out of the housing, noting how the return spring ends locate on the housing and the twistgrip **(see illustration)**. Remove the slider, noting how it locates in the track in the twistgrip and in the housing **(see illustration)**.

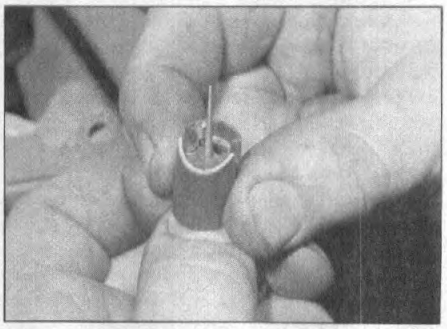
5 To detach the cable from the carburettor, remove the screw securing the carburettor top cover, noting that the cover is under spring pressure, then lift the cover and withdraw the throttle slide **(see illustrations)**. Holding the cover, push the slide to compress the spring, thereby creating freeplay in the cable. Free the cable nipple from its slot in the bottom of the slide and align it with the larger adjacent hole so that the slide can be drawn off the cable **(see illustration)**. Remove the slide and the



10.5a Remove the screw . . .

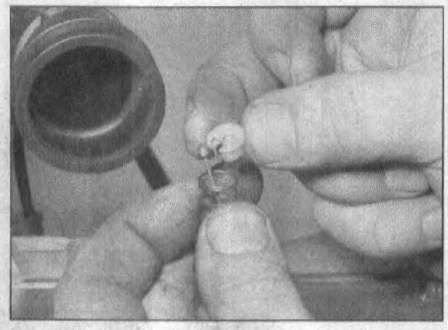


10.5b . . . and lift off the cover and throttle slide

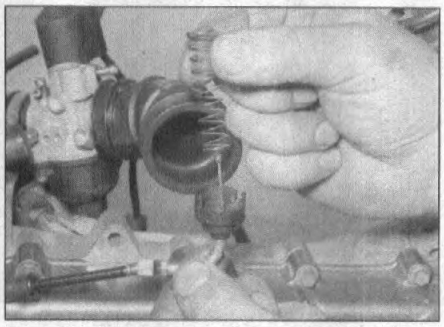


10.5c Free the nipple from its slot . . .

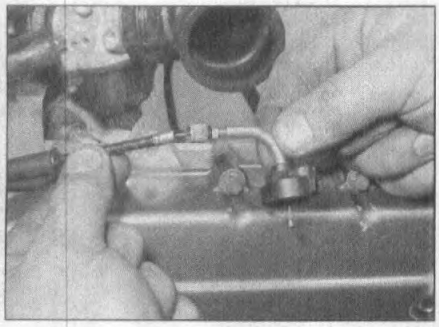
10.5d . . . and draw it out of the slide . . .



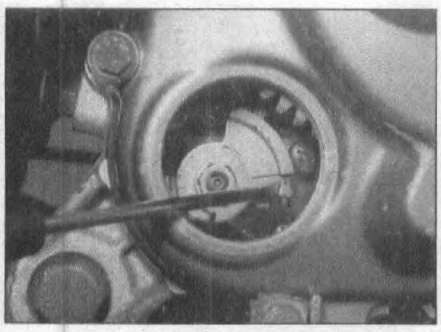
10.5e . . . then remove the spring seat . . .



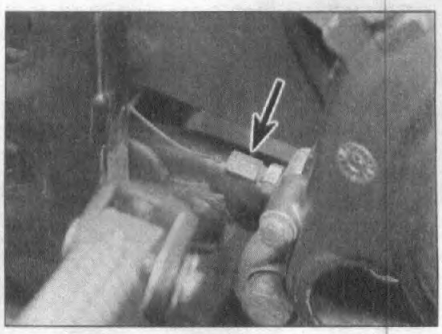
10.5f . . . and the spring . . .



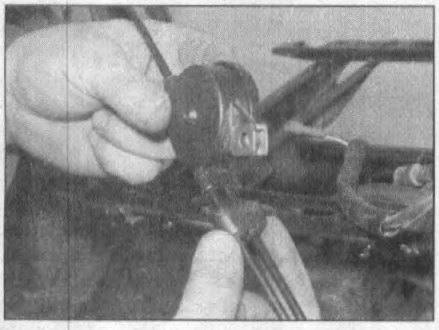
10.5g . . . and draw the cable out of the top cover



10.6a Lever up the tab securing the nipple . . .

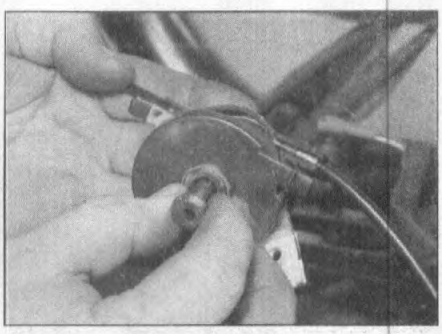


10.6b . . . and draw the cable out of the adjuster (arrowed)



10.7a Draw off the splitter cover . . .

10.7b . . . then press in the tabs . . .

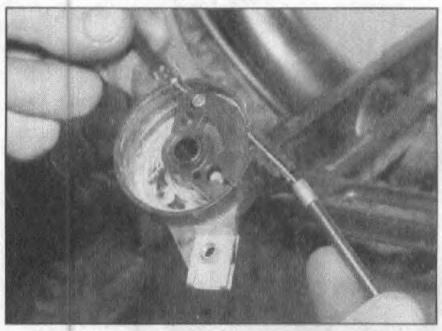


10.7c . . . withdraw the peg and remove the cover

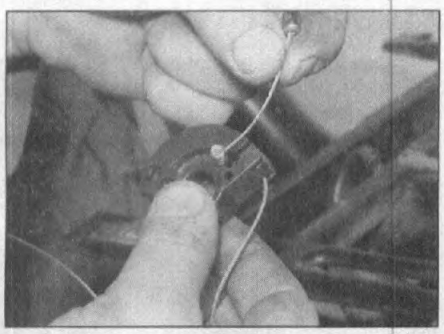
spring seat, noting how they fit, then remove the spring and draw the cable out of the elbow on the top of the cover **(see illustrations)**.

6 To detach the cable from the oil pump, lever up the tab securing the cable nipple, then release the cable from its channel and draw it out of the front of the transmission housing **(see illustrations)**. Manually move the oil pump cam round to provide some slack in the cable if required (doing this will certainly help installation of the cable). If required, slacken the locknut on the cable adjuster, then unscrew the adjuster from the transmission housing.

7 On models with the cam type cable splitter, first detach the cable being renewed from the twistgrip, carburettor or oil pump as relevant. Remove the screw (on the underside of the bellypan) securing the splitter to its mounting. Draw the cable rubber covers off the splitter, then depress the tabs on the bottom of the peg securing the splitter cover and draw the peg out



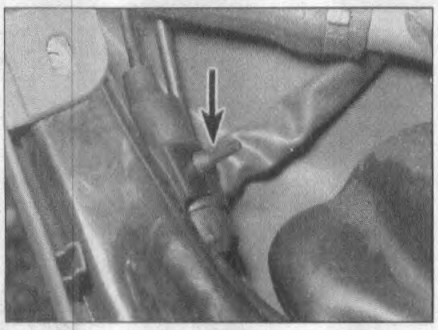
10.7d Draw out the outer cables . . .



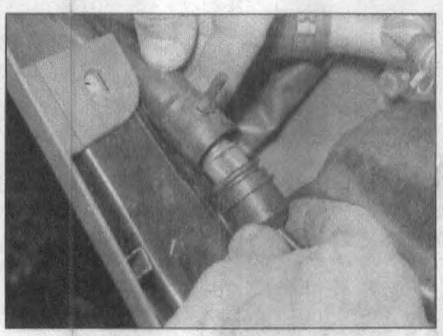
10.7e . . . then remove the cam and detach the cable nipples

of the splitter and remove the cover **(see illustrations)**. Draw the outer cables out of their sockets, then lift the cam off its pivot and detach the cable nipples from the cam as required, noting their relative positions **(see illustrations)**.

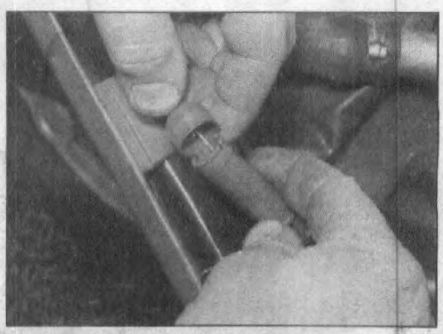
8 On models with the slider type splitter, first detach the cables from the carburettor and the oil pump as described above. Detach the splitter holder from the frame and draw the rubber covers off the splitter **(see illustrations)**.



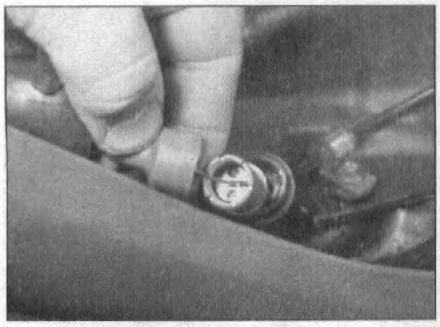
10.8a Free the splitter from its bracket (arrowed) . . .



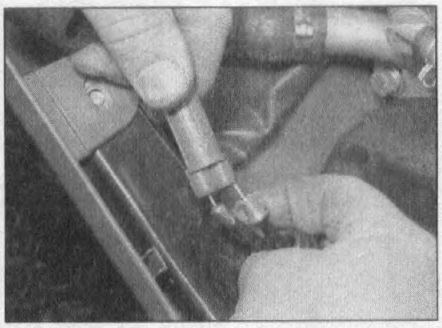
10.8b . . . and draw off the covers



10.8c Remove the cap . . .



10.8d . . . and draw out the slider



10.8e Note how the outer cables locate in the splitter

Remove the cap from the splitter and draw the slider out of the housing using the main cable from the twistgrip **(see illustrations)**. Detach the cable(s) from the splitter as required, noting their relative positions **(see illustration)**.

Installation

9 Installation is the reverse of removal, noting the following points:

a) Lubricate the cable nipples with multi-purpose grease.

b) Make sure the cables are correctly routed. They must not interfere with any other component and should not be kinked or bent sharply. Turn the handlebars back-and-forth to make sure the cable doesn't cause the steering to bind.

c) Operate the throttle to check that it opens and closes smoothly and freely.

d) Check and adjust the cable freeplay and the oil pump setting (see Chapter 1). This is very important to ensure that the engine receives the correct lubrication supply.

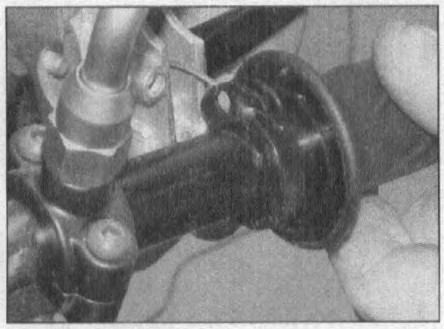
e) Start the engine and check that the idle speed does not rise as the handlebars are turned. If it does, a cable is routed incorrectly. Correct the problem before riding the scooter.

Four-stroke engines

Removal

10 Two types of throttle twistgrip are used. Some models have a motorcycle-type twistgrip, where the nipple on the end of the inner cable fits into a socket in the twistgrip. Other models have a sliding type twistgrip, where the end of the inner cable is secured in a slider, which locates into a diagonal track inside the twistgrip.

10.12a On B125 models, undo the screw to split the twistgrip housing . . .



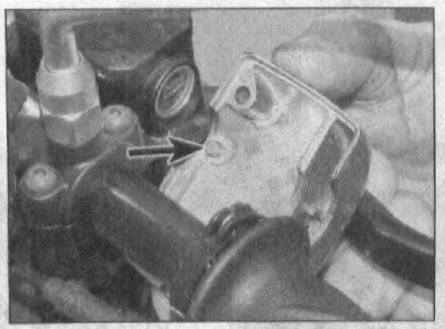
10.12b . . . then detach the cable nipple from the twistgrip . . .

11 To access the cable at the throttle twistgrip, remove the handlebar front cover. To access the cable at the carburettor, remove the storage compartment (see Chapter 7).

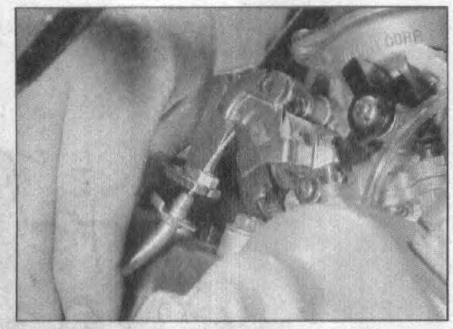
12 On most models with a motorcycle type twistgrip, slacken the cable adjuster locknut and thread the adjuster fully into the housing **(see illustration 10.3a)**. Pull back the twistgrip rubber, then remove the screws securing the cover plate and remove the plate, noting how it fits **(see illustration 10.3b)**. Detach the cable nipple from its socket, then remove the cable elbow, noting how it fits **(see illustrations 10.3c and 10.3d)**. Now unscrew the cable adjuster from its housing and remove the cable via the slot in the housing **(see illustration 10.3e)**. Note that on B125 models the twistgrip housing is in two halves. Slacken the throttle cable adjuster, then undo the screw securing the halves of the housing together and separate them **(see illustration)**. Detach the cable nipple from the twistgrip and pull the cable out **(see illustration)**. Note how the pin in the front half of the housing locates in the handlebar **(see illustration)**.

13 On models with a sliding twistgrip, slacken the screw securing the end of the cable in the slider, then draw the cable out **(see illustrations 10.4a and 10.4b)**. Make a note of the distance from the end of the cable where the screw located as an aid for correctly setting the new cable. Note that the inner cable is available separately from the outer cable. To remove the slider, remove the grub screw securing the twistgrip in the housing, then draw the twistgrip out of the housing, carefully noting how the return spring ends locate on the housing and the twistgrip **(see illustration 10.4c)**. Remove the slider, noting how it locates in the track in the twistgrip and in the housing **(see illustration 10.4d)**.

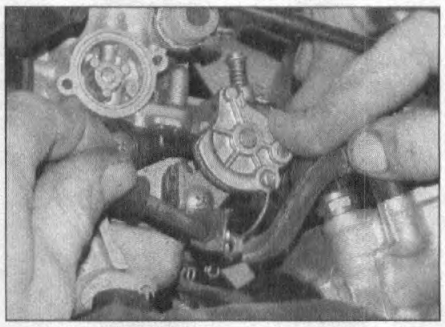
14 Unscrew the nut securing the outer cable in its bracket on the carburettor and lift the cable out of the bracket, then detach the cable nipple from the cam on the carburettor noting how it fits **(see illustrations)**. Withdraw the cable from the scooter noting the correct routing.



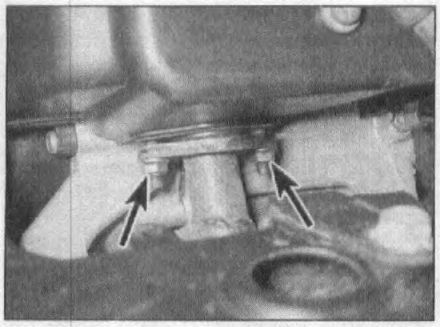
10.12c . . . noting how the pin (arrowed) locates in the handlebar



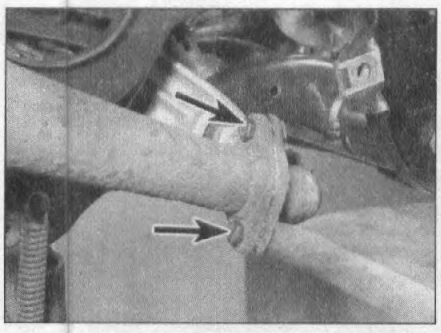
10.14a Detach the cable from the bracket . . .



10.14b . . . then detach the cable nipple from the cam



11.2a Unscrew the two nuts (arrowed) . . .



11.2b . . . and the two bolts (arrowed)

11.3a Loosen the silencer clamp

Installation

15 Installation is the reverse of removal, noting the following points:

a) Lubricate the cable nipple(s) with multi-purpose grease.

b) Make sure the cable is correctly routed. It must not interfere with any other component and should not be kinked or bent sharply. Turn the handlebars back-and-forth to make sure the cable doesn't cause the steering to bind.

c) Operate the throttle to check that it opens and closes smoothly and freely.

d) Check and adjust the cable freeplay (see Chapter 1).

e) Start the engine and check that the idle speed does not rise as the handlebars are turned. If it does, the cable is routed incorrectly. Correct the problem before riding the scooter.

11 Exhaust system – removal and installation

Note: *Some models are fitted with a one-piece exhaust system. Follow the procedure for removing the complete system.*

Warning: If the engine has been running the exhaust system will be very hot. Allow the system to cool before carrying out any work.

Downpipe removal

1 Remove the engine access panel and, if required by your model, the right-hand side panel (see Chapter 7).

2 Unscrew the two nuts securing the downpipe to the cylinder or cylinder head and the two bolts or clamp securing the downpipe to the silencer and remove the downpipe **(see illustrations)**. Remove the gasket from the exhaust port and from the downpipe to silencer joint. Discard them, as new ones must be used.

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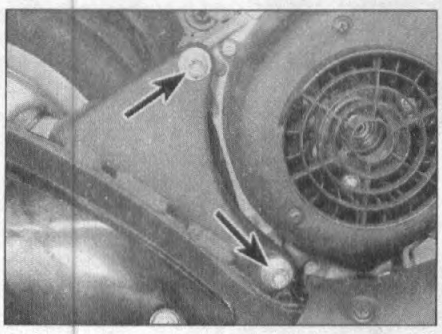
Exhaust system clamp bolts tend to become corroded and seized. It is advisable to spray them with penetrating oil before attempting to loosen them.

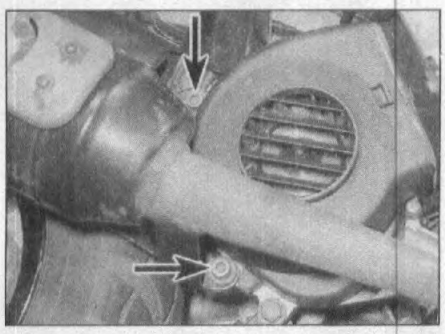
Silencer removal

Note: *On all later models, the silencer incorporates a catalytic converter – handle the silencer with care to avoid damage.*

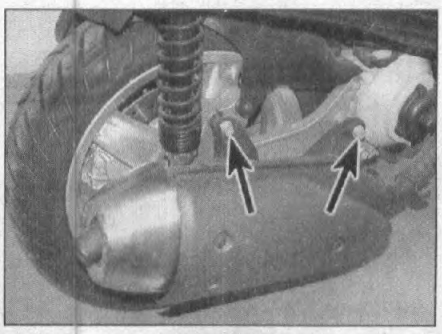
3 Undo the two bolts or loosen the clamp securing the silencer to the downpipe **(see illustration)**. Support the silencer, then remove the bolts securing it to the engine or rear subframe and lift off **(see illustrations)**. Where fitted, note the spring washer between the silencer bracket and the engine casing **(see illustration)**. If fitted, remove the gasket from the silencer to downpipe joint **(see illustration)**. Discard it, as a new one must be used.



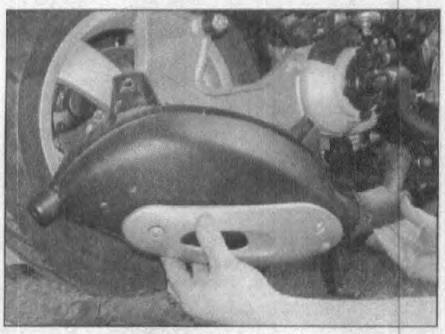
11.3b Silencer mounting bolts – ET4



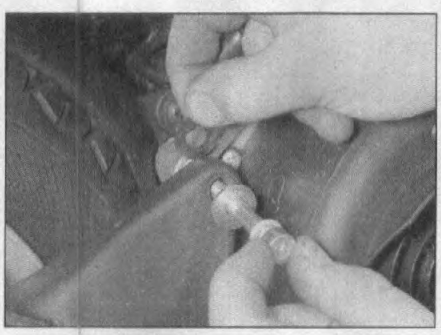
11.3c Silencer mounting bolts – Typhoon



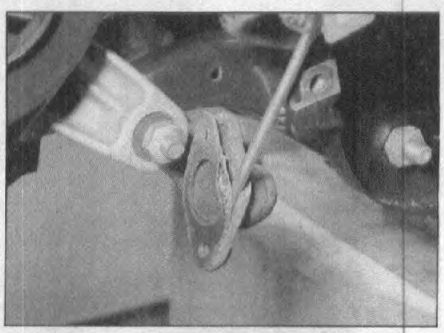
11.3d Silencer mounting bolts – X9



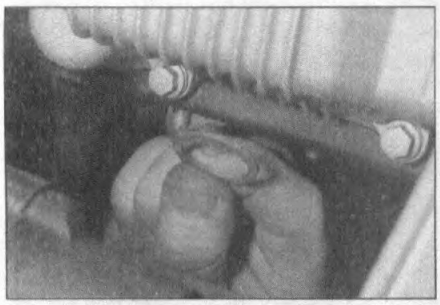
11.3e Remove the silencer carefully to avoid damaging the catalytic converter



11.3f Note the location of the washers behind the silencer bracket



11.3g Remove the gasket and discard it



11.5 Remove the gasket from the exhaust port

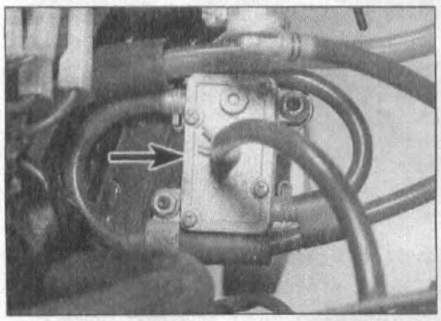
Complete system removal

4 Remove the engine access panel and, if required by your model, the right-hand side panel (see Chapter 7). On two-stroke models fitted with a secondary air system (see Chapter 1, Section 21), loosen the clip securing the air hose to the extension on the exhaust downpipe and disconnect the hose.

5 Unscrew the two nuts securing the downpipe to the cylinder or cylinder head and the bolts securing the silencer to the engine and remove the exhaust system **(see illustrations 11.2a, 11.3b, 11.3c and 11.3d)**. Remove the gasket from the exhaust port. Discard it, as a new one must be used **(see illustration)**.

Installation

6 Installation is the reverse of removal, noting the following:



13.2a Fuel pump (arrowed) – Hexagon

a) When installing the silencer or the complete system, install the silencer-to-engine bolts first to take the weight – do not allow the other mountings to take the weight by themselves. Don't forget to fit the spring washers between the silencer bracket and the engine if applicable.

b) Leave all fasteners loose until the entire system has been installed, making alignment of the various sections easier. Tighten the silencer mountings last. Note that on some models the top silencer mounting bolt threads into a nut which sits captive, but not fixed, in a slot in the crankcase – make sure the nut is correctly positioned.

c) Use a new gasket in the exhaust port and between the downpipe and the silencer, where fitted.

d) Run the engine and check the system for leaks.

12 Catalytic converter – general information

1 To minimise the amount of engine exhaust pollutants escaping into the atmosphere, all two-stroke and four-stroke models with Hi-Per2 and Hi-Per4 engines, and later LEADER-engine models, are fitted with an exhaust system incorporating a simple, open-loop catalytic converter.

2 The catalytic converter works in conjunction with the secondary air system which promotes the burning of any excess fuel present in the exhaust gases. Ensure the secondary air system and system filters are checked at the specified service interval (see Chapter 1, Section 21).

3 The catalytic converter has no link with the fuel and ignition systems, and requires no routine maintenance. However the following points should be noted:

a) Always use unleaded fuel – the use of leaded fuel or LRP will destroy the converter.

b) Do not use any fuel or oil additives.

c) Keep the fuel and ignition systems in good order – if the fuel/air mixture is suspected of being incorrect, have it checked by a Piaggio dealer on an exhaust gas analyser.

d) When the exhaust system is removed from the scooter handle it with care to avoid damaging the catalytic converter.

13 Fuel pump – check and renewal

Warning: Refer to the precautions given in Section 1 before proceeding.

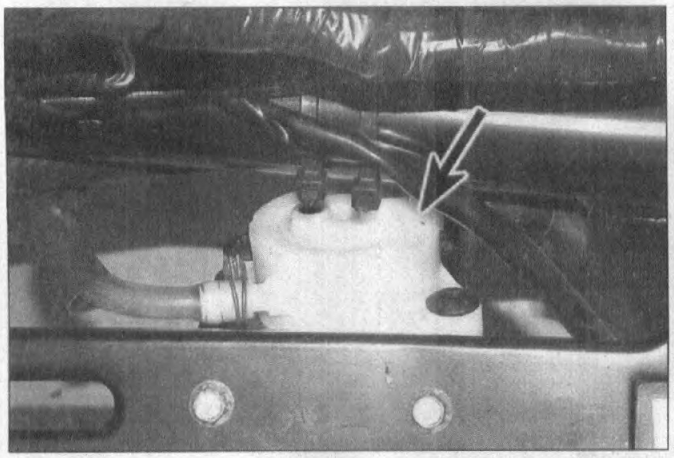
Vacuum fuel pump – B125, X8, X9, GT/GTV125, GT200 and NRG Power models

Note: *Later models of the X8, X9, Liberty 125, plus the GTS125 and S125 are fitted with an electric fuel pump – see the end of this Section for information.*

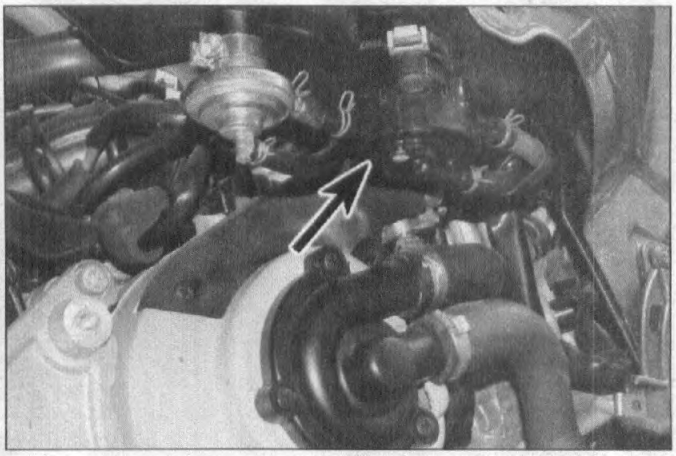
Check

1 The fuel system is pressurised. The fuel pump is operated by the alternating vacuum and pressure in the crankcase when the engine is running which opens and closes a diaphragm in the pump. On later Hexagon two-stroke models, the pump supplies fuel to a header tank which ensures a supply of fuel to the carburettor when the scooter has been standing unused. On all other models, the pump supplies fuel direct to the carburettor. The most likely cause of pump failure will be a split in the diaphragm.

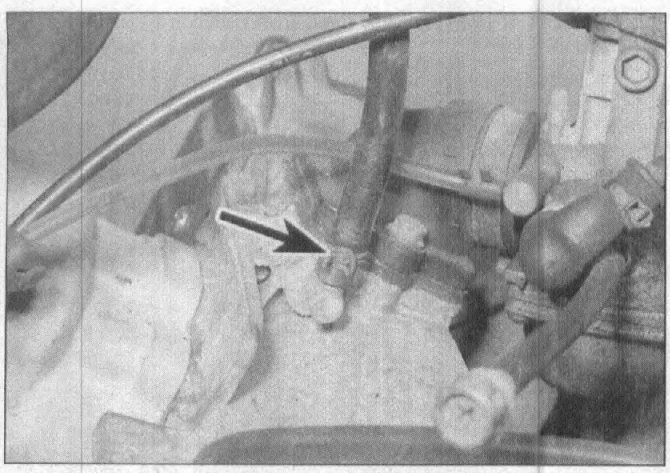
2 On Hexagon models, remove the seat (see Chapter 7); the fuel pump is mounted on the frame above the engine **(see illustration)**. On B125, X8 125, X9 125 and NRG Power DT and DD models, remove the belly panel (see Chapter 7); the fuel pump is mounted on the frame alongside the fuel tank **(see illustration)**. On GT and GTV models, the fuel pump is mounted on the underside of the fuel tank **(see illustration)**.



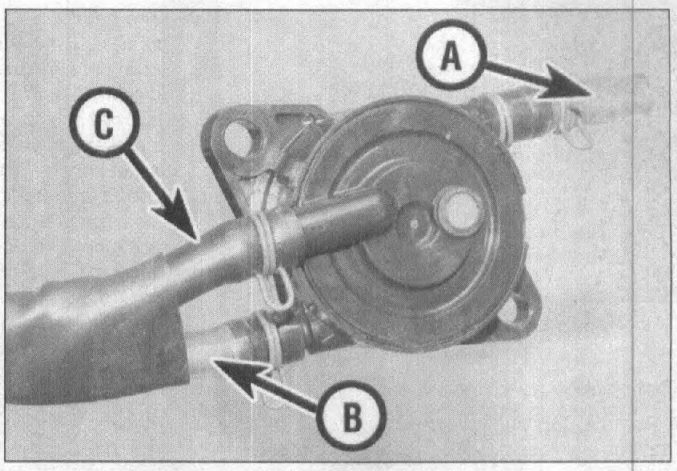
13.2b Location of fuel pump (arrowed) on X9 model



13.2c Location of the fuel pump (arrowed) on GT125 models



13.4a Check the vacuum hose from the crankcase (arrowed)



13.4b Fuel supply hose from tank (A), feed hose to carburettor (B) and vacuum hose (C)

3 To check whether the pump is operating, release the clip securing the fuel supply hose to the carburettor or header tank as applicable, and detach the hose. Place the open end in a container suitable for storing petrol. Turn the engine over on the starter motor and check whether fuel flows from the hose into the container. If fuel flows, the pump is working correctly. On later Hexagon two-stroke models, if the pump is good but fuel is not reaching the carburettor, check that the vent pipe from the header tank to the fuel tank is not blocked or kinked.

4 If no fuel flows from the pump hose, first check that this is not due to a blocked filter or fuel hose, or due to a split in the vacuum hose from the crankcase, before renewing the pump **(see illustration)**. Check all the hoses for splits, cracks and kinks, and check that they are securely connected on each end by a good clip **(see illustration)**. If all the hoses are good, renew the pump. On Hexagon two-stroke models, it is possible to disassemble the pump for cleaning or inspection – holding the diaphragm up to the light will reveal any splits or holes – but no individual components are available.

Renewal

5 Remove the bodywork as required by your model to access the fuel pump (see Chapter 7).

6 Release the clips securing the fuel and vacuum hoses and detach them from the pump, noting which fits where. Be prepared to catch any residue fuel in a suitable container. The fuel hoses should be clamped to prevent fuel leakage using any of the methods shown (*see **Tool Tips***).

7 On Hexagon models, unscrew the nuts securing the pump to the frame. On all other models undo the screws securing the pump to the pump bracket **(see illustration)**. Remove the pump, noting which way up it fits.

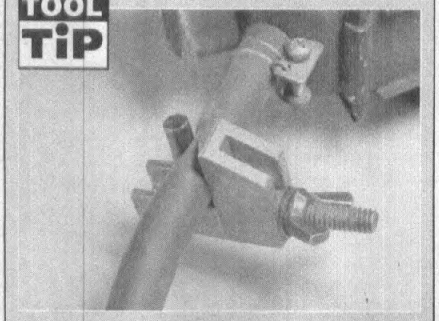
8 Install the new pump, making sure the hoses are correctly attached and secured with the clips. If the old clips are corroded or deformed, fit new ones.

Typhoon 80 and 125 models

General

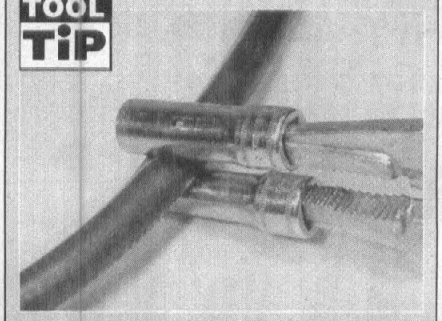
9 These models have two fuel tanks; the main fuel tank below the rear bodywork and an auxiliary fuel tank behind the fairing **(see illustrations overleaf)**. Fuel added via the filler cap in the main fuel tank is distributed

TOOL TiP



A wingnut type clamp.

TOOL TiP

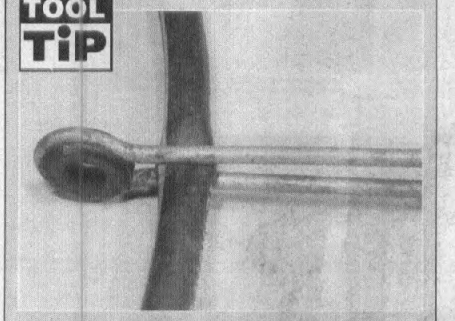


Two sockets and self-locking grips.

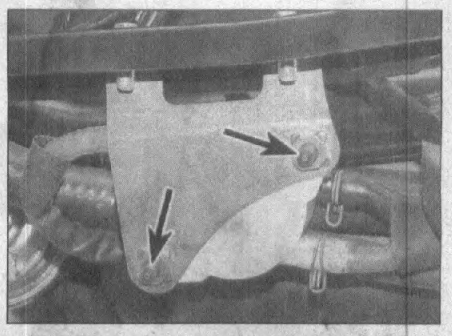
TOOL TiP

Thick card and self-locking grips.

TOOL TiP

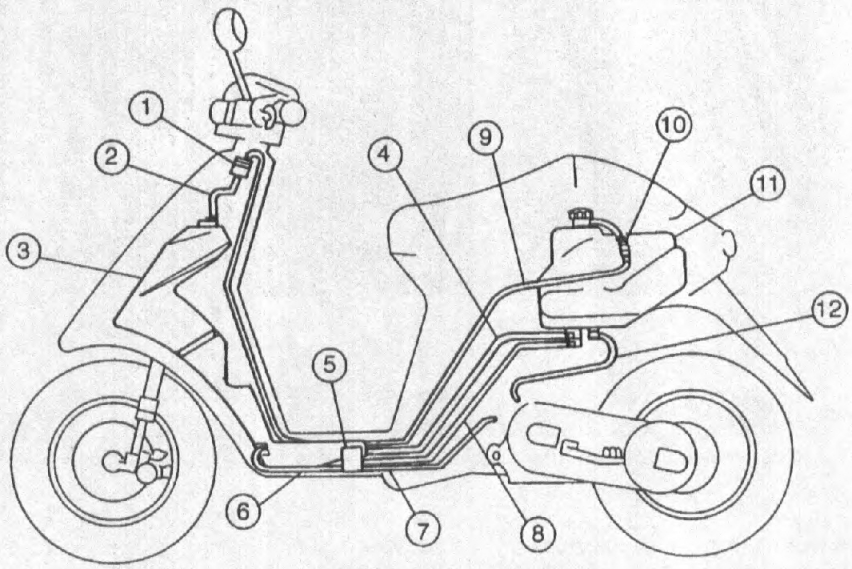


An automotive brake hose clamp.



13.7 Pump is secured to the bracket by two screws

1 *Vent pipe filter*
2 *Auxiliary tank vent pipe*
3 *Auxiliary tank*
4 *Fuel balance pipe*
5 *Fuel pump*
6 *Auxiliary tank-to-pump fuel pipe*
7 *Pump-to-crankcase vacuum pipe*
8 *Pump-to-main fuel tank fuel pipe*
9 *Main fuel tank vent pipe*
10 *One-way valve*
11 *Main fuel tank*
12 *Fuel supply pipe to carburettor*



13.9a Fuel supply system components

evenly between both tanks via a balance pipe which runs under the footboard. A vent hose runs from the top of the auxiliary tank to the filler neck of the main fuel tank.

10 As the fuel level in the main fuel tank drops to show a 1/4 tank capacity on the gauge, a pump located under the footboards, pumps fuel from the auxiliary tank into the main tank until the auxiliary tank is drained. The pump is vacuum-operated via a hose from the engine.

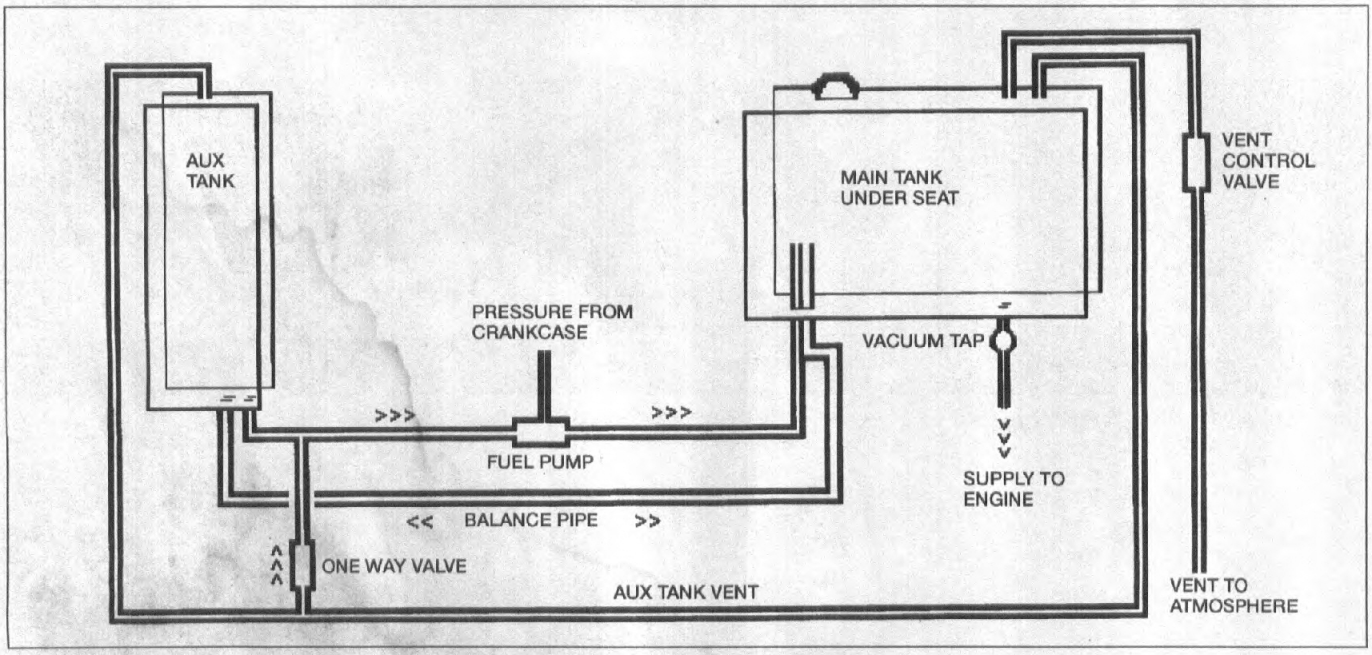
Note: *The fuel supply to the carburettor is not pressurised. If the pump fails, it will not be possible to transfer fuel from the auxiliary tank to the main tank.*

Check

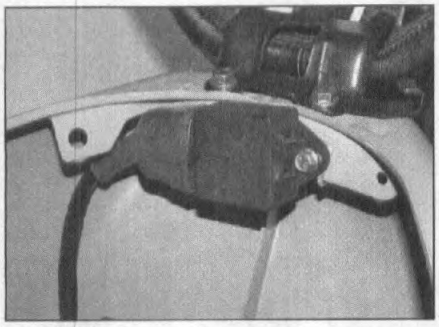
11 To check the operation of the pump, remove the filler cap from the main fuel tank. With the engine running it should be possible to see pumped fuel coming out of the supply pipe in the bottom of the tank.

12 Check for trapped or kinked pipes under the footboard. Check the auxiliary tank vent hose and the operation of the one-way valve **(see illustration 13.9b)**.

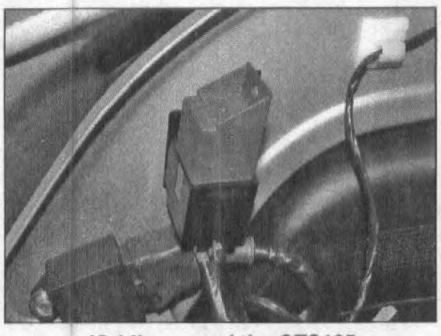
13 Check the main tank vent hose and the vent control valve. Disconnect the vent hose from the tank. There should be slight resistance when you blow through the hose from the tank end and no resistance when you blow through it from the open end.



13.9b Fuel supply system operation



13.14a Pump relay location on the S125 . . .



13.14b . . . and the GTS125

13.15 Fuel filter (arrowed)

Electric fuel pump – later 125 models

Check

14 Later 125 models feature an electrically-operated fuel pump. The pump is triggered by a relay **(see illustrations)**. Pump operation can be heard. When the ignition is switched on, the pump will run for 13 seconds to prime the fuel system. Above 2000 rpm the pump should always be running, but below this its operation will be intermittant according to engine speed.

15 A fuel filter is located in the fuel feed pipe from the tank to the pump **(see illustration)**. Check that the filter isn't blocked before assuming that the pump is at fault.

16 If the pump is suspected of being faulty, check that battery voltage is reaching the relay by disconnecting the relay's wire connector and using a multimeter set to the 0-20 dcv scale to check for a 12V supply between the orange (positive probe) and black wire (negative proble) on the wire harness side of the connector **(see illustration)**.

17 To test the relay, first disconnect it from the scooter. The relay terminals are numbered. Connect a continuity tester or multimeter set to the ohms range across terminals 87 and 30 of the relay. No continuity should be indicated. Now connect a 12V battery across terminals 85 and 86 – continuity should now be indicated across terminals 87 and 30 if the relay is operating correctly.

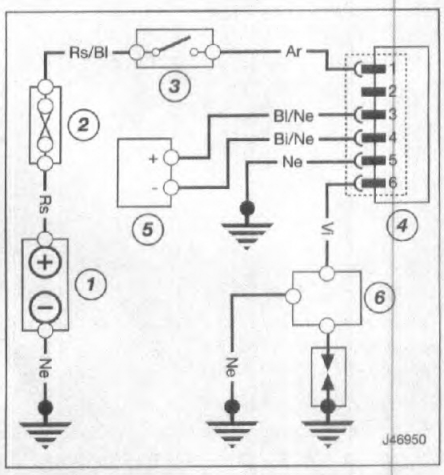
18 If the relay checks out ok, yet the fuel pump doesn't work, check the two wires from the relay to the pump for continuity, failing that renew the pump.

Renewal

19 The fuel pump will either be mounted on the inside of the frame or to the base of the fuel tank **(see illustrations)**.

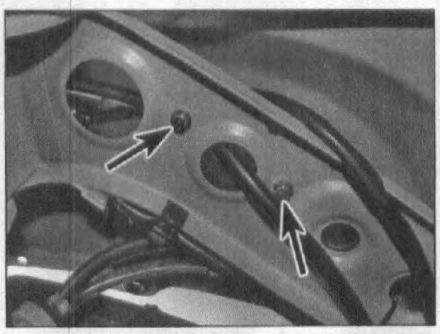
20 Disconnect the pump's wire connector. Clamp the two fuel pipes (see ***Tool Tip***), then release their clips and detach them from the pump. Ease the pump out of its rubber mounting sleeve.

21 Make sure that fuel pipes are a good fit on the pump unions; renew the pipes and their clips if they have deteriorated in any way. If the pump is being renewed it is good practice to renew the fuel filter at the same time.

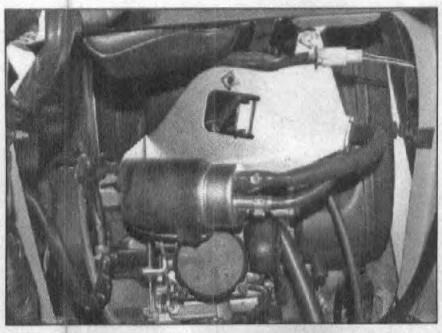


13.16 Fuel pump circuit diagram

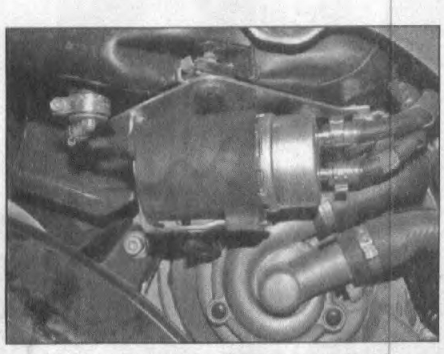
1 *Battery*
2 *Fuse*
3 *Ignition (main switch)*
4 *Relay*
5 *Pump*
6 *HT coil*



13.19a Release the two mounting nuts (arrowed) . . .



13.19b . . . and manoeuvre the pump and its bracket out on S125



13.19c Pump bracket is mounted to underside of fuel tank on GTS