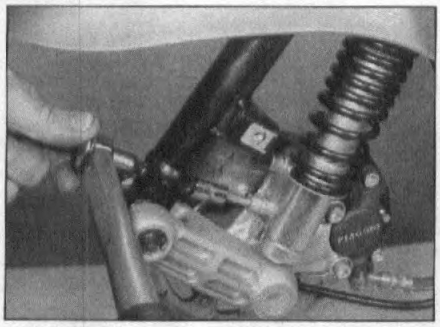
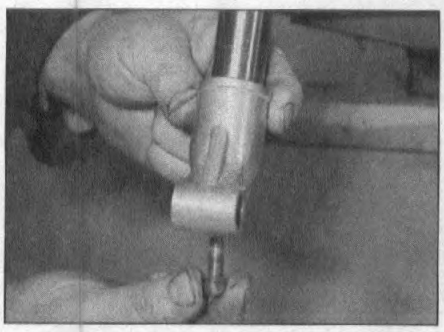
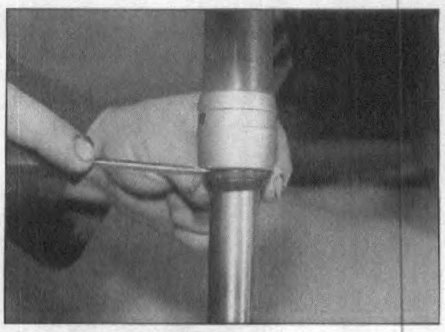


5.23 Tighten the shock absorber mounting bolts and nuts to the specified torque



5.26a Remove the bolt and slide off the axle/brake caliper bracket



5.26b Lever off the seal and draw it off the slider

spring using a coil spring compressor by just enough to remove the pressure on the spring seat at the top. Unscrew the top nut and remove the washers, the buffer, the mounting plate, the spring seat and the sleeve, then carefully release the compressor until the spring is relaxed. Remove the spring, noting which way up it fits. On some earlier models, a lower buffer and sleeve are also fitted. Carefully note the relative positions of all components and how and which way up they fit. Install the new components and rebuild the shock in a reverse of the disassembly procedure.

12 Visually check the condition of the needle roller bearings in the trailing link arm and the brake caliper/shock absorber mounting bracket.

13 Worn bearings can be drifted out of their bores, but note that removal will destroy them; new components should be obtained before work commences. Before removing the bearings, carefully measure or mark their set depth within the bore so that the new ones can be correctly installed. The new ones should be pressed or drawn into their bores rather than driven into position. In the absence of a press, a suitable drawbolt arrangement can be made up as described below.

14 Obtain a long bolt or a length of threaded rod from a local engineering works or some other supplier. The bolt or rod should be about one inch longer than the combined width of the arm and one bearing. Also required are suitable nuts and two large and robust washers having a larger outside diameter than the bearing housing. In the case of the threaded rod, fit one nut to one end of the rod and stake it in place for convenience.

15 Fit one of the washers over the bolt or rod so that it rests against the head or staked nut, then pass the assembly through the bore. Over the projecting end place the bearing, which should be greased to ease installation, followed by the remaining washer and nut.

16 Holding the bearing to ensure that it is kept square, slowly tighten the nut so that the bearing is drawn into its bore.

17 Once it is fully home, remove the drawbolt arrangement and repeat the procedure to fit the other bearing.

18 Lubricate the needle roller bearings with molybdenum disulphide grease.

19 Fit new dust seals and O-rings.

Reassembly

20 Slide the brake caliper/shock absorber mounting bracket onto the trailing link arm and secure it with the circlip, making sure it sits properly in its groove **(see illustration 5.6)**.

21 Lubricate the bearing spacer pin with molybdenum disulphide grease. Align the trailing link arm with the steering stem and drive or press the pin through the arm and stem.

22 Fit the new sprung star washers and drive them into place using a piece of tubing that bears only on the section between the raised inner section and the raised outer tangs.

23 Install the shock absorber and tighten the nuts and bolts to the torque settings specified at the beginning of the Chapter **(see illustration)**.

24 Install the hub assembly and the front wheel (see Chapter 8) and the covers, where applicable.

Upside-down telescopic forks

Seal renewal

25 Remove the front wheel and, if applicable, displace the front brake caliper (see Chapter 8).

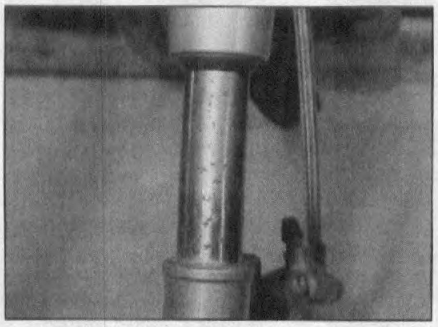
26 Remove the Allen bolt from the base of the fork slider and draw the axle/brake caliper bracket off the bottom **(see illustration)**. If necessary, heat the bracket with a hot air gun to aid removal. Lever the seal out of the bottom of the fork tube and remove it from the slider **(see illustration)**.

27 Clean the bottom of the slider and the inside of the axle/brake caliper bracket and remove any traces of corrosion **(see illustration)**.

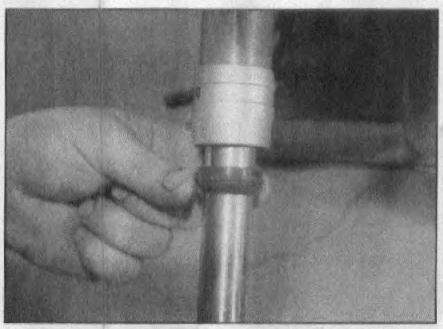
28 Apply grease to the inside and outside of the new seal, then fit it over the slider and press it into position in the bottom of the tube **(see illustration)**.

29 Apply Loctite 242E or a similar locking compound to the bottom of the slider, then fit the axle/brake caliper bracket and tighten the bolt securely. Use the axle inserted through the bracket to prevent the fork slider rotating when tightening the bolt **(see illustration)**.

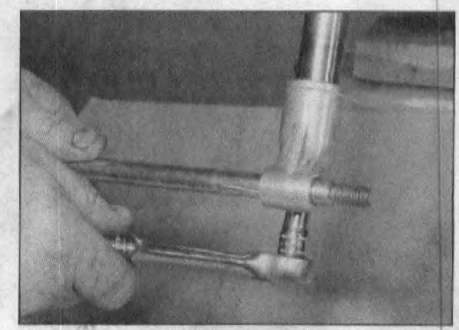
30 Install the front wheel (see Chapter 8). Check the operation of the front forks.



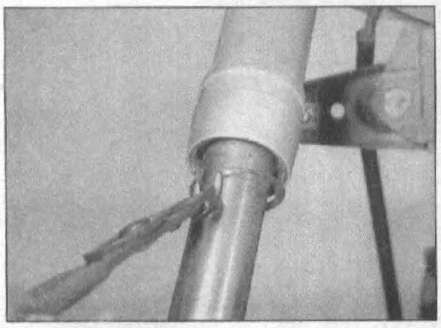
5.27 The sliders are prone to pitting and corrosion, which will ruin the seal



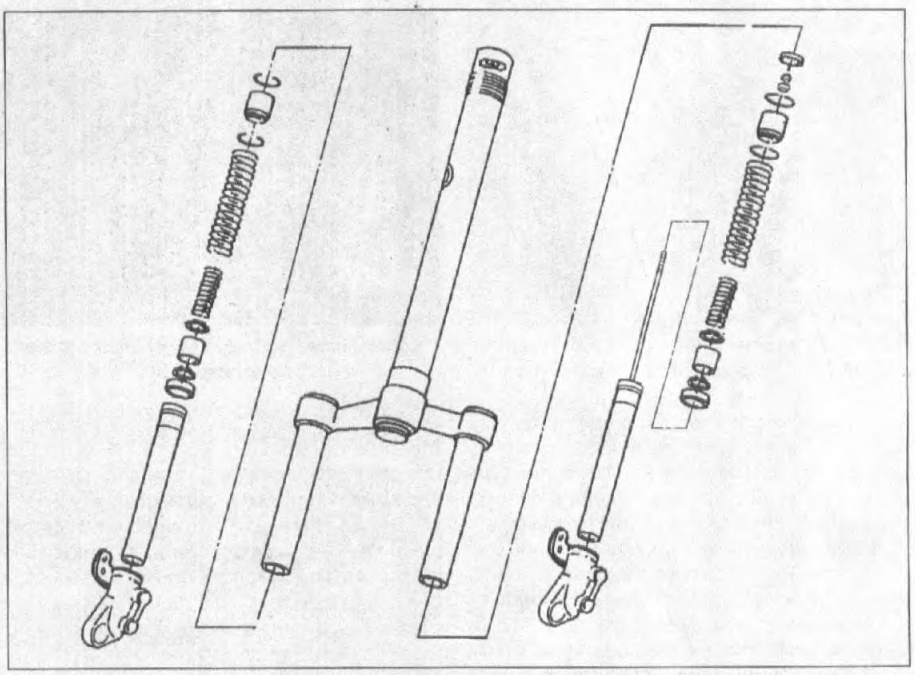
5.28 Press the new seal up into the tube



5.29 Use the axle to prevent the bracket rotating



5.32a Removing the circlip



5.32b Upside-down front fork assembly

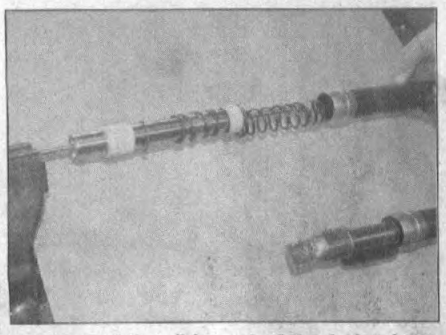
Disassembly

Note: *The internal components of these forks are retained by a series of circlips which makes them difficult to disassemble. Also, some models have had undocumented changes to the internal components and may differ to those described. A certain amount of reader input and common sense will have to be applied if the forks are to be disassembled completely. It is advised that the procedure is carried out by a Piaggio dealer.*

Note: *Always dismantle the fork legs separately to avoid interchanging parts and thus causing an accelerated rate of wear. Store all components in separate, clearly-marked containers.*

31 Remove the front wheel and, if applicable, displace the front brake caliper (see Chapter 8). Follow the procedure in Step 26 and remove the axle/brake caliper bracket and seal.

32 Remove the circlip from inside the bottom of the fork tube using a pair of internal circlip pliers **(see illustration)**. The slider assembly is retained by a circlip that fits in a tapered groove on the inside of the fork tube; dislodge the circlip by pulling the slider down sharply. If necessary, screw a suitable bolt into the thread in the bottom of the slider, then tighten the bolt in a vice. Strike the underside of the steering stem with a heavy mallet to dislodge the circlip **(see illustration)**. **Note:** *On all NRG models, Skipper (1998 to 2000) and Skipper ST models, the left-hand fork contains an integral damper cartridge, secured by a nut on the top of the fork tube. Unscrew the nut to release the damper rod before attempting to disassemble the fork leg.* If water has penetrated the seal, it is likely that the circlip will be very difficult to remove.



5.33 Pull the slider out of the fork tube

33 Pull the slider out of the fork tube, together with the lower bush, retaining circlip, rebound spring, upper bush, spring seat and compression spring. Note the order of the fork components for reassembly **(see illustration)**. Remove the upper bush lower circlip, the bush and the upper circlip from the slider. Discard the circlips if they are corroded and fit new ones on reassembly.

Inspection

34 Clean all parts in solvent and blow them dry with compressed air, if available. Check the sliders for score marks, scratches, flaking of the chrome finish and excessive or abnormal wear. Look for dents in the fork tube and fit a new steering stem assembly if any are found. Check the action of the damper, where fitted; if the rod slides freely in and out of the cartridge, or if the rod binds in the cartridge, fit a new damper. **Note:** *The damper is an integral part of the slider and cannot be removed from it.*

35 If available, check the fork sliders for runout using V-blocks and a dial gauge, or have it done by a Piaggio dealer. If the amount of runout is excessive, the sliders should be renewed.

Warning: If the slider is bent, it should not be straightened; renew it.

36 Check the springs for cracks and other damage. If they are defective, bent or sagged, renew them both. Never renew only one spring.

37 Examine the working surfaces of each bush; if worn or scuffed they must be renewed.

Reassembly

38 Install the various components in the reverse order of removal, coating them with grease as you install them. Fit the slider assembly into the tube, then, if applicable, secure the damper rod with the nut on the top of the fork tube. Use a suitable length of tubing to install the retaining circlip, the lower bush and the lower circlip squarely into the fork tube and ensure the circlips are securely located in their grooves before preceding to the next step. Use the tubing to press the seal into the bottom of the tube.

39 Install the axle/brake caliper bracket (see Step 29). If applicable, install the front brake caliper, then install the front wheel (see Chapter 8). Check the operation of the front forks.

Conventional telescopic forks

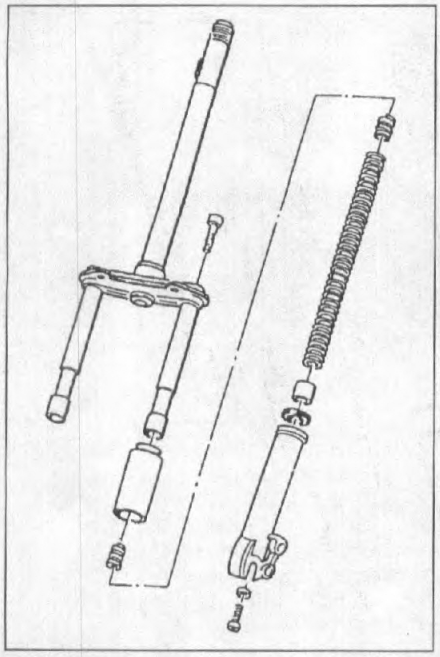
Note: *Two types of conventional telescopic fork are fitted to the scooters covered by this manual. On the first type, the tubes are an integral part of the fork yoke (Steps 40 to 51), on the second, motorcycle-type fork, the tubes are clamped in the yoke and can be removed individually for disassembly (Steps 52 to 76).*

Note: *Always dismantle the fork legs separately and store all components in separate, clearly marked containers to avoid interchanging parts. Check the availability of new parts and the type and quantity of fork oil required with a Piaggio dealer before disassembling the forks. Note that on some scooters the forks are lubricated with grease.*

Disassembly

40 Remove the front wheel (see Chapter 8).

41 Place a suitable oil drain tray below the



5.41 Conventional forks with integral yoke and tubes

fork, then unscrew the bolt in the bottom of the fork slider and allow the oil to drain, whilst holding the slider in place **(see illustration)**. When the oil has drained, draw the slider down off the tube. For oil seal renewal only, the spring can be left in place secured in the top of the fork tube. A buffer is fitted in between the bottom of the spring and the slider – remove it if required.

42 To remove the oil seal, remove the circlip from the top of the slider, then remove the oil seal, either using the Piaggio service tool (Part No. 021467/17/18Y), a commercially-available expanding puller, or by carefully levering it out using a screwdriver. Take care not to gouge the rim of the slider when doing this.

43 To remove the spring, unscrew the bolt in the top of the fork tube and draw the spring out of the tube. Hold the spring to prevent it from turning with the bolt.

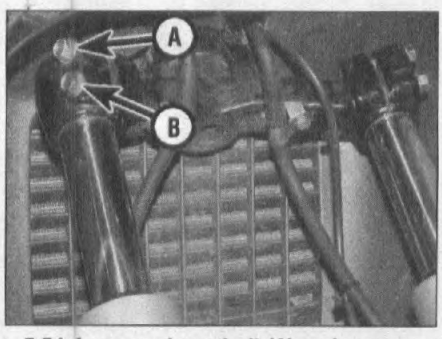
Inspection

44 Clean all parts in solvent and blow them dry with compressed air, if available. Check each fork tube for score marks, scratches, flaking of the chrome finish and excessive or abnormal wear. Look for dents in the tube and renew the tube in both legs if any are found. Check the fork seal seat for nicks, gouges and scratches. If damage is evident, leaks will occur.

45 Check the spring for cracks and other damage. If it is defective, bent or sagged, renew the springs in both legs with new ones. Never renew only one spring.

Reassembly

46 Press the new oil seal squarely into its recess in the slider as far as possible, then either use the Piaggio service tool (Part No. 040971Y), or a suitable piece of tubing or a



5.54 Loosen clamp bolt (A) and remove clamp bolt (B)

socket to tap the seal fully into place until the circlip groove is visible above the seal.

> **HAYNES HiNT** ***Place the old oil seal on top of the new one to protect it when driving the seal into place.***

47 Once the seal is correctly seated, fit the circlip, making sure it is correctly located in its groove.

48 If removed, fit the buffer into the bottom of the fork slider. Check that both plugs are in the ends of the spring, then insert the spring into the slider. Install the bolt into the bottom of the slider and thread it into the plug in the base of the spring. Hold the spring to prevent it from turning with the bolt.

49 Slowly pour in the specified quantity of the specified grade of fork oil.

50 Apply some fork oil to the lips of the seal, then insert the top of the spring into the bottom of the fork tube. Lift the slider so that the bottom of the tube fits squarely through the oil seal and into the slider, and raise it until the spring contacts the top of the tube. Holding the slider in position, install the bolt and thread it into the plug in the top of the spring.

51 Install the front wheel (see Chapter 8). Check the operation of the front forks.

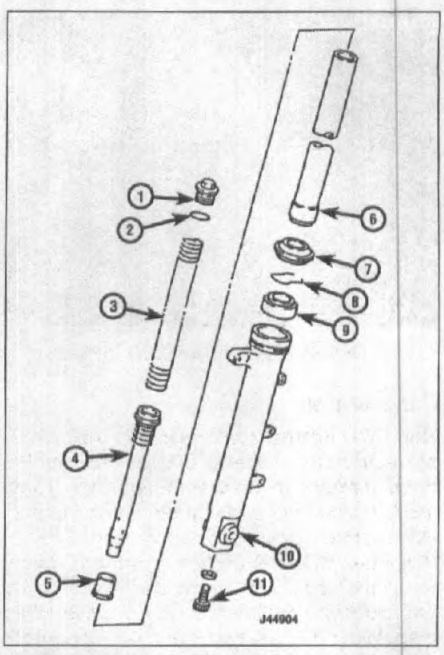
Motorcycle-type fork

Note: *Two types of conventional telescopic fork are fitted to the scooters covered by this manual. On the first type, the tubes are an integral part of the fork yoke (Steps 40 to 51), on the second, motorcycle-type fork, the tubes are clamped in the yoke and can be removed individually for disassembly (Steps 52 to 76).*

Note: *Always dismantle the fork legs separately and store all components in separate, clearly marked containers to avoid interchanging parts. Check the availability of new parts and the type and quantity of fork oil required with a Piaggio dealer before disassembling the forks. Note that on some scooters the forks are lubricated with grease.*

Removal

52 Remove the front wheel and displace the brake caliper (see Chapter 8).



5.57 Motorcycle-type fork components

1 Top bolt
2 O-ring
3 Spring
4 Damper
5 Damper seat
6 Fork tube
7 Dust seal
8 Circlip
9 Oil seal
10 Fork slider
11 Damper bolt

53 Remove the front mudguard and, where fitted, the fork leg shrouds (see Chapter 7).

54 Remove each fork leg individually. Loosen the top fork leg clamp bolt and undo and remove the lower clamp bolt **(see illustration)**. Remove the fork leg by twisting it and pulling it downwards.

> **HAYNES HiNT** ***If the fork legs are seized in the yoke, spray the area with penetrating oil and allow time for it to soak in before trying again.***

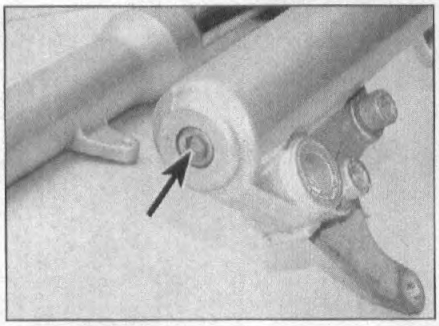
Installation

55 Remove all traces of corrosion from the fork tubes and the yoke. Install each fork leg individually. Slide the leg up through the yoke until the top edge of the fork tube is level with the top edge of the yoke. Ensure the location groove for the lower clamp bolt is correctly aligned. Tighten the clamp bolts securely or to the torque setting specified at the beginning of the Chapter.

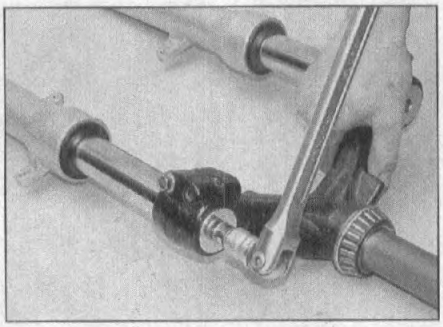
56 Install the remaining components in the reverse order of removal. Check the operation of the front forks.

Disassembly

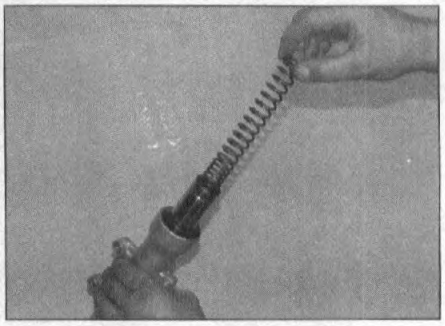
57 Remove the fork leg (see Steps 52 to 54). Always dismantle the fork legs separately to avoid interchanging parts. Store all components in separate, clearly-marked containers **(see illustration)**.



5.58 Loosen the damper bolt (arrowed)



5.59 Clamp the fork tube to loosen the top bolt



5.61 Compress the fork leg and remove the spring

58 The damper bolt should be loosened at this stage. Invert the fork leg and compress the fork tube in the slider so that the spring exerts maximum pressure on the damper head, then loosen the bolt in the base of the fork slider **(see illustration)**.

59 To remove the fork top bolt, clamp the fork tube in a vice equipped with soft jaws, taking care not to overtighten or score the tube's surface, and loosen the top bolt. **Note:** *If the steering stem has been removed, temporarily clamp the fork leg in the yoke using the lower clamp bolt only* ***(see illustration)***.

60 Unscrew the top bolt and remove it. Note the O-ring fitted to the top bolt; if it is damaged, fit a new one on reassembly.

Warning: The fork spring is pressing on the fork top bolt with considerable pressure. Unscrew the bolt very carefully, keeping a downward pressure on it and release it slowly as it is likely to spring clear. It is advisable to wear some form of eye and face protection when carrying out this operation.

61 Slide the fork tube down into the slider and withdraw the spring **(see illustration)**. Note which way up the spring is fitted.

62 Carefully prise out the dust seal from the top of the slider, then prise out the oil seal retaining clip **(see illustrations)**.

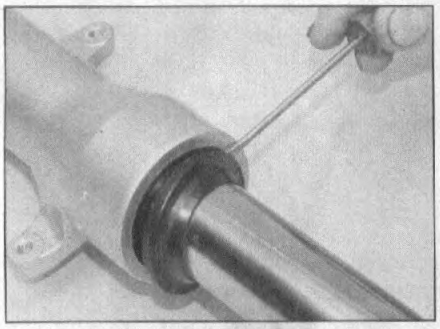
63 Invert the fork leg over a suitable container and pump the fork vigorously to expel as much fork oil as possible.

64 Remove the previously-loosened damper bolt and its sealing washer from the bottom of the slider. Discard the sealing washer, as a new one must be used on reassembly. If the damper bolt was not loosened before dismantling the fork, temporarily install the spring and press down on it to prevent the damper from turning.

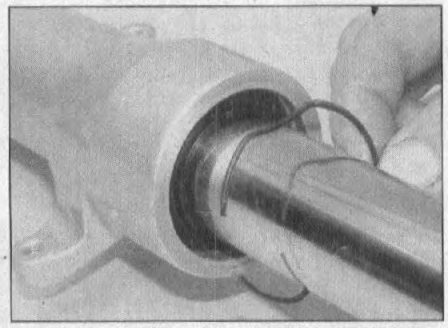
65 Pull the fork tube out of the slider.

66 Withdraw the damper and the damper seat from inside the fork slider.

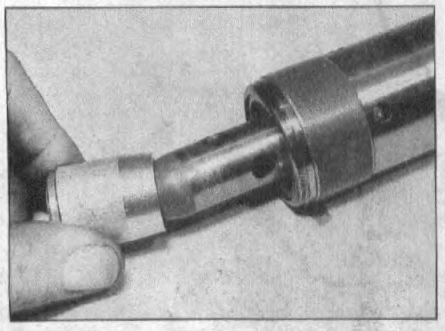
67 Carefully prise the oil seal out of the slider. Discard the oil and dust seals, as new ones must be used on reassembly.



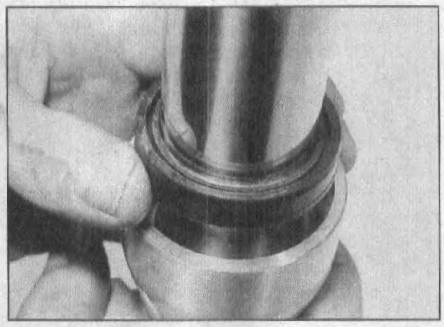
5.62a Prise out the dust seal . . .



5.62b . . . then prise out the retaining clip



5.69 Fit the seat onto the bottom of the damper



5.71 Install the oil seal with markings facing up

Inspection

68 Follow the procedure in Steps 44 and 45 to clean and check the fork components. If either of the fork tubes appears bent, have them both checked by a scooter dealer or specialist engineer. If necessary, fit new fork tubes, do not have them straightened.

Reassembly

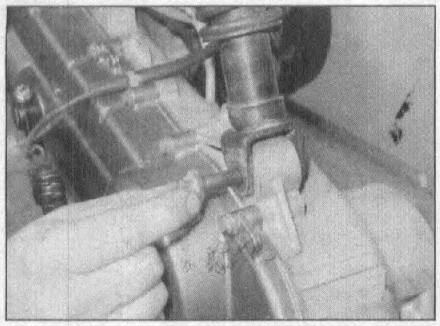
69 Insert the damper into the bottom of the fork tube and install the damper seat on the bottom of the damper **(see illustration)**.

70 Lubricate the fork tube with the specified fork oil and insert the assembly into the slider. Fit a new sealing washer to the damper bolt and apply a few drops of a suitable, non-permanent thread-locking compound, then install the bolt into the bottom of the slider and tighten it to the torque setting specified at the beginning of the Chapter. If the damper rotates inside the tube, hold it with spring pressure as on disassembly (see Step 64).

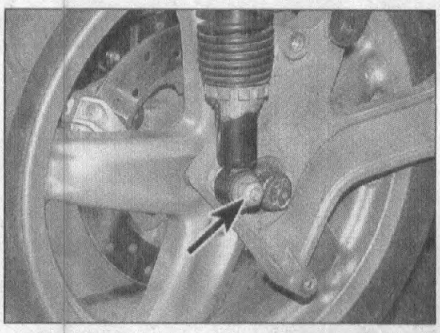
71 Push the fork tube fully into the slider, then lubricate the inside of the new oil seal with fork oil and slide it over the tube with its markings facing upwards **(see illustration)**. Press the seal into place in the slider. If necessary, use a suitable piece of tubing to tap the seal carefully into place; the tubing must be slightly larger in diameter than the fork tube and slightly smaller in diameter than the seal recess in the slider. Take care not to scratch the fork tube during this operation; if the fork tube is pushed fully into the slider any accidental scratching is confined to the area above the seal.

72 Fit the retaining clip, making sure it is correctly located in its groove. Lubricate the inside of the new dust seal then slide it down the fork tube and press it into position.

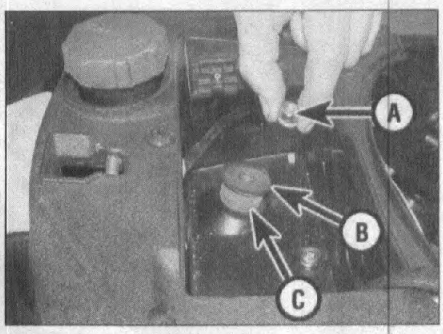
73 Slowly pour in the correct quantity of the specified grade of fork oil and carefully pump the fork to distribute the oil evenly.



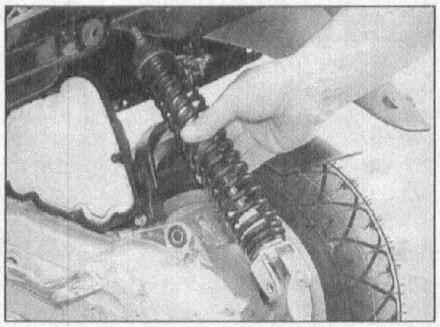
6.2a Unscrew the nut and withdraw the bolt



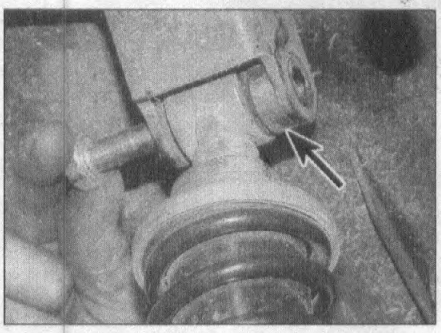
6.2b Right-hand lower shock absorber mounting (arrowed)



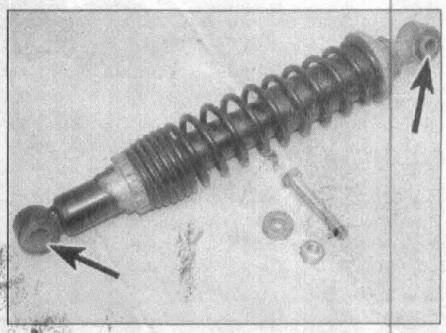
6.3a Unscrew the nut (A) and remove the washer (B) and rubber bush (C)



6.3b Lift out the rear shock absorber



6.4 Withdraw the bolt, noting the spacer (arrowed)



6.7 Check the mounting bolts and bushes (arrowed) for wear

74 Pull the fork tube out of the slider to its full extension and install the spring.

75 If necessary, fit a new O-ring to the fork top bolt. Keep the fork leg fully extended and press down on the spring whilst threading the top bolt into the top of the fork tube. Turn the bolt carefully to ensure it is not cross-threaded. Hold the fork leg and tighten the top bolt to the torque setting specified at the beginning of the Chapter.

Warning: It will be necessary to compress the spring by pressing it down with the top bolt in order to engage the threads of the top bolt with the fork tube. This is a potentially dangerous operation and should be performed with care, using an assistant if necessary. Wipe off any excess oil before starting to prevent the possibility of slipping.

76 Install the fork leg (see Steps 55 and 56).

6 Rear shock absorber – removal, inspection and installation

Note: *Some scooters are fitted with twin rear shock absorbers; individual components are not available for these units.*

Removal

1 Support the scooter on its centre stand, then position a support under the rear wheel so that the engine does not drop when the shock absorber is removed. Check that the weight of the machine is off the rear suspension so that the shock is not compressed.

2 The lower end of the shock absorber is secured to the gearbox casing and, on twin shock models, to a stud on the right-hand subframe. Unscrew the nut and, where fitted, remove the bolt securing the bottom of the shock absorber and pull the shock away from its mounting **(see illustrations)**.

3 On single shock models, the upper end of the shock absorber is secured to the frame by a nut and washer assembly. Lift up or remove the seat and remove the battery and battery tray as required according to model to access the fixing (see Chapters 7 and 9). Position a ring spanner on the nut and hold the centre of the damper rod with a screwdriver to prevent it turning, then undo the nut. Note the location of the washers and rubber bush, then manoeuvre the shock away from the machine **(see illustrations)**.

4 On twin shock models, remove the body panels as necessary to access the upper shock mountings (see Chapter 7). Undo the upper mounting nut, then support the shock and withdraw the bolt, noting the position of any spacers **(see illustration)**.

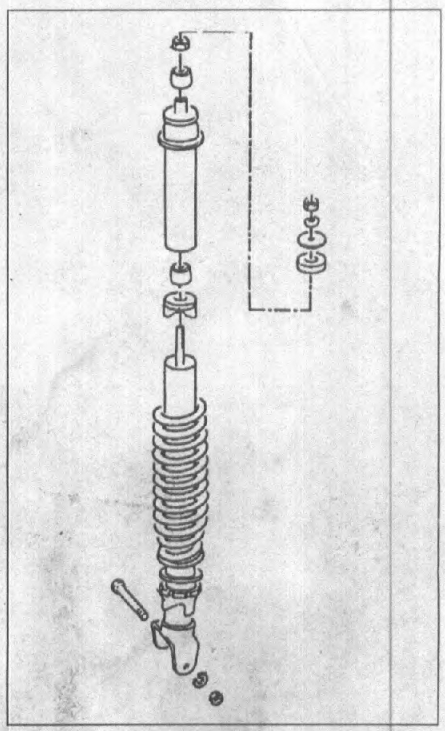
Inspection

5 Inspect the shock absorber for obvious physical damage and the coil spring for looseness, cracks or signs of fatigue.

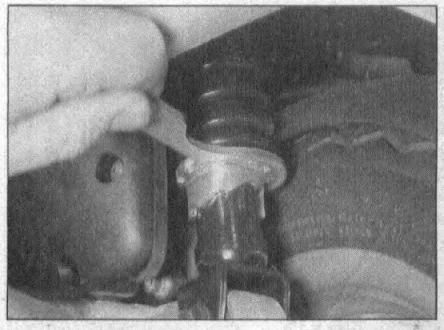
6 Inspect the damper rod for signs of bending, pitting and oil leaks.

7 Inspect the pivot hardware at the top and bottom of the shock for wear or damage **(see illustration)**.

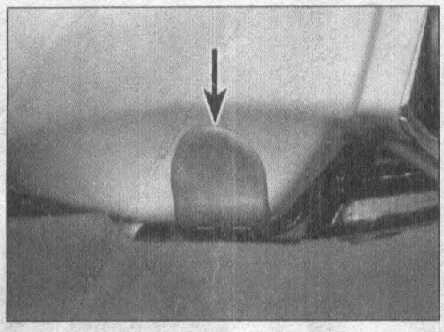
8 Individual parts can be obtained for the shock absorber on certain models – check availability with a Piaggio dealer before dismantling the unit. Carefully note the relative positions of all components, and how and which way up they fit **(see illustration)**. Compress the spring using a coil spring



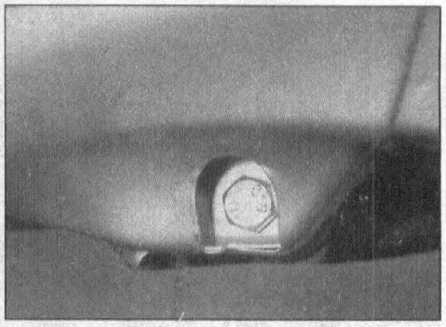
6.8 Rear shock absorber components



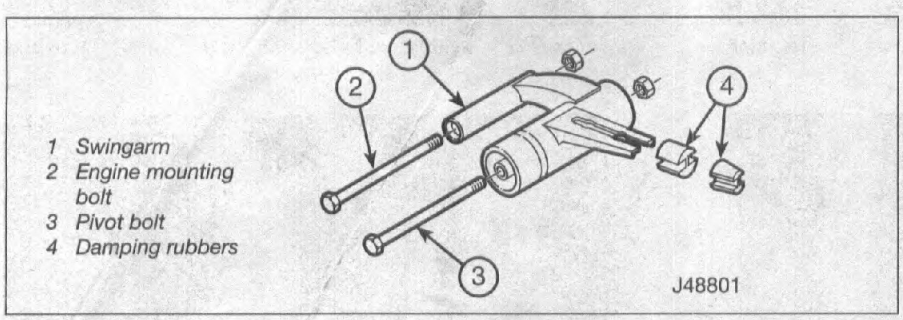
7.1 Adjusting the rear suspension using the tool provided



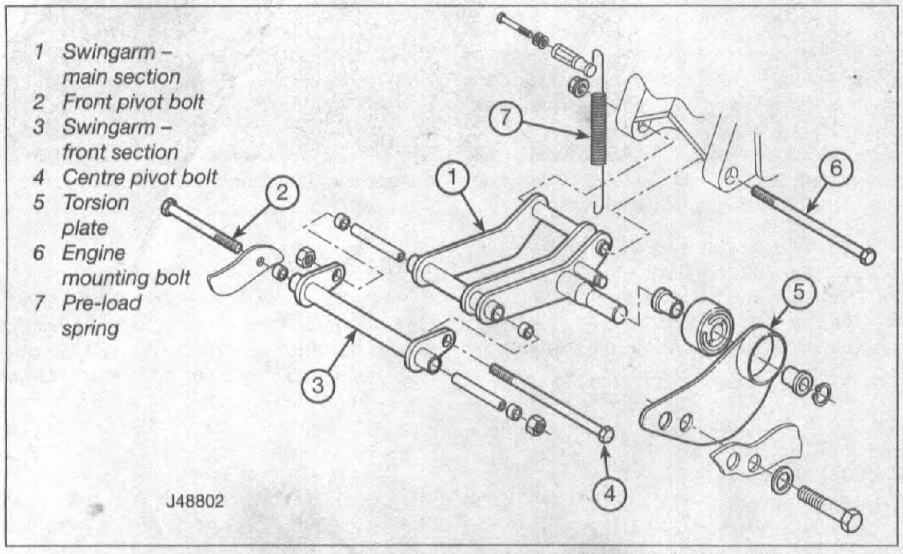
8.1a Remove the cover (arrowed) on each side . . .



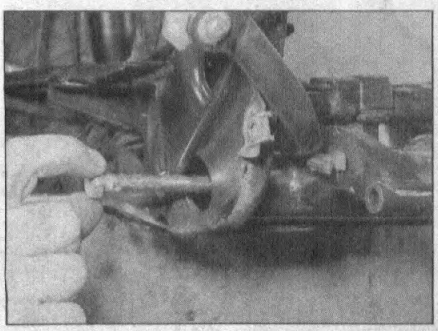
8.1b . . . to access the swingarm nut and pivot bolt



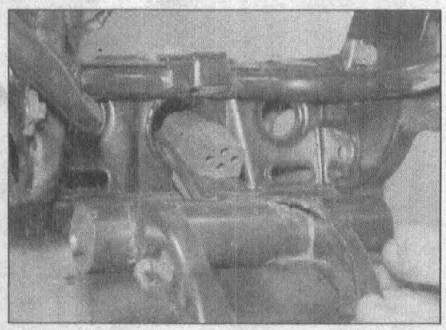
8.2a One-piece swingarm



8.2b Built-up swingarm assembly



8.3a Withdraw the pivot bolt . . .



8.3b . . . and remove the swingarm

compressor by just enough to remove the pressure on the spring seat at the top. Unscrew the top nut and remove the various components according to model, noting their order, then carefully release the compressor until the spring is relaxed. Remove the spring, noting which way up it fits. Install the new components and rebuild the shock in a reverse of the disassembly procedure.

Installation

9 Installation is the reverse of removal. Tighten the shock absorber mountings to the torque settings specified at the beginning of the Chapter.

7 Rear shock absorber – preload adjustment

1 Preload adjustment is made using a suitable C-spanner (one is provided in the toolkit) to turn the spring seat on the bottom of the shock absorber **(see illustration)**. Align the setting required with the adjustment stopper.

2 To increase the preload, turn the spring seat anti-clockwise. To decrease the preload, turn the spring seat clockwise.

8 Swingarm – removal, inspection and installation

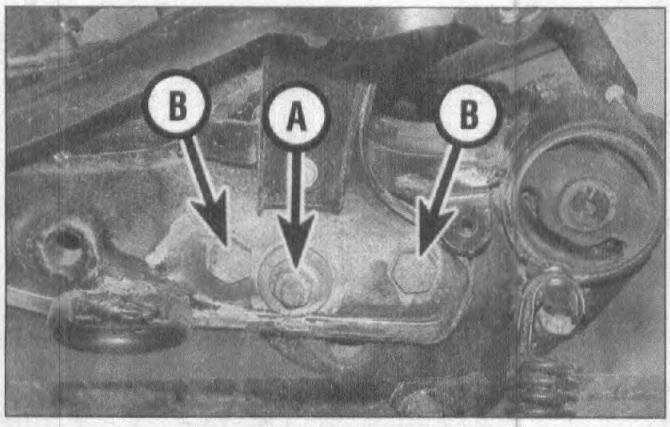
Removal

1 Remove the engine (see Chapter 2A, 2B, 2C, 2D, 2E or 2F). Where fitted, remove the cover to access the front mounting for the swingarm **(see illustrations)**.

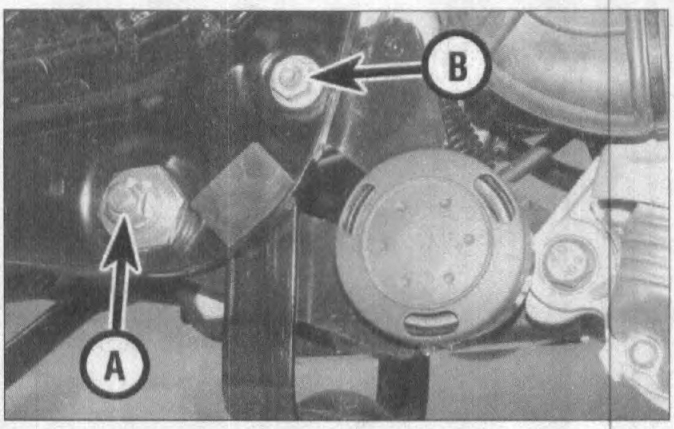
2 Two different designs of swingarm are used, either a one-piece unit or a more complex built-up assembly with a pre-load spring **(see illustrations)**.

3 The one-piece swingarm is secured to the frame by the pivot bolt. Unscrew the nut on the end of the pivot bolt, then withdraw the bolt and remove the swingarm, noting how it fits **(see illustrations)**.

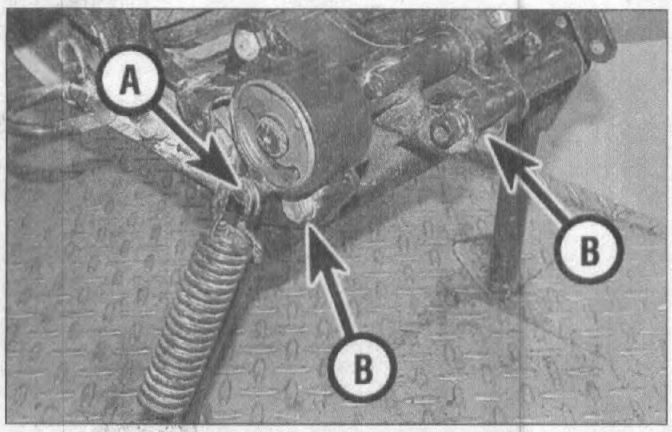
4 The built-up swingarm assembly is secured



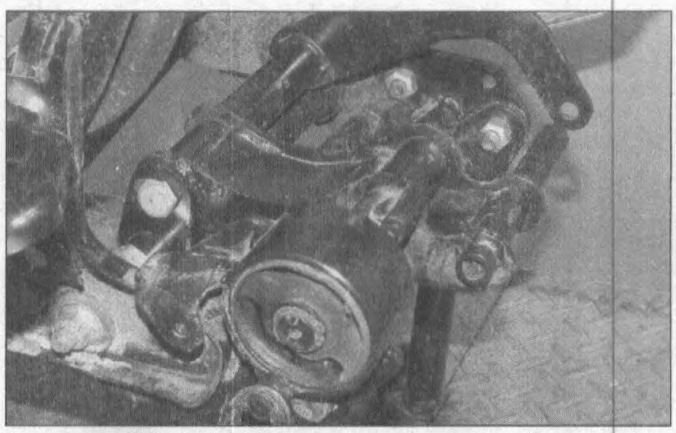
8.4a Swingarm assembly front pivot bolt (A) and torsion plate bolts (B)



8.4b Swingarm assembly front pivot bolt (A) and torsion plate bolt (B) – X8 model



8.4c Centre stand spring location (A) and pivot bolts (B)



8.4d Remove the swingarm and its bracket as an assembly

to the frame by the front pivot bolt and torsion plate mounting bolt(s) **(see illustrations)**. On some models, the centre stand is bolted to the swingarm assembly – before removing the swingarm, support the machine on an auxiliary stand, then undo the centre stand pivot bolts and lift off the stand, noting how the stand springs locate **(see illustration)**. Unhook the swingarm pre-load spring, noting how it fits, then undo the front pivot bolt and withdraw the it. Undo the torsion plate bolts and lift off the swingarm assembly **(see illustration)**.

Inspection

5 Thoroughly clean all components, removing all traces of dirt, corrosion and grease.

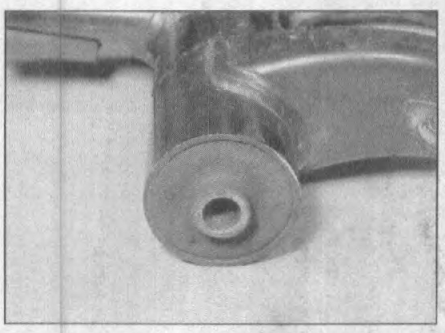
6 On the built-up swingarm assembly, lift off the torsion plate, then undo centre pivot bolt and withdraw it to separate the assembly. Note the location of the pivot bushes and spacers **(see illustration 8.2b)**.

7 Inspect all components closely, looking for obvious signs of wear such as heavy scoring, and cracks or distortion due to accident damage. Any damaged or worn component must be renewed. Check with a Piaggio dealer as to the availability of components.

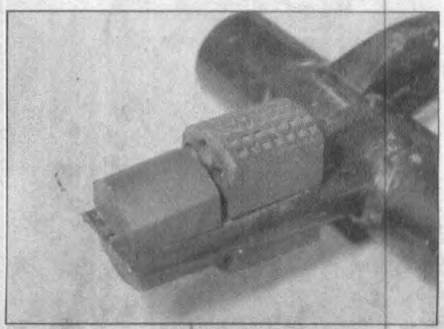
8 Check the swingarm pivot bolt(s) and the engine mounting bolt for straightness by rolling them on a flat surface such as a piece of plate glass (first wipe off all old grease and remove any corrosion using fine emery cloth).

9 Check the various bushes and seals for cracks and deterioration **(see illustration)**. On some models, the silentbloc bushes can be renewed although they are a very tight fit and the job is best done by a Piaggio dealer or specialist engineer. On other models a new swingarm will have to be fitted.

10 Check the condition of the swingarm damping rubbers, where fitted, and renew them if necessary **(see illustration)**.



8.9 Check the condition of the bushes . . .



8.10 . . . and the damping rubbers, where fitted

Installation

11 Installation is the reverse of removal. Smear some grease onto the pivot bolt(s) before assembly and tighten the swingarm pivot bolt to the torque setting specified at the beginning of the Chapter. On models with a built-up swingarm assembly, install the pre-load spring.

12 Install the engine.

13 Check the operation of the rear suspension before taking the machine on the road.