

Chapter 2

Engine, clutch and transmission

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Degrees of difficulty

Easy, suitable for
novice with little
experience



Fairly easy, suitable
for beginner with
some experience



Fairly difficult,
suitable for competent
DIY mechanic



Difficult, suitable for
experienced DIY
mechanic



Very difficult,
suitable for expert DIY
or professional



Specifications

General

Capacity	
T595 and 955i Daytona models	955 cc
T509 Speed Triple models	885 cc
955i Speed Triple models	955 cc
Sprint models	955 cc
Tiger models	885 cc
Bore	
885 cc engines	76.0 mm
955 cc engines	79.0 mm
Stroke – all models	65.0 mm
Compression ratio	
T595 and 955i Daytona models	11.2 to 1
T509 Speed Triple models	11.0 to 1
955i Speed Triple models	11.2 to 1
Sprint models	11.2 to 1
Tiger models	11.3 to 1
Cylinder numbering (from left side to right side of the bike) ..	1-2-3
Firing order	1-2-3

2•2 Engine, clutch and transmission

Camshafts and followers

Camshaft runout	0.05 mm max.
Camshaft end-float	
Standard	0.03 to 0.13 mm
Maximum	0.2 mm
Camshaft bearing oil clearance	0.12 mm max.
Camshaft journal diameter – all journals except outrigger	22.90 to 22.93 mm
Camshaft journal diameter – outrigger journals (cam chain end)	22.923 to 22.936 mm
Camshaft bearing bore diameter	23.000 to 23.021 mm
Follower outside diameter	27.987 to 27.993 mm
Follower bore diameter	28.000 to 28.021 mm
Cam chain tensioner spring free length	73.7 mm

Valves, guides and springs

Intake valve stem diameter	
Standard	5.475 to 5.490 mm
Service limit	5.47 mm
Exhaust valve stem diameter	
Standard	5.455 to 5.470 mm
Service limit	5.45 mm
Valve guide bore diameter – intake and exhaust	5.500 to 5.515 mm
Valve stem-to-guide clearance – intake	
Standard	0.01 to 0.04 mm
Service limit	0.07 mm
Valve stem-to-guide clearance – exhaust	
Standard	0.03 to 0.06 mm
Service limit	0.09 mm
Valve face width	1.8 to 2.5 mm
Valve seat width	
Standard	0.9 to 1.1 mm
Service limit	1.5 mm
Valve spring length	
Inner spring	not less than 24.0 mm with 15 kg load
Outer spring	not less than 26.5 mm with 41 kg load

Cylinder liners

Cylinder liner ID	
T509 Speed Triple to VIN 53779 (aluminium liners)	
Standard	75.985 to 76.003 mm
Service limit	76.053 mm
T509 Speed Triple VIN 53780-on (cast iron liners)	
Standard	76.030 to 76.050 mm
Service limit	76.100 mm
955i Daytona and Speed Triple, Sprint models	
Standard	79.030 to 79.050 mm
Service limit	79.10 mm
Tiger models	
Standard	75.985 to 76.030 mm
Service limit	76.050 mm

Pistons

Piston OD (measured 5 mm up from skirt, at 90° to piston pin axis)	
885 cc engines	
Cylinders 1 and 3	
Standard	75.960 to 75.980 mm
Service limit	75.920 mm
Cylinder 2	
Standard	75.96 to 75.97 mm
Service limit	75.900 mm
955 cc engines	
Cylinders 1 and 3	
Standard	78.960 to 78.980 mm
Service limit	78.920 mm
Cylinder 2	
Standard	78.96 to 78.97 mm
Service limit	78.900 mm
Piston pin bore diameter in piston	19.002 to 19.008 mm
Piston pin diameter	18.995 to 19.000 mm
Connecting rod small-end diameter	19.016 to 19.034 mm

Piston rings

Ring-to-groove clearance (top and second rings)	0.02 to 0.06 mm
End gap (installed)	
885 cc engines	
T509 Speed Triple	
Top ring	0.15 to 0.30 mm
Second ring	0.26 to 0.41 mm
Oil control ring side rails	0.20 to 0.70 mm
Tiger	
Top ring	0.11 to 0.26 mm
Second ring	0.26 to 0.41 mm
Oil control ring side rails	0.20 to 0.70 mm
955 cc engines	
Top ring	0.15 to 0.30 mm
Second ring	0.30 to 0.45 mm
Oil control ring side rails	0.20 to 0.70 mm

Clutch

Friction plates	
Quantity	9
Thickness	
Standard	3.80 to 3.88 mm
Service limit	3.60 mm
Plain plates	
Quantity	8
Warpage	
Standard	0.15 mm
Service limit	0.20 mm
Clutch shim clearance	0.075 to 0.125 mm
Clutch cable freeplay	see Chapter 1

Lubrication system

Oil pressure @ 5000 rpm	40 psi (2.76 Bars) at 80°C oil temp.
Oil pump rotor tip-to-outer rotor clearance	
Standard	0.15 mm
Service limit	0.20 mm
Oil pump outer rotor-to-body clearance	
Standard	0.15 to 0.22 mm
Service limit	0.35 mm
Oil pump rotor end-float	
Standard	0.007 to 0.02 mm
Service limit	0.10 mm

Connecting rods and bearings

Connecting rod side clearance	
Standard	0.15 to 0.30 mm
Service limit	0.5 mm
Connecting rod big-end bearing oil clearance	
Standard	0.036 to 0.066 mm
Service limit	0.1 mm
Connecting rod big-end journal diameter	
Standard	40.946 to 40.960 mm
Service limit	40.932 mm

Crankshaft and main bearings

Main bearing oil clearance	
Standard	0.020 to 0.044 mm
Service limit	0.1 mm
Main bearing journal diameter	
Standard	37.960 to 37.976 mm
Service limit	37.936 mm
Crankshaft end-float	
Standard	0.05 to 0.20 mm
Service limit	0.40 mm

2•4 Engine, clutch and transmission

Transmission

Primary reduction ratio	1.75 to 1 (105/60T)
Gear ratios (No. of teeth)	
First gear	2.733 to 1 (41/15T)
Second gear	1.947 to 1 (37/19T)
Third gear	1.545 to 1 (34/22T)
Fourth gear	1.291 to 1 (31/24T)
Fifth gear	1.154 to 1 (30/26T)
Sixth gear	1.074 to 1 (29/27T)
Final reduction ratio	
T595 Daytona and 955i Daytona to VIN 89736	2.388 to 1 (43/18T)
955i Daytona VIN 89737-on (except Germany)	2.333 to 1 (42/18T)
955i Daytona VIN 89737-on (Germany)	2.263 to 1 (43/19T)
T509 and 955i Speed Triple	2.388 to 1 (43/18T)
Sprint ST (1999 models)	2.388 to 1 (43/18T)
Sprint RS and ST (2000-on models)	2.263 to 1 (43/19T)
Tiger	2.666 to 1 (48/18T)
Selector fork end width	
Standard	5.8 to 5.9 mm
Service limit	5.7 mm
Selector fork groove width in gears	
Standard	6.0 to 6.1 mm
Service limit	6.25 mm
Selector fork-to-groove clearance	0.55 mm maximum

Torque settings

Engine mounting bolts	
Daytona and Speed Triple models	
Engine mounting bracket-to-cylinder head bolts	30 Nm
All other mounting bolts	
Initial setting	80 Nm
Final setting	95 Nm
Suspension linkage-to-frame bolt	95 Nm
Sprint models	
Mounting bolts	95 Nm
Adjuster bolts	3 Nm
Adjuster bolt locknuts	55 Nm
Suspension linkage-to-frame bolt	48 Nm
Tiger models	
Engine mounting bracket-to-cylinder head bolts	30 Nm
All other mounting bolts	95 Nm
Swingarm pivot bolt	85 Nm
Ignition coil/spark plug cap screws	10 Nm
Valve cover bolts	10 Nm
Cam chain tensioner mounting bolts	9 Nm
Cam chain tensioner end bolt	23 Nm
Camshaft sprocket bolts	15 Nm
Camshaft cap bolts	10 Nm
Cam chain upper guide screws	10 Nm
Cam chain tensioner blade pivot bolt	18 Nm
Cam chain support bolt	10 Nm
Ignition timing rotor Allen bolt	27 Nm
Cylinder head bolts	
Stage 1	20 Nm
Stage 2	27 Nm
Stage 3	Angle-tighten 90°
Cylinder head-to-cylinder block screws	12 Nm
External oil hose banjo bolts	25 Nm
Clutch centre nut	105 Nm
Clutch pressure plate bolts	10 Nm
Clutch cover bolts	9 Nm
Internal oil pipe banjo bolts	8 Nm
Sump bolts	12 Nm
Oil cooler hose banjo bolts	25 Nm
Oil pressure relief valve	15 Nm
Crankcase 6 mm bolts (see text)	12 Nm
Crankcase 8 mm bolts (see text)	28 Nm
Crankcase breather disc screws	12 Nm

Torque settings (continued)

Connecting rod cap nuts	14 Nm + 120° (see text)
Balancer shaft end cap(s)	40 Nm
Oil pump driven gear screw	9 Nm
Oil pump middle gear screw	9 Nm
Oil pump mounting screws	12 Nm
Gearchange mechanism centralising spring locating pin	28 Nm
Selector drum bearing retainer bolt	12 Nm
Selector drum detent cam screw	12 Nm
Pawl retainer plate screws	9 Nm
Neutral and gear stopper arm nuts	9 Nm
Selector fork shaft retainer plate screw	6 Nm
Starter clutch body bolts	12 Nm
Idle/reduction gear shaft retainer bolt	12 Nm
Alternator driveshaft needle bearing retainer screw	10 Nm
Alternator driveshaft ball bearing retainer bolts	12 Nm
Alternator driveshaft long bolt nut	40 Nm

1 General information

The engine/transmission is a water-cooled in-line three-cylinder design, fitted across the frame. The twelve valves are operated by double overhead camshafts, chain driven off the right-hand end of the crankshaft. The pistons run in removable liners, surrounded by a water jacket.

The engine/transmission is constructed in aluminium alloy with the crankcase divided horizontally. The crankcase incorporates a wet sump, pressure fed lubrication system, and houses a gear driven oil pump. An external oil feed pipe supplies oil to the cylinder head and cam components. A single balancer shaft is driven directly off a gear on the right-hand end of the crankshaft.

The clutch is of the wet multi-plate type and is gear driven off the crankshaft. An auxiliary gear on the back of the clutch drives the oil pump (and thence the water pump) and the alternator driveshaft.

The transmission is of the six-speed constant mesh type. Final drive to the rear wheel is by chain and sprockets.

Many of the bolts used on Triumph motorcycles are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to purchase a set before attempting work on the engine. Make sure you get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be a useful addition to the bits.

2 Operations possible with the engine in the frame

The components and assemblies listed below can be removed without having to remove the engine/transmission assembly from the frame. If however, a number of areas

require attention at the same time, removal of the engine is recommended.

Valve cover
Cam chain tensioner
Camshafts and followers
Cam chain and tensioner/guide blades
Cylinder head
Cylinder liners and pistons
Starter motor
Alternator
Water pump
Clutch
Oil cooler (where fitted)
Sump
Alternator
Alternator/starter clutch drive (but see text)

3 Operations requiring engine removal

It is necessary to remove the engine/transmission assembly from the frame and separate the crankcase halves to gain access to the following components.

Starter clutch
Gearchange mechanism
Selector drum and forks
Transmission shafts
Crankshaft and bearings
Connecting rod assemblies and bearings
Oil pump and pressure relief valve
Balancer shaft

4 Major engine repair – general note

1 It is not always easy to determine when or if an engine should be completely overhauled, as a number of factors must be considered.

2 High mileage is not necessarily an indication that an overhaul is needed, while low mileage, on the other hand, does not preclude the need for an overhaul. Frequency of servicing is probably the single most important consideration. An engine that has

regular and frequent oil and filter changes, as well as other required maintenance, will most likely give many miles of reliable service. Conversely, a neglected engine, or one which has not been run in properly, may require an overhaul very early in its life.

3 Exhaust smoke and excessive oil consumption are both indications that piston rings and/or valve guides are in need of attention, although make sure that the fault is not due to oil leakage.

4 If the engine is making obvious knocking or rumbling noises, the connecting rod and/or main bearings are probably at fault.

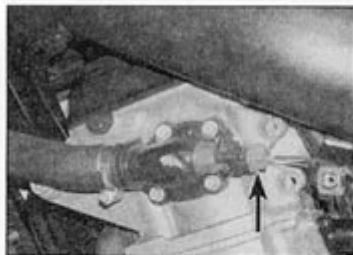
5 Loss of power, rough running, excessive valve train noise and high fuel consumption rates may also point to the need for an overhaul, especially if they are all present at the same time. If a complete tune-up does not remedy the situation, major mechanical work is the only solution.

6 An engine overhaul generally involves restoring the internal parts to the specifications of a new engine. The piston rings and main and connecting rod bearings are usually renewed during a major overhaul. Generally the valve seats are reground, since they are usually in less than perfect condition at this point. The end result should be a like new engine that will give as many trouble-free miles as the original.

7 Before beginning the engine overhaul, read through the related procedures to familiarise yourself with the scope and requirements of the job. Overhauling an engine is not all that difficult, but it is time consuming. Plan on the motorcycle being tied up for a minimum of two weeks. Check on the availability of parts and make sure that any necessary special tools, equipment and supplies are obtained in advance.

8 Most work can be done with typical workshop hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be renewed. Often a dealer will handle the inspection of parts and offer advice concerning reconditioning and renewal. As a general rule, time is the primary cost of an overhaul so it does not pay to install worn or substandard parts.

2•6 Engine, clutch and transmission



5.6 Coolant temperature sensor wiring connector (arrowed) – Sprint models



5.8 Make an alignment mark with the slit in the clamp, then unscrew the bolt (arrowed) and slide the arm (or lever) off the shaft



5.11a Unscrew the rear mounting bolt and detach the lead(s)

9 As a final note, to ensure maximum life and minimum trouble from a rebuilt engine, everything must be assembled with care in a spotlessly clean environment.

5 Engine – removal and installation

Caution: The engine is very heavy. Engine removal and installation should be carried out with the aid of at least one assistant. Personal injury or damage could occur if the engine falls or is dropped. An hydraulic or mechanical floor jack should be used to support and lower or raise the engine if possible.

Removal

1 Position the bike on its centre stand (ST model) or an auxiliary stand so that it is supported in an upright position, making sure it is secure. Note that the swingarm pivot must be slackened before removing the engine to allow expansion of the frame, so if you have a stand that locates in the pivot points, slacken the pivot before fitting the stand (see Step 19, 20 or 21 according to model). It is a good idea to hold the front brake on by using a cable-tie or a rag tied around the throttle and brake lever. Work can be made easier by raising the machine to a suitable height on a hydraulic ramp.

2 If the engine is dirty, particularly around its mountings, wash it thoroughly before starting any major dismantling work. This will make work much easier and rule out the possibility of caked on lumps of dirt falling into some vital component.

3 Remove the seat (see Chapter 7), then remove the battery (see Chapter 8).

4 Remove the fairing, fairing side panels and belly-pan, according to your model (see Chapter 7). Where a panel bolts to a mounting bracket on the engine, it is advisable to remove the bracket to prevent it becoming bent or damaged.

5 Remove the fuel tank and the air filter housing (see Chapter 4).

6 Drain the engine oil and coolant (see Chapter 1). Remove the oil cooler (see Section 20), and the radiator and the thermostat housing along with all the coolant hoses, noting their routing (see Chapter 3). It is advisable to tag the end of each hose using masking tape, then write the location of the hose on the tape. On Sprint models, disconnect the coolant temperature sensor wiring connector from the sensor on the left-hand side of the engine (see illustration).

7 Remove the exhaust system (Chapter 4).

8 Make an alignment mark across the gearchange shaft end and the gearchange linkage arm or gearchange lever (according to model) as an aid to installation, then unscrew the pinch bolt and slide the arm or lever off

the shaft (see illustration).

9 Trace the wiring from the sidestand switch and disconnect it at the wiring connector. If required, remove the sidestand and its bracket (see Chapter 5).

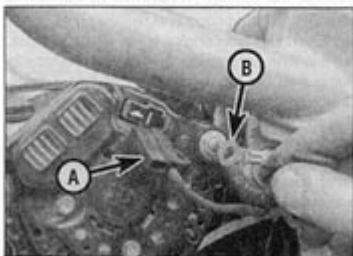
10 If required, remove the throttle bodies (see Chapter 4). The engine can be removed with them in place, though it is always best to remove them first to prevent the possibility of damage (see Chapter 4). Plug the intake manifold joints with clean rags to prevent anything dropping down them. If you are not removing the throttle bodies, detach the throttle cable from them (see Chapter 4).

11 If required, remove the alternator (see Chapter 8). If it is not being removed, unscrew the mounting bolt securing the earth lead(s) and detach the lead(s) (see illustration). Disconnect the wiring connector from the alternator (see illustration). Pull back the rubber boot, then unscrew the nut and detach the lead from the end of the alternator.

12 If required, remove the starter motor (see Chapter 8). If it is not being removed, pull back the rubber boot on the terminal, then unscrew the nut and detach the lead (see illustration).

13 Remove the front sprocket (see Chapter 5).

14 Disconnect the crankshaft position sensor wiring connector (see illustration). Where fitted, also detach the camshaft position sensor wiring connector from the sensor on the valve cover.



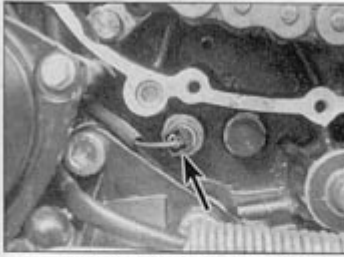
5.11b Disconnect the wiring connector (A), then unscrew the terminal nut and detach the lead (B)



5.12 Pull back the rubber boot and unscrew the nut (arrowed) securing the lead



5.14 Disconnect the crankshaft position sensor wiring connector



5.15 Disconnect the wiring connector from the neutral switch (arrowed)

15 Detach the wire from the neutral switch (see illustration)."

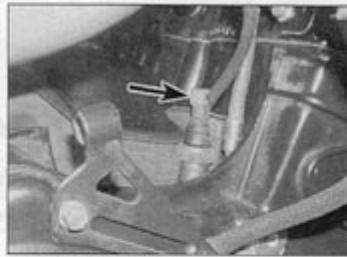
16 Detach the clutch cable from the release lever on the clutch cover (see Section 17).

17 Detach the wire from the oil pressure switch (see illustration).

18 Disconnect the ignition coil/spark plug cap wiring connectors (see illustration). Undo the screws securing the coils/caps to the valve cover and pull them off the spark plugs (see illustrations).

19 On Daytona, Speed Triple and Sprint ST models, remove the blanking cap from each end of the swingarm pivot. Counter-hold the pivot on the left-hand side and slacken the bolt on the right-hand side (see illustration). Also slacken the bolt that secures the suspension linkage assembly to the frame (see illustration).

20 On Sprint RS models, remove the blanking cap from the right-hand end of the swingarm pivot (see illustration). Counter-hold the pivot



5.17 Disconnect the wiring connector from the oil pressure switch (arrowed)



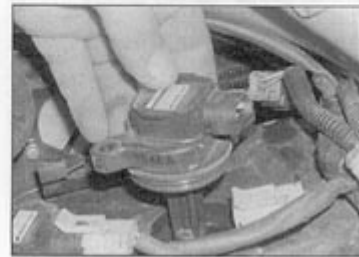
5.18b ... then undo the screws securing the coil to the valve cover ...

on the right-hand end and slacken the nut on the left-hand end. Also slacken the bolt that secures the suspension linkage assembly to the frame (see illustration).

21 On Tiger models, remove the brake pedal (see Chapter 5). Unscrew the bolts securing

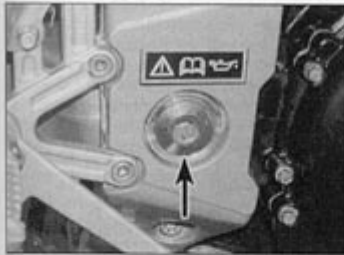


5.18a Disconnect the wiring connector ...

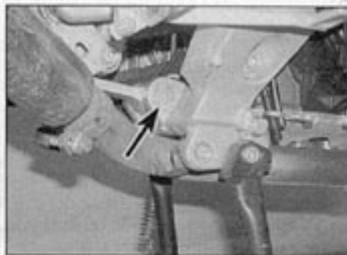


5.18c ... and pull it off the spark plug

the footrest mounting plate, then detach it from the frame and support or tie it so that no strain is placed on the brake hose (see illustration). Also unscrew the bolts securing the left-hand footrest bracket and remove it (see illustration). Remove the blanking cap



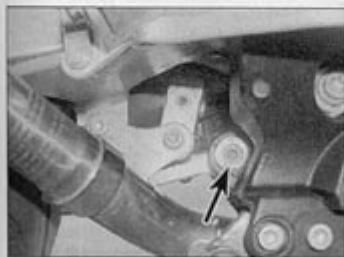
5.19a Slacken the swingarm pivot bolt (arrowed)



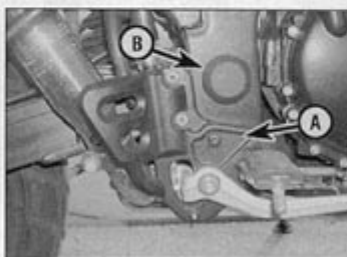
5.19b Slacken the suspension linkage-to-frame bolt (arrowed) - Sprint ST shown



5.20a Remove the blanking cap (arrowed) and slacken the pivot as described



5.20b Suspension linkage-to-frame bolt (arrowed)



5.21a Right-hand footrest bracket (A) and swingarm pivot cap (B)



5.21b Left-hand footrest bracket (arrowed)

2•8 Engine, clutch and transmission

from each end of the swingarm pivot. Counter-hold the left-hand end of the pivot and slacken the bolt on the right-hand end.

22 At this point, position an hydraulic jack under the engine with a block of wood between the jack head and sump. Make sure the jack is centrally positioned so the engine will not topple in any direction when the last mounting bolt is removed. Take the weight of the engine on the jack. Unless you are using a ramp with a front wheel clamp, also place a block of wood under the rear wheel to prevent the bike tilting back when the engine is removed. Check around the engine and frame to make sure that all wiring, cables and hoses that need to be disconnected have been disconnected, and that any remaining connected to the engine are not retained by any clips, guides or brackets connected to the frame. Check that any protruding mounting brackets will not get in the way and remove them if necessary.

23 When removing the engine mounting bolts, retrieve all nuts, washers and spacers from the mountings and slip them back on the bolts in their correct order for safekeeping, noting carefully where each fits (see illustrations). On Daytona, Speed Triple and Tiger models, unscrew the bolts securing the engine mounting bracket to the frame and the engine on the left-hand side and remove the bracket, noting how it fits. On all models, slacken all the engine mounting bolts and nuts, then withdraw the mounting bolts from each side of the engine. On Tiger models, note which way round the exhaust system collector box brackets are fitted on the lower rear mounting bolts, and similarly note the radiator brackets on the front mounting bolts.

24 Have an assistant steady the engine as it is lowered on the jack, and slip the drive chain off the output shaft. When it is clear of the frame lugs, move it to one side. Lift the engine off the jack and onto the work surface. On Tiger models, retrieve the chain rubbing block, noting how it fits.



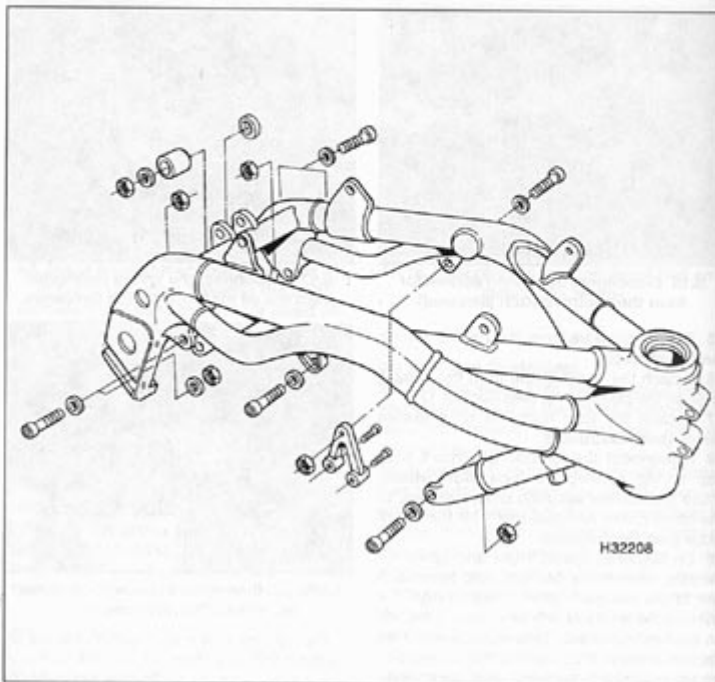
Warning: The engine is heavy and may cause injury if it falls.

Installation

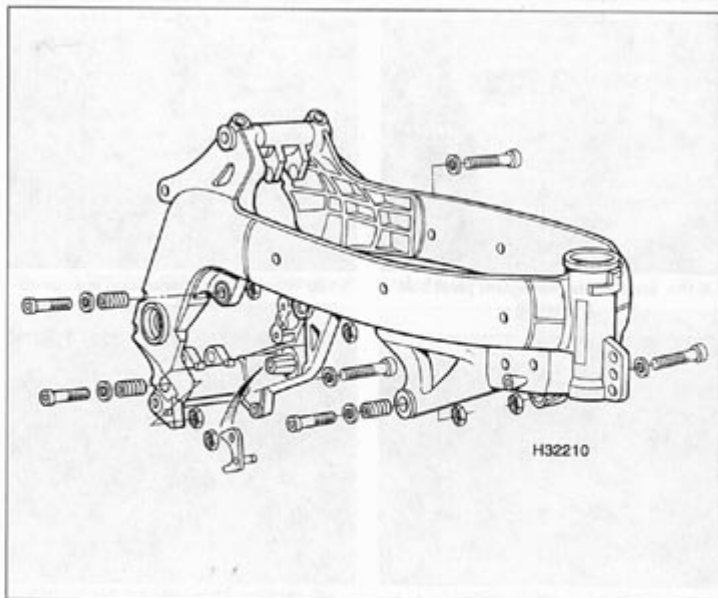
Daytona and Speed Triple models

25 With the aid of an assistant place the engine on top of the jack and block of wood and carefully raise it into position in the frame, slipping the drive chain around the output shaft as you do so. Manoeuvre the engine as required so that all mounting holes align. Make sure no wires, cables or hoses become trapped between the engine and the frame.

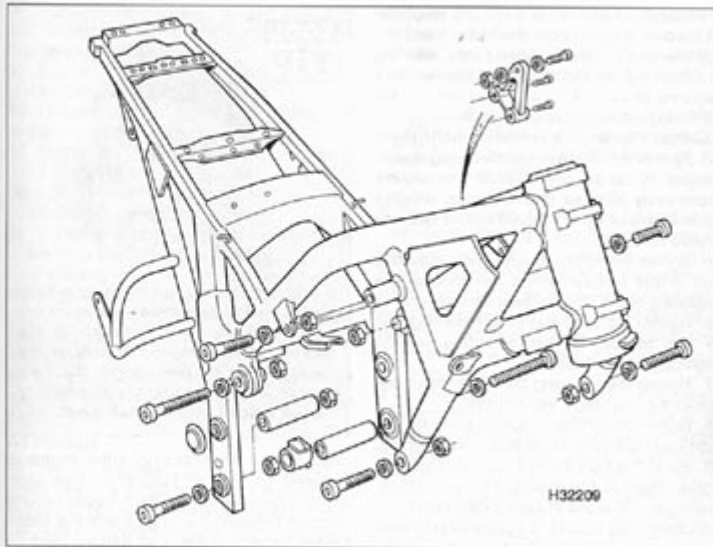
26 Fit the washers on the mounting bolts then install them in the frame, along with any spacers previously fitted, then fit the mounting bolt nuts, where appropriate, and tighten



5.23a Engine mounting details – Daytona and Speed Triple models



5.23b Engine mounting details – Sprint models



5.23c Engine mounting details – Tiger models

them finger-tight (see illustrations and 5.23a). Also fit the engine mounting bracket between the frame and the engine on the left-hand side and tighten its bolts finger-tight. Remove the jack from under the engine.

27 Unscrew the pivot bolt from the right-hand end of the swingarm pivot (see illustration 5.19a). Now slacken both the locknut and the adjuster bolt, referring to Chapter 5 for details on the special tools required to do this. Now follow the correct tightening procedure as detailed below.

Caution: The engine mounting bolts must be tightened in the correct sequence. Failure to do so could leave the engine

incorrectly aligned in the frame, placing undue stress on it, which could lead to severe damage.

28 Tighten the engine mounting bracket-to-cylinder head bolts on the left-hand side to the torque setting specified at the beginning of the Chapter (see illustration).

29 Tighten the left-hand front mounting bolt to the initial torque setting specified at the beginning of the Chapter.

30 Tighten the left-hand upper rear mounting bolt to the initial specified torque setting.

31 Tighten the left-hand lower rear mounting bolt to the initial specified torque setting.

32 Now check the gap between the engine



5.26a Do not forget the spacer with the lower rear bolt on the left-hand side

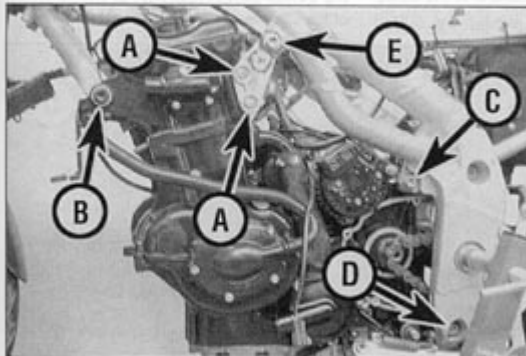


5.26b Any spacers on the right-hand side fit between the engine and the frame

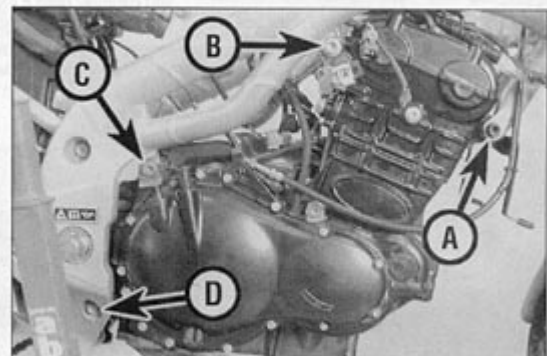
and frame at all right-hand mounting points using a 1 mm feeler gauge. If any gap is found to be larger than 1 mm, insert a suitable washer to reduce the gap to below 1 mm. The Triumph Pt. No. for the correct washers is 3550220-T0301. **Note:** If a washer is needed for the lower rear mounting bolt, then an identical washer must be fitted between the suspension linkage and the frame on the right-hand side – refer to Chapter 5 for removal of the linkage rods.

33 Tighten the right-hand front mounting bolt to the initial specified torque setting (see illustration).

34 Tighten the right-hand middle mounting



5.28 Mounting bracket-to-cylinder head bolts (A), front mounting bolt (B), upper rear mounting bolt (C), lower rear mounting bolt (D), bracket-to-frame bolt (E) – Daytona and Speed Triple models, left-hand side



5.33 Front mounting bolt (A), middle mounting bolt (B), upper rear mounting bolt (C), lower rear mounting bolt (D) – Daytona and Speed Triple models, right-hand side

2•10 Engine, clutch and transmission

bolt to the initial specified torque setting.

35 Tighten the right-hand upper rear mounting bolt to the initial specified torque setting.

36 Tighten the right-hand lower rear mounting bolt to the initial specified torque setting.

37 Tighten the engine mounting bracket-to-frame bolt on the left-hand side to the initial specified torque setting (see illustration 5.28).

38 With the exception of the engine mounting bracket-to-cylinder head bolts on the left-hand side, now tighten all the mounting bolts in the same sequence as above to the final torque setting specified at the beginning of the Chapter.

39 Refer to Chapter 5 and tighten the swingarm adjuster bolt, lockring and pivot bolt as described, following the relevant Steps.

40 Tighten the suspension linkage-to-frame bolt to the specified torque setting.

Sprint models

41 Using the Triumph special tool (Pt. No. T3880088) or a suitable peg spanner (which can be made by cutting four sections out of an old socket of a suitable size), unscrew the locknuts on the adjuster bolts at all right-hand mounting points (see illustration 5.23b). Now thread the adjuster bolts out of the frame until they no longer protrude on the inside.

42 With the aid of an assistant place the engine on top of the jack and block of wood and carefully raise it into position in the frame, slipping the drive chain around the output shaft as you do. Manoeuvre the engine as required so that all mounting holes align. Make sure no wires, cables or hoses become trapped between the engine and the frame.

43 Fit the washers on the left-hand mounting bolts then install them in the frame, along with any spacers previously fitted, then fit the mounting bolt nuts, where appropriate, and tighten them finger-tight (see illustration 5.23b).

44 On ST models, unscrew the pivot bolt from

the right-hand end of the swingarm pivot. On all models, slacken both the locknut and the adjuster bolt on the right-hand side, referring to Chapter 5 for details of the special tools required to do this. Now follow the correct tightening procedure as detailed below.

Caution: The engine mounting bolts must be tightened in the correct sequence. Failure to do so could leave the engine incorrectly aligned in the frame, placing undue stress on it, which could lead to severe damage.

45 Tighten the left-hand upper rear mounting bolt to the torque setting specified at the beginning of the Chapter (see illustration).

46 Tighten the left-hand front mounting bolt to the torque setting specified at the beginning of the Chapter.

47 Tighten the left-hand lower rear mounting bolt to the specified torque setting.

48 Tighten the three adjuster bolts on the right-hand side to the specified torque setting.

49 Install the right-hand mounting bolts and tighten them to the specified torque setting, making sure that the adjuster bolts do not turn with them – by making a couple of reference marks between the adjuster bolt and the frame you will be able to tell whether the adjuster bolts have moved.

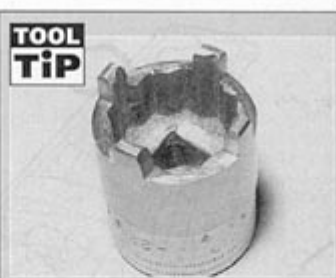
50 Using the Triumph special tool (Pt. No. T3880088) or a suitable peg spanner (which can be made by cutting four sections out of an old socket of a suitable size – see **Tool Tip** above), tighten the locknuts on the adjuster bolts to the specified torque setting.

51 Refer to Chapter 5 and tighten the swingarm adjuster bolt, locknut and pivot bolt as described, following the relevant Steps.

52 Tighten the suspension linkage-to-frame bolt to the specified torque setting (see illustration 5.20b).

Tiger models

53 With the aid of an assistant place the engine on top of the jack and block of wood and carefully raise it into position in the frame, slipping the drive chain around the output



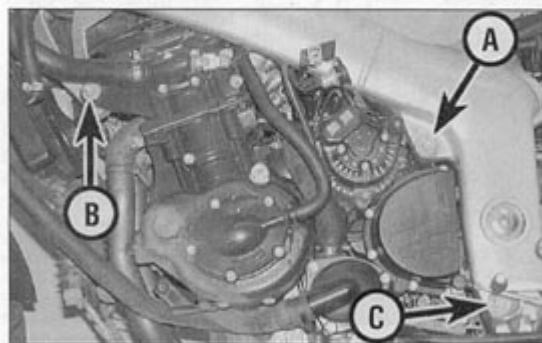
TOOL TIP
A peg spanner can be made by cutting an old socket as shown – measure the width and depth of the slots in the castellations on the socket. If an old socket is not available, castellations can be welded onto a suitable nut.

shaft as you do. Manoeuvre the engine as required so that all mounting holes align. Make sure no wires, cables or hoses become trapped between the engine and the frame. Do not forget to fit the chain rubbing block.

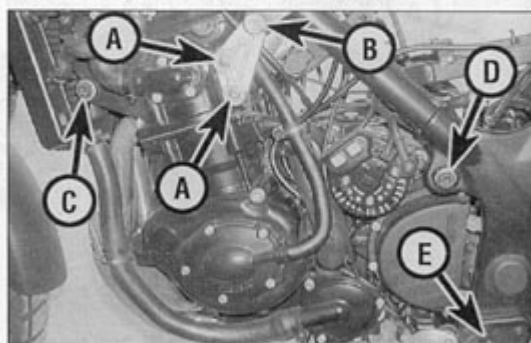
54 Fit the washers on the mounting bolts then install them in the frame, along with the exhaust collector box and radiator brackets and any spacers previously fitted, then fit the mounting bolt nuts, where appropriate, and tighten them finger-tight (see illustration 5.23c). Also fit the engine mounting bracket between the frame and the engine on the left-hand side and tighten its bolts finger-tight. Remove the jack from under the engine.

Caution: The engine mounting bolts must be tightened in the correct sequence. Failure to do so could leave the engine incorrectly aligned in the frame, placing undue stress on it, which could lead to severe damage.

55 Tighten the engine mounting bracket-to-cylinder head bolts on the left-hand side to the torque setting specified at the beginning of the Chapter (see illustration).



5.45 Upper rear mounting bolt (A), front mounting bolt (B), lower rear mounting bolt (C) – Sprint models, left-hand side



5.55 Mounting bracket-to-cylinder head bolts (A), middle mounting bolt (B), front mounting bolt (C), upper rear mounting bolt (D), lower rear mounting bolt (E) – Tiger models, left-hand side

- 56 Tighten the left-hand middle mounting bolt to the torque setting specified at the beginning of the Chapter.
- 57 Tighten the right-hand middle mounting bolt to the specified torque setting.
- 58 Tighten the left-hand front mounting bolt to the initial specified torque setting.
- 59 Tighten the left-hand upper rear mounting bolt to the specified torque setting.
- 60 Tighten the left-hand lower rear mounting bolt to the specified torque setting.
- 61 Tighten the right-hand front mounting bolt to the initial specified torque setting.
- 62 Tighten the right-hand upper rear mounting bolt to the specified torque setting.
- 63 Tighten the right-hand lower rear mounting bolt to the specified torque setting.
- 64 Tighten the swingarm pivot bolt to the specified torque setting, then fit the blanking caps.

All models

65 The remainder of the installation procedure is a direct reversal of the removal sequence, noting the following points.

- a) Tighten all nuts and bolts to the specified torque settings (where given).
- b) Align the previously made mark on the gearchange linkage arm or lever with that on the gearchange shaft end.
- c) Make sure all wires, cables and hoses are correctly routed and connected, and secured by any clips or ties. Tighten the ignition coil/cap screws to the specified torque setting.
- d) Adjust the drive chain as described in Chapter 1.
- e) Use new gaskets on the exhaust pipe connections, and new O-rings on the coolant connections, where appropriate.
- f) Refill the engine with oil and coolant (see Chapter 1).
- g) Adjust the throttle and clutch cable freeplay (see Chapter 1).
- h) Adjust the drive chain slack (see Chapter 1).
- i) Start the engine and check that there are no oil or coolant leaks before installing the body panels.

6 Engine disassembly and reassembly – general information

Disassembly

1 Before disassembling the engine, thoroughly clean and degrease clean the external surfaces. This will prevent contamination of the engine internals, and will also make working a lot easier and cleaner. A high flash-point solvent, such as paraffin (kerosene) can be used, or better still, a proprietary engine degreaser such as Gunk. Use old paintbrushes and toothbrushes to

work the solvent into the various recesses of the engine casings. Take care to exclude solvent or water from the electrical components and intake and exhaust ports.



Warning: The use of petrol (gasoline) as a cleaning agent should be avoided due to the risk of fire.

2 When clean and dry, arrange the unit on the workbench, leaving a suitable clear area for working. Gather a selection of small containers and plastic bags so that parts can be grouped together in an easily identifiable manner. Some paper and a pen should be on hand to permit notes to be made and labels attached where necessary. A supply of clean rag is also required.

3 Before commencing work, read through the appropriate section so that some idea of the necessary procedure can be gained. When removing various engine components it should be noted that great force is seldom required, unless specified. In many cases, a component's reluctance to be removed is indicative of an incorrect approach or removal method. If in any doubt, re-check with the text.

4 An engine support stand can be made from short lengths of 2 x 4 inch wood bolted together into a rectangle to help support the engine if required (see illustration), though the engine will sit nicely on the flat bottom of the sump, and there are two pegs at the front to keep it stable. The perimeter of the mount should be just big enough to accommodate the sump within it so that the engine rests on its crankcase.

5 When disassembling the engine, keep 'mated' parts together (including gears, liners, pistons, connecting rods, valves, etc. that have been in contact with each other during engine operation). These 'mated' parts must be reused or renewed as an assembly.

6 Engine/transmission disassembly should be done in the following general order with reference to the appropriate Sections.

Remove the camshafts

Remove the cam chain/tensioner blade

Remove the cylinder head and cam chain guide blade

Remove the cylinder liners and pistons
Remove the clutch
Remove the alternator (see Chapter 8)
Remove the starter motor (see Chapter 8)
Remove the water pump (see Chapter 3)
Remove the sump
Separate the crankcase halves
Remove the crankshaft/connecting rods
Remove the balancer shaft
Remove the transmission shafts/gears
Remove the gearchange components
Remove the oil pump
Remove the alternator/starter drive

Reassembly

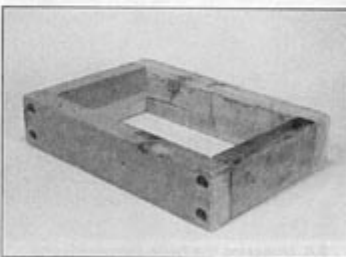
7 Reassembly is accomplished by reversing the general disassembly sequence.

7 Valve cover – removal and installation

Note: The valve cover can be removed with the engine in the frame. If the engine has been removed, ignore the steps which do not apply.

Removal

- 1 Remove the seat and disconnect the battery negative lead.
- 2 On Daytona and Sprint models, remove the fairing side panels (see Chapter 7).
- 3 Remove the fuel tank and the airbox (see Chapter 4). On Tiger models, undo the screw securing the thermostat housing so that it can be moved aside when removing the valve cover – there is no need to drain the cooling system or detach any of the hoses (see illustration).
- 4 Disconnect the ignition coil/spark plug cap wiring connectors (see illustration 5.18a). Undo the screws securing the coils/caps to the valve cover and pull them off the spark plugs (see illustrations 5.18b and c).
- 5 Unscrew the eight valve cover bolts evenly in a criss-cross pattern, starting at the centre and working outwards, and remove them with their seals, then lift the valve cover off the



6.4 An engine support made from pieces of 2 x 4 inch wood



7.3 Thermostat housing screw (arrowed) – Tiger models

2•12 Engine, clutch and transmission

cylinder head (see illustration). If the cover is stuck, do not try to lever it off with a screwdriver. Tap it gently around the sides with a rubber hammer or block of wood to dislodge it.

Installation

6 Examine the valve cover gasket for signs of damage or deterioration and fit a new one if necessary. Similarly check the rubber seals on the cover bolts for cracks, hardening and deterioration.

7 Clean the mating surfaces of the cylinder head and the valve cover with lacquer thinner, acetone or brake system cleaner. If a new gasket is being used, remove any traces of old glue or sealant.

8 Fit the gasket into the valve cover, making sure it locates correctly into the groove. Use a few dabs of grease to keep the gasket in place while the cover is fitted.

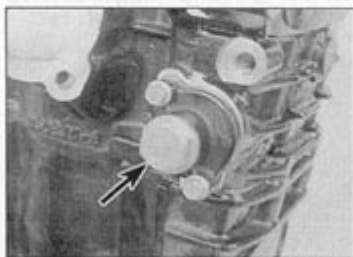
9 Apply a suitable silicone sealant to the cut-outs in the cylinder head where the gasket half-circles fit (see illustration). Position the valve cover on the cylinder head, making sure the gasket stays in place (see illustration). Install the cover bolts, using new seals if necessary, and tighten them evenly in a criss-cross pattern, starting at the centre and working outwards, to the torque setting specified at the beginning of the Chapter – the two longer bolts are located at the cam chain end (see illustration).

10 Install the remaining components in the reverse order of removal. Tighten the ignition coil/cap screws to the specified torque setting.

8 Cam chain tensioner – removal, inspection and installation

Removal

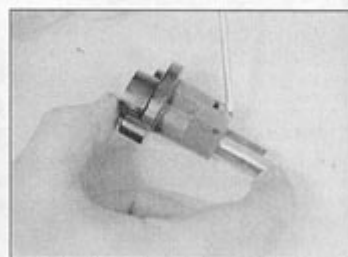
1 Remove the valve cover (see Section 7). On Daytona models, remove the belly-pan and the right-hand fairing side panel (see Chapter 7). On Sprint ST models, remove the belly-pan (see Chapter 7).



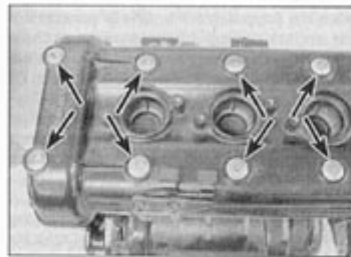
8.5 Unscrew the bolt (arrowed) and withdraw the spring from the tensioner body



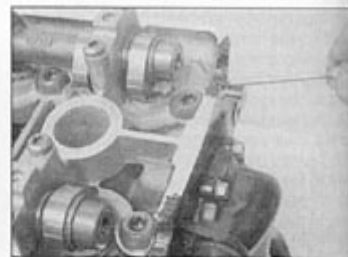
8.6 Unscrew the bolts (arrowed) and withdraw the tensioner body from the head



8.7 Release the catch and check the plunger moves freely in and out



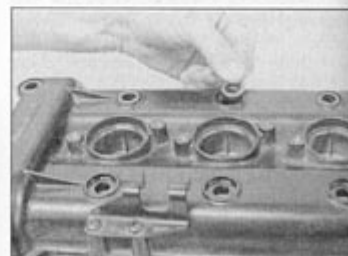
7.5 Unscrew the cover bolts (arrowed) and lift the cover off the engine



7.9a Apply the sealant to the cutouts in the head



7.9b Make sure the gasket stays in place when fitting the cover



7.9c Fit new bolt seals if necessary

2 Drain the engine oil (see Chapter 1).

3 Remove the clutch cover, referring to the relevant Steps in Section 16. Using a ring spanner on the nut on the end of the crankshaft, rotate the crankshaft clockwise so that the T1 mark on the ignition timing rotor is aligned with the crankshaft position sensor pick-up (see illustration 9.3a). In this position, the arrow marks on the cam sprockets should face inwards towards each other (see illustration 9.3b). If they face away from each other, turn the crankshaft clockwise one full turn so that the T1 mark again aligns with the sensor – the arrows on the camshaft sprockets will now be facing towards each other.

4 When the tensioner is withdrawn from the cylinder block, the cam chain will be untensioned, and may jump a tooth on the intake cam sprocket. To prevent this, insert a

wedge between the tensioner blade and the crankcase to hold the blade in firm contact with the cam chain whilst the tensioner is removed.

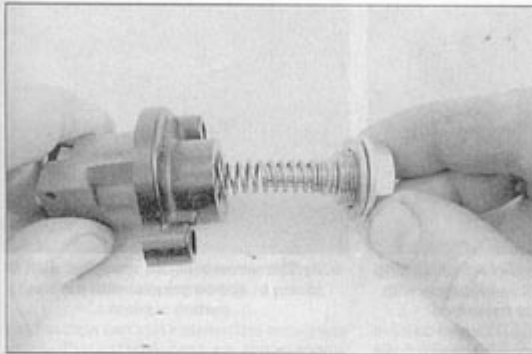
5 Undo the large end bolt from the tensioner and withdraw the spring, noting that it will be under tension (see illustration).

6 Remove the two mounting bolts and withdraw the tensioner (see illustration). Discard its gasket as a new one must be used.

Inspection

7 Examine the tensioner components for signs of wear or damage. Lift the catch on the tensioner body and move the plunger in and out – if it doesn't move smoothly and freely, replace the tensioner with a new one (see illustration).

8 If the spring has sagged, the tensioner will not be able to take up chain play effectively. Measure the free length of the spring and



8.10a Fit the spring and end bolt into the tensioner ...



8.10b ... then turn the bolt anti-clockwise so that it threads into the plunger

compare to the specification. If the spring length has reduced significantly, the tensioner must be renewed.

Installation

Method A

9 Lift the catch on the tensioner body and push the plunger fully inwards (see illustration 8.7). Release the catch to lock the plunger in the retracted position.

10 Install the spring in the tensioner. Fit a new sealing washer to the end bolt and install the end bolt in the end of the spring (see illustration). Hold the tensioner body against the palm of your hand and compress the spring into the body so that the brass threaded ring on the end bolt contacts the end of the plunger; turn the end bolt **anti-clockwise** to thread the brass ring into the plunger (see illustration). This will keep the plunger retracted even though it is under spring pressure. **Note:** It may take several attempts to achieve this.

11 Check that the crankshaft is still aligned as described in Step 3. Slip a new gasket over the tensioner body and install the tensioner in the cylinder head (see illustration). Secure it with

the two mounting bolts, tightening them to the specified torque setting (see illustration).

12 Remove the wood wedge from the tensioner blade, making sure that the chain does not jump a tooth on the cam sprocket as you do. Screw the tensioner end bolt **clockwise** into the tensioner body (see illustration); as you do this, the threaded brass section will thread itself out of the plunger, thereby releasing it, at the same time as the bolt threads will lock into the body. The tensioner ratchet will be heard to release and the plunger shoot out into contact with the tensioner blade as the brass ring releases the plunger. Tighten the end bolt to the specified torque setting.

13 Check that the timing marks are correct (see Step 3). Rotate the engine several times and recheck the timing marks – if the cam chain has jumped whilst the tensioner was removed, reposition it as described in Section 9. Install the valve cover (see Section 7).

14 Install the clutch cover (see Section 16, following the relevant Steps).

15 Fill the engine to the correct level with oil (see *Daily (pre-ride) checks*).

Method B

16 Lift the catch on the tensioner body and

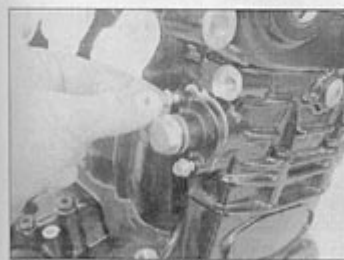


8.11a Install the tensioner assembly using a new gasket ...

push the plunger fully inwards (see illustration 8.7). Release the catch to lock the plunger in the retracted position.

17 Slip a new gasket over the tensioner body and install the tensioner in the cylinder head (see illustration). Secure it with the mounting two bolts, tightening them to the specified torque setting (see illustration 8.6).

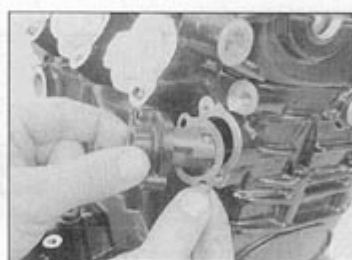
18 Remove the wood wedge from the tensioner blade, making sure that the chain does not jump a tooth on the cam sprocket as you do. Using a slim rod inserted into the tensioner body, use finger pressure only to



8.11b ... and tighten the mounting bolts to the specified torque

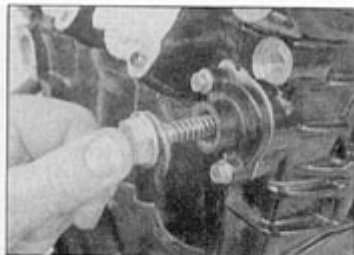


8.12 Turn the end bolt clockwise as described to release the plunger, and tighten it to the specified torque



8.17 Install the tensioner using a new gasket

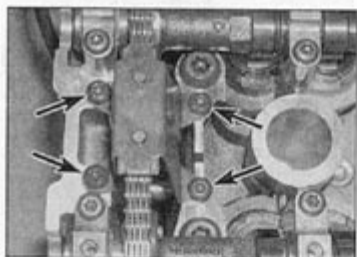
2•14 Engine, clutch and transmission



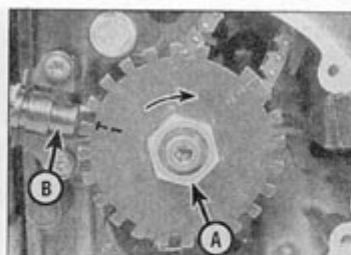
8.18 Fit the spring and end bolt into the tensioner

push the tensioner plunger in until it contacts the tensioner blade; the ratchet and catch will hold it in this position. Fit a new sealing washer onto the end bolt and install the spring and end bolt into the tensioner body (see illustration). Tighten the end bolt to the specified torque setting.

19 Check that the timing marks are correct (see Step 3). Rotate the engine several times and recheck the timing marks – if the cam chain has jumped whilst the tensioner was removed, reposition it as described in Section 9. Install the valve cover (see Section 7).



9.5 Undo the screws (arrowed) and remove the guide



9.3a Turn the crankshaft clockwise using the nut (A), until the T1 mark aligns with the sensor (B) as described

20 Install the clutch cover (see Section 16, following the relevant Steps).

21 Fill the engine to the correct level with oil (see Chapter 1).

9 Camshafts and followers – removal, inspection and installation

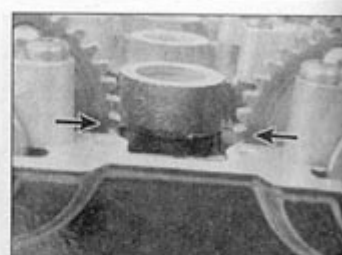
Note: This procedure can be carried out with the engine in the frame.

Removal

1 Remove the valve cover (see Section 7). On Daytona models, remove the belly-pan and the right-hand fairing side panel (see Chapter 7). On Sprint ST models, remove the belly-pan (see Chapter 7).

2 Drain the engine oil (see Chapter 1).

3 Remove the clutch cover, referring to the relevant Steps of Section 16. Using a ring spanner on the nut on the end of the crankshaft, rotate the crankshaft clockwise until the T1 mark on the ignition timing rotor aligns with the crankshaft position sensor pick-up (see illustration). In this position, the arrow marks on the camshaft sprockets will either be pointing inwards towards each other and be parallel with the top surface of the



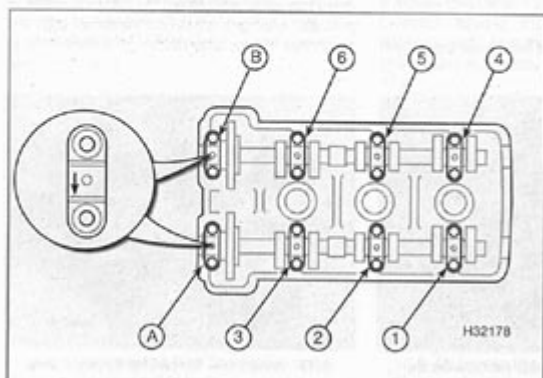
9.3b The arrow on each sprocket must be facing in and be parallel with the head mating surface

cylinder head, which is the position you want them in, or they will be pointing away from each other (see illustration). If they point away from each other, turn the crankshaft clockwise one full turn so that the T1 mark again aligns with the sensor – the arrows on the camshaft sprockets will now be pointing towards each other. **Note:** When the cam sprocket arrows are exactly parallel with the head, the centre of the crankshaft position sensor pick-up will be aligned either with the leading edge, centre or trailing edge of the T1 tooth on the rotor, depending on your model. If the timing is set up incorrectly, the sensor will not align with any part of the tooth.

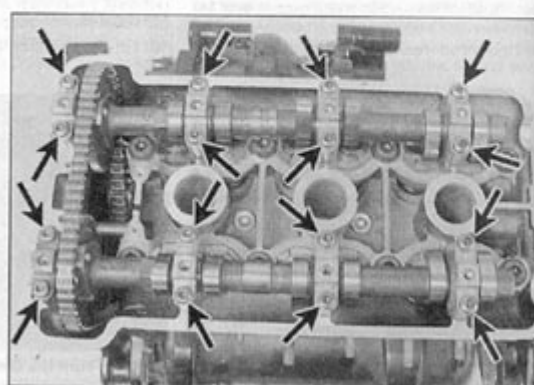
4 Remove the cam chain tensioner (see Section 8).

5 Remove the four screws securing the cam chain upper guide and lift it off (see illustration).

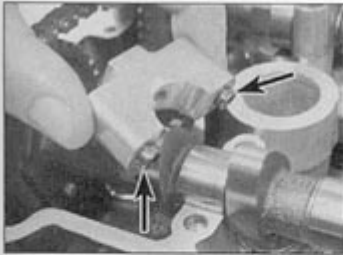
6 Before disturbing the camshaft caps, check for identification markings scribed on their top surfaces. These markings ensure that the caps can be matched up to their original journals on installation. The caps are numbered 1 to 6; the two outrigger caps on the cam chain end are denoted A and B (see illustration). If you can't see any markings, or they are unclear, make your own marks. Note that the numbered cap bolt holes are offset so



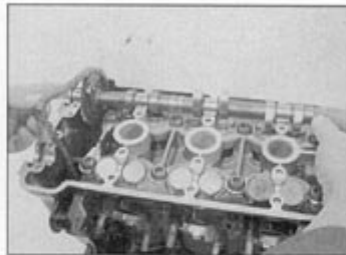
9.6 Camshaft cap identification markings



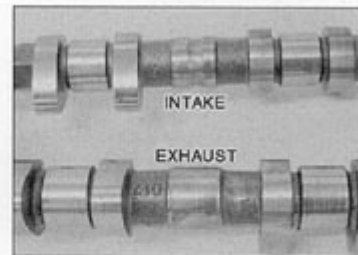
9.7a Camshaft cap bolts (arrowed)



9.7b Lift the cap off its journal, noting the dowels (arrowed)



9.9a Lift the camshaft off the head and disengage it from the chain



9.9b Note the difference between the camshafts for identification

that the caps can't be installed the wrong way round. The lettered caps on the outrigger journals are symmetrical, but have an arrow cast into them which must point forwards – mark your own arrow if one is not visible.

7 Working on one camshaft at a time, slacken all eight cap bolts evenly and a little at a time in a criss-cross sequence, slackening the bolts above any lobes that are pressing onto a valve last in the sequence so that the pressure from the open valves cannot cause the camshaft to bend (see illustration). Remove the bolts, then remove the caps (see illustration). Retrieve the dowels on each cap if they are loose – if they are not in the caps, they will be in the head.

Caution: A camshaft could break if the holder bolts are not slackened as described and the pressure from a depressed valve causes the shaft to bend. Also, if the holder does not come squarely away from the head, the holder is likely to break. If this happens the cylinder head must be renewed; the holders are matched to the head and cannot be obtained separately.

8 Lift the camshaft off the head and disengage it from the cam chain.

9 Repeat the procedure for the other camshaft (see illustration). The cam chain can be left to rest on its support bolt in the tunnel. Note that the camshafts are slightly different for identification purposes – the intake camshaft has a groove in its centre section, while the same section on the

exhaust camshaft is plain (see illustration).

10 If the shims and followers are being removed from the cylinder head, obtain a container which is divided into twelve compartments, and label each compartment with the location of its corresponding valve in the cylinder head and whether it belongs with an intake or an exhaust valve. If a container is not available, use labelled plastic bags (egg cartons also work very well). Remove the cam follower of the valve in question (see illustration). It is probably best to leave the shims in the followers for safekeeping.

Inspection

11 Inspect the cam bearing surfaces of the head and the caps (see illustration). Look for score marks, deep scratches and evidence of spalling (a pitted appearance). Check the camshaft lobes for heat discoloration (blue appearance), score marks, chipped areas, flat spots and spalling (see illustration).

12 Check the amount of camshaft runout by supporting each end of the camshaft on V-blocks, and measuring any runout using a dial gauge. If the runout exceeds the specified limit the camshaft must be replaced with a new one.

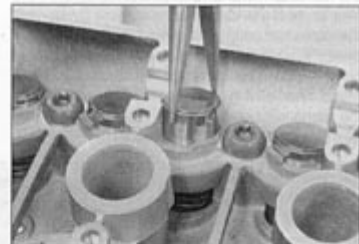


Refer to Tools and Workshop Tips (Section 3) in the Reference section for details of how to read a micrometer and dial gauge.

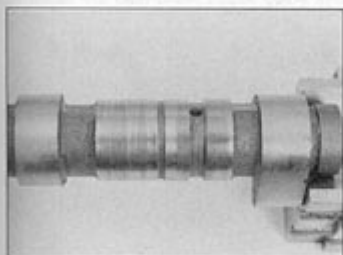
13 Next, check the camshaft journal oil clearances, using a product called Plastigauge. Check each camshaft in turn rather than at the same time. The intake camshaft can be identified by its grooved centre section and the exhaust by its plain section (see illustration 9.9b).

14 Clean the camshafts, the bearing surfaces in the cylinder head and the caps with a clean, lint-free cloth, then lay the camshaft in place in the cylinder head – there is no need to engage the chain on the sprocket.

15 Cut strips of Plastigauge and lay one piece on each bearing journal, parallel with the camshaft centreline (see illustration). Make sure the camshaft cap dowels are installed then fit the caps in their proper positions (see Step 6) (see illustration 9.7b and 9.6). Lubricate the threads of the cap bolts with



9.10 Lift each follower out of its bore – note the shim sitting in the top of the follower



9.11a Inspect the bearing surfaces for scratches or wear

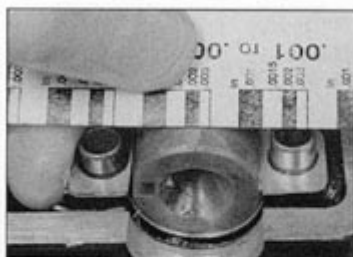


9.11b Check the lobes of the camshaft for wear – here's an example of damage requiring camshaft repair or renewal



9.15 Lay a strip of Plastigauge across each bearing journal, parallel with the camshaft centreline

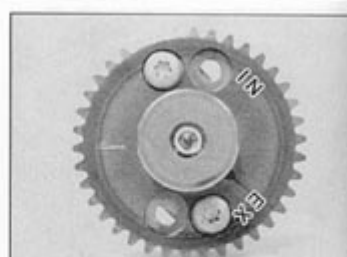
2•16 Engine, clutch and transmission



9.17a Compare the width of the crushed Plastigauge to the scale printed on the Plastigauge container



9.17b Measure the cam bearing journals with a micrometer



9.20 This sprocket is fitted to the exhaust camshaft

clean engine oil, then fit them in the caps. Ensuring that the camshafts are not rotated at all, tighten all eight cap bolts evenly, a little at a time, in a criss-cross sequence, until the specified torque setting is reached.

16 Now unscrew the bolts evenly, a little at a time, in a criss-cross sequence and carefully lift off the caps, again making sure the camshaft is not rotated.

17 To determine the oil clearance, compare the crushed Plastigauge (at its widest point) on each journal to the scale printed on the Plastigauge container (see illustration). Compare the results to this Chapter's Specifications. If the oil clearance is greater than specified, measure the diameter of the camshaft journal with a micrometer (see illustration). If the journal diameter is less than the specified limit, replace the camshaft with a new one and recheck the clearance. If the clearance is still too great, or if the camshaft journal is within its limit, replace the cylinder head and caps as a set with new ones – individual caps are not available. Note that if specialist measuring tools are available, the camshaft bearing bore inside diameter can be compared with the specified limit.

18 Repeat the oil clearance check on the other camshaft.

19 Check the sprockets for wear, cracks and other damage, renewing them if necessary. If the sprockets are worn, the cam chain is also worn, and probably the sprocket on the crankshaft as well. If wear this severe is apparent, the cam chain and all sprockets should be renewed (see Section 10). Except in cases of oil starvation (and worn sprockets), the cam chain itself should wear very little. If the chain has stretched excessively, which makes it difficult to maintain proper tension, or if it is stiff or the links are binding or kinking, replace it with a new one.

20 The same design sprocket is used for each camshaft, but different hole positions are provided for fitting to the intake or exhaust camshaft. When fitted to the intake camshaft the holes next to the IN marking should be used, and those next to the EX marking for the exhaust camshaft (see illustration). The sprocket bolts must have a drop of non-permanent thread locking compound applied to their threads and be tightened to the specified torque setting.

21 Inspect the outer surfaces of the followers

for evidence of scoring or other damage. If a follower is in poor condition, it is probable that the bore in which it works is also damaged. Measure the outside diameter of the followers and the inside diameter of the bores and compare the results to the limits in the Specifications at the beginning of this Chapter. If the bores are seriously out-of-round or tapered, the cylinder head and the followers must be renewed.

Installation

22 Lubricate each follower with engine oil and install each with its shim in the cylinder head (see illustration). **Note:** It is important that the followers and shims are returned to their original valves otherwise the valve clearances will be inaccurate.

23 Check that the crankshaft is positioned as described in Step 3.

24 Apply a smear of clean engine oil to the cylinder head camshaft bearing surfaces.

25 Hook the cam chain up from its tunnel and make sure that it is engaged around the lower sprocket teeth on the crankshaft. Keeping the front run of the chain taut, lay the exhaust camshaft in position so that the arrow mark on its sprocket points rearwards and is parallel with the top mating surface of the cylinder head, then engage the chain on the sprocket teeth (see illustration).

26 Slip the intake camshaft through the cam chain so that the arrow mark on its sprocket points forwards and is parallel with the head (see illustration). Engage the chain fully on



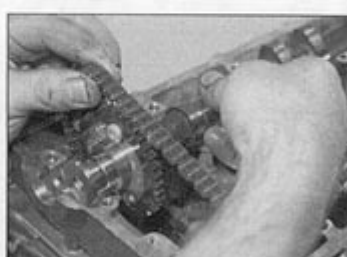
Before renewing the camshafts, cylinder head/caps because of damage, check with local machine shops specialising in motorcycle engine work. In the case of the camshafts, it may be possible for cam lobes to be welded, reground and hardened, at a cost far lower than that of a new camshaft. If the bearing surfaces in the head or holders are damaged, it may be possible for them to be bored out to accept bearing inserts. Due to the cost of new components it is recommended that all options are explored!



9.22 Lubricate the followers and slip them into their bores



9.25 Keeping the front run of the chain taut, lay the exhaust camshaft in the head, positioning it as described



9.26 Lay the intake shaft in the head, making sure the chain is taut between the sprockets



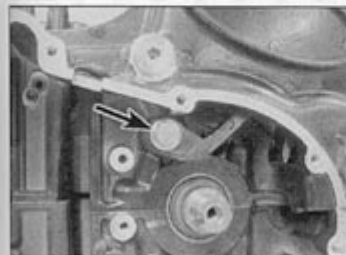
9.27 Tighten the cap bolts to the specified torque setting

the sprocket teeth, making sure that the chain is tight between the camshafts, with any slack lying in the rear run where it will later be taken up by the tensioner. Before proceeding, check that everything aligns as described in Step 3. If it doesn't, the valve timing is inaccurate, and the valves could contact the pistons when the engine is turned over.

27 Oil the camshaft journals. Ensure that the camshaft cap dowels are installed and fit the caps in their proper positions (see Step 6) (see illustration 9.7b and 9.6). Lubricate the threads of the cap bolts with clean engine oil, then fit them in the caps. Tighten all eight cap bolts evenly, a little at a time, in a criss-cross sequence, until the specified torque setting is reached (see illustration). Repeat for the other camshaft. **Note:** Be careful that the cam chain doesn't jump a tooth as the intake camshaft is tightened down (see *Haynes Hint*).

28 With all caps tightened down, check that the valve timing marks still align (see Step 3). If the chain has jumped a tooth, release the pressure on the tensioner blade (if applied), then slip the cam chain off the sprockets (there should be enough slack in the rear run to do this easily without having to displace the camshafts). Turn the camshaft(s) as required using a spanner on the cast hex until their alignment is correct (see illustration). With the timing is set up correctly, check that each camshaft is not pinched by turning it a few degrees in each direction with a spanner on the hex.

29 Install the cam chain upper guide and



10.2a Unscrew the pivot bolt (arrowed) . . .



HAYNES HINT
Keep the cam chain taut all round by applying pressure to the tensioner blade via the tensioner hole – using a finger works well, though a wooden dowel is easier. Alternatively, place a wedge between the blade and the crankcase

tighten its screws to the specified torque setting (see illustration).

30 Install the cam chain tensioner (Section 8).

31 If the camshafts or any of the valve components have been renewed, or if you are unsure whether you have returned the shims to their original locations, check the valve clearances (see Chapter 1).

32 Install the clutch cover, referring to the relevant Steps of Section 16.

33 Install the valve cover (see Section 7).

34 Refill the engine with oil (see *Daily (pre-ride) checks*). On Daytona models, install the belly-pan and the right-hand fairing side panel (see Chapter 7). On Sprint ST models, install the belly-pan (see Chapter 7).

10 Cam chain and tensioner/guide blades – removal and installation

Note: The cam chain and blades can be removed with the engine in the frame.

Cam chain tensioner blade

Removal

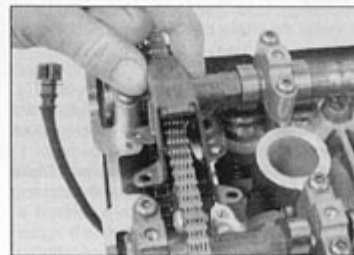
1 Remove the intake camshaft as described in Section 9.



10.2b . . . and lift the tensioner blade out of the tunnel



9.28 Slip the chain off the sprocket and turn the camshaft as required using a spanner on the cast hex



9.29 Install the upper guide on the head

2 Undo the tensioner blade pivot bolt from the right-hand side of the crankcase (see illustration). Retrieve the washer from between the blade and the crankcase as you withdraw the bolt, and the collar from the bolt hole if it doesn't come out with the bolt (see illustration 10.4). Lift the blade out of the back of the cam chain tunnel (see illustration).

3 Check the tensioner blade for cracking and other damage, renewing it if necessary.

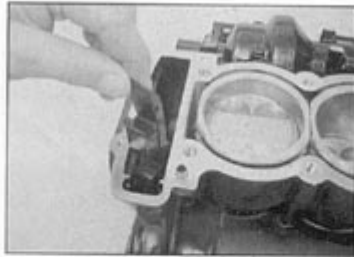
Installation

4 Slide the washer and collar onto the pivot bolt. Lower the tensioner blade down through the chain tunnel (see illustration 10.2b), then slip the bolt through the blade, locating the inner washer between the blade and the crankcase as you do (see illustration). Thread the bolt into the crankcase and tighten



10.4 Locate the inner washer between the blade and the crankcase

2•18 Engine, clutch and transmission



10.7 Lift the guide blade out of the tunnel

it to the torque setting specified at the beginning of the Chapter.

5 Install the intake camshaft (see Section 9).

Cam chain guide blade

6 Remove the cylinder head (see Section 11).

7 Lift the blade out of the front of the cam chain tunnel, noting how it locates (see illustration).

8 Installation is the reverse of removal. Make sure the blade locates correctly at the top and bottom (see illustrations).

Cam chain upper guide

9 Remove the valve cover (see Section 7).

10 Remove the four screws securing the cam chain upper guide and lift off (see illustration 9.5).

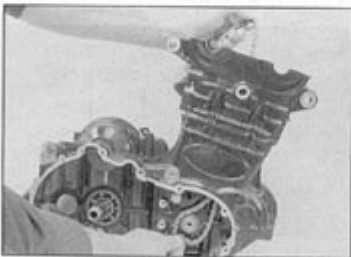
11 Installation is the reverse of removal (see illustration 9.29).

Cam chain and crankshaft sprocket

Removal

12 Remove the camshafts (see Section 9). To prevent the possibility of damage, remove the crankshaft position sensor (see Chapter 4).

13 Counterhold the engine turning hexagon on the crankshaft with a ring spanner and unscrew the Allen bolt from the centre (see illustration). Remove the hexagon and ignition timing rotor from the crankshaft, noting how they locate over the square-section key (see illustrations).



10.15 ... then disengage the chain from the crankshaft sprocket and lift it out of the tunnel



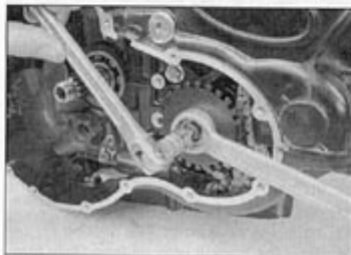
10.8a Locate the lugs in the cutouts (arrows) ...



10.8b ... and make sure the blade hooks onto the crankcase correctly at the bottom

14 Hold the cam chain and remove the support bolt from the centre of the right-hand side of the cylinder head (see illustration).

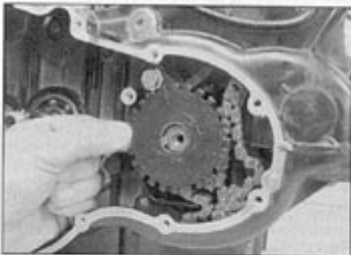
15 Slip the chain off the crankshaft sprocket and lift it out of the head (see illustration).



10.13a Counter-hold the hex and unscrew the bolt



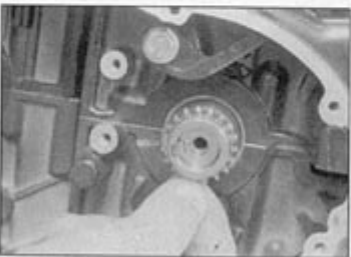
10.13b Remove the hex ...



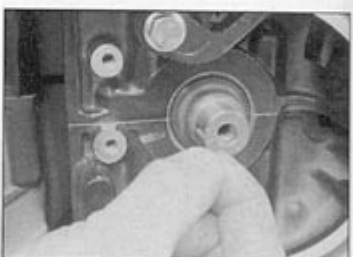
10.13c ... and the rotor, noting how they locate over the key



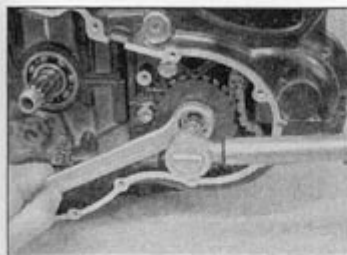
10.14 Unscrew and remove the support bolt ...



10.16a Slide the sprocket off the crankshaft, noting which way round it fits



10.16b Remove the key for safekeeping if it is loose



10.18 Tighten the Allen bolt to the specified torque

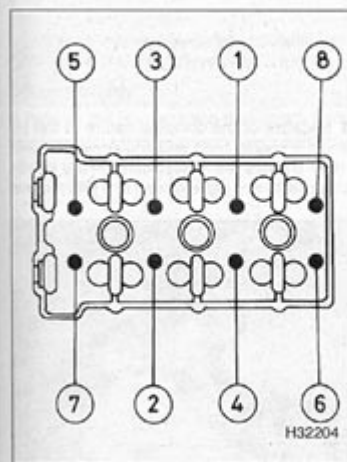
Inspection

17 Check the cam chain for binding and obvious damage and renew it if necessary. Inspect the sprocket for chipped or missing teeth. If the chain and sprocket show signs of extensive wear renew them as a set (including the camshaft sprockets).

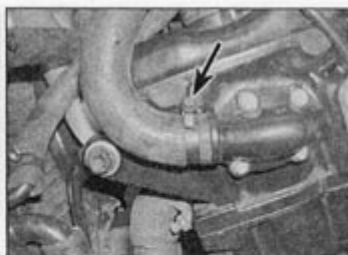
Installation

18 Installation is a reverse of the removal procedure, noting the following:

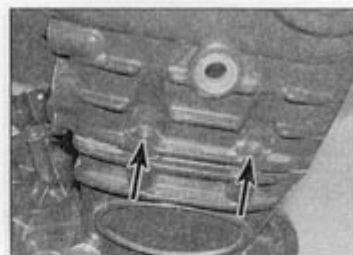
- Locate the sprocket, timing rotor and square-section key (see illustrations 10.16, 13c and 13b). Install the timing rotor with its marked side facing outwards.
- Tighten the cam chain support bolt to the specified torque setting.
- Apply a drop of non-permanent thread locking compound to the threads of the timing rotor Allen bolt and tighten it to the specified torque setting, counter-holding the hex as you do (see illustration).
- Do not forget to install the crankshaft position sensor (see Chapter 4).



11.9 Cylinder head bolt TIGHTENING sequence



11.2 Slacken the clamp screw (arrowed) and detach the hose



11.7 Remove the two screws (arrowed) from the right-hand end of the head

11 Cylinder head – removal and installation

Caution: The engine must be completely cool before beginning this procedure or the cylinder head may become warped.

Note: This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply. It will be necessary to support the engine under the sump during this procedure, therefore position the bike on its centrestand (Sprint ST) or on an auxiliary stand (all other models).

Removal

- Remove the fuel tank and airbox (see Chapter 4).
- Remove the radiator and thermostat housing (see Chapter 3). On Sprint models, disconnect the wire from the coolant temperature sender unit on the left-hand end of the cylinder head (see illustration 5.6). On all models, slacken the clamp securing the coolant hose to the left-hand end of the cylinder head and detach the hose (see illustration).
- Remove the exhaust system (see Chapter 4).
- Remove the throttle bodies (see Chapter 4).
- Remove the camshafts and followers (see Section 9). Remove the cam chain



11.11 Carefully lift the head up off the engine

support bolt from the centre of the right-hand side of the cylinder head (see illustration 10.14).

6 Unscrew the banjo bolt securing the external oil hose to the cylinder head and position the hose aside. Discard the sealing washers as new ones must be fitted on installation.

7 Remove the two screws from the right-hand end of the cylinder head-to-crankcase joint (see illustration).

8 Position a jack and wooden block under the sump, then refer to Section 5 and remove the cylinder head-to-frame bolts on each side. As they are withdrawn, take the weight of the engine on the jack so that no additional strain is placed on the engine's rear mountings.

9 Slacken the eight cylinder head bolts by half a turn at a time in a reverse of the specified sequence shown (see illustration).

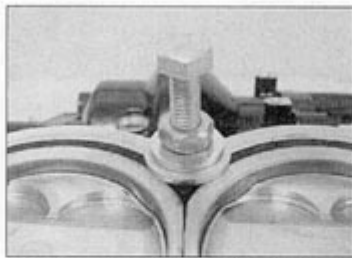
10 Tap around the joint faces of the cylinder head with a soft-faced mallet to free the head. Don't attempt to free the head by inserting a screwdriver between the head and cylinder block – you'll damage the sealing surfaces.

11 Carefully lift the head off the block, and remove it from the engine (see illustration). Recover the two dowels if they are loose.

12 Lift the cam chain guide blade from the front of the tunnel, noting how it locates (see illustration 10.7).

13 Whenever the cylinder head is disturbed it is possible that the seal between the liners and crankcase will be broken. Unfortunately there is no easy way of telling whether this has occurred or not, and so the only way to be sure is to remove the liners and resal them before installing the head, and Triumph specify this practise. On the model we stripped down, we found that the liners were in fact quite difficult to remove, and so the chances were that the seal remained intact. If the crankshaft is rotated at all with the head off, then the liners must be removed and resaled. If you feel certain that the seal has not broken, you can clamp them in place using suitable bolts, nuts and washers threaded into the head bolt holes as shown to

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11.13 Assemble a bolt, nut and washers as shown to clamp the liners

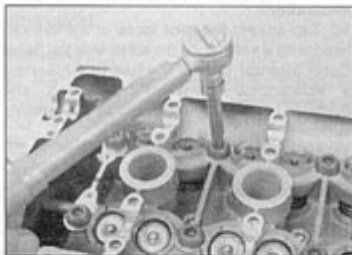
prevent any movement (see illustration) – do not overtighten the clamps as the mating surface of the head could be indented, causing leakage and compression problems. However if you are in any doubt at all (and it is impossible to be 100% certain), it is essential that the liners are removed, otherwise coolant from the cylinder block water jacket will seep into the crankcase. Refer to Section 14 for liner removal and installation details.

Installation

14 Fit and seal the liners in the cylinder block (see Section 14). If the liners were clamped in place, remove the clamps.

15 Locate the cam chain guide blade into the tunnel. Make sure the blade locates correctly at the top and bottom (see illustrations 10.8a and b).

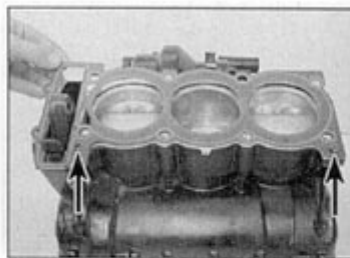
16 Check that the cylinder head bolt holes in



11.20a Tighten the cylinder head bolts as described to the specified torque settings...



11.20b ... and then through the specified angle using a degree disc



11.17 Lay the new gasket on the head, locating it over the dowels (arrowed)

the block are clean and dry. Ensure both cylinder head and block mating surfaces are clean.

17 Fit the dowels to the block (if removed), then lay the new head gasket over the dowels and onto the head (see illustration).

18 Carefully lower the cylinder head onto the block (see illustration 11.11).

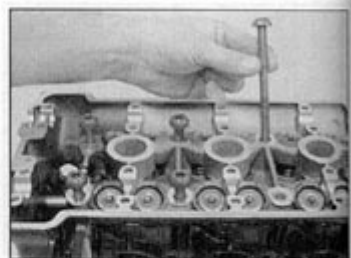
19 Clean the threads and under the heads of the cylinder head bolts. Lubricate the threads with clean engine oil, then wipe them with a lint-free cloth so that all excess oil is removed, but not so that they are completely dry. Install the cylinder head bolts and tighten them finger-tight only at this stage (see illustration).

20 Tighten the cylinder head bolts in the correct numerical sequence (see illustration 11.9) to the stage 1 torque setting (see illustration). Repeat to the stage 2 torque setting. Finally, attach a degree disc to the torque wrench and angle-tighten each bolt 90° following the same sequence (see illustration). **Note:** The cylinder head may not seat fully when placed on the block due to the liners being slightly proud – if it does not pull down during tightening, remove the head for investigation. If the head is detached, the liners should be resealed (see Step 13).

21 Realign the engine mounting lugs with the frame, using pressure from the jack if necessary, and install the mounting bolts, washers and nuts, referring to Section 5 for model specific details. Tighten the bolts to the specified torque settings, following the procedure in section 5. Remove the jack.



11.22 Tighten the end screws to the specified torque



11.19 Install the bolts and tighten them finger-tight

22 Tighten the screws on the right-hand end of the cylinder head to the specified torque setting (see illustration).

23 Lift the cam chain up the tunnel, using a piece of wire to hook it up if necessary, then install the support bolt and tighten it to the specified torque setting (see illustration 10.14).

24 Install the followers and camshafts (see Section 9).

25 Install the valve cover (see Section 7).

26 Using new sealing washers on each side of the external oil hose union, install the hose on the engine and tighten the banjo bolt to the specified torque setting (see illustration).

27 Push the coolant pipe onto its union on the cylinder head and tighten the clamp securely (see illustration 11.2). On Sprint models, reconnect the coolant temperature sensor wire (see illustration 5.6).

28 Install the throttle bodies, exhaust system radiator and thermostat housing, referring to the relevant Chapters.

29 Fill the cooling system (see Chapter 1).

30 Install the airbox and fuel tank (see Chapter 4).

12 Valves/valve seats/valve guides – overhaul

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**1** Because of the complex nature of this job and the special tools and equipment required, most owners leave servicing of the valves, valve seats and valve guides to a professional.



**11.26** Use a new sealing washer on each side of the union

However, you can make an initial assessment of whether the valves are seating, and therefore sealing, correctly by pouring a small amount of solvent into each of the valve ports. If the solvent leaks past any valve into the combustion chamber area the valve is not seating and sealing correctly.

2 You can also remove the valves from the cylinder head, clean the components, check them for wear to assess the extent of the work needed, and, unless a valve service is required, grind in the valves (see Section 13). The head can then be reassembled.

3 A dealer service department will remove the valves and springs, renew the valves and guides, recut the valve seats, check and renew the valve springs, spring retainers and collets (as necessary), replace the valve seals with new ones and reassemble the valve components.

4 After the valve service has been performed, the head will be in like-new condition. When the head is returned, be sure to clean it again very thoroughly before installation on the engine to remove any metal particles or abrasive grit that may still be present from the valve service operations. Use compressed air, if available, to blow out all the holes and passages.

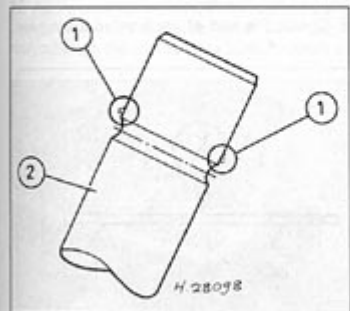
### 13 Cylinder head and valves – disassembly, inspection and reassembly

1 As mentioned in the previous section, valve seat recutting should be left to a Triumph dealer. However, disassembly, cleaning and inspection of the valves and related components can be done (if the necessary special tools are available) by the home mechanic. This way no expense is incurred if the inspection reveals that overhaul is not required at this time.

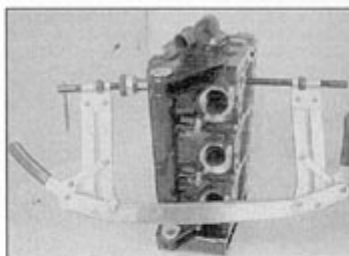
2 To disassemble the valve components without the risk of damaging them, a valve spring compressor is absolutely necessary. Make sure it is suitable for motorcycle work.

#### Disassembly

3 Remove the followers and their shims if you



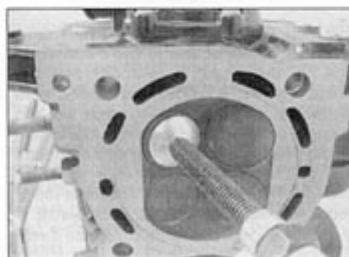
13.6e If the valve stem (2) won't pull through the guide, deburr the area above the collet groove (1)



13.6a Compressing the valve springs using a valve spring compressor



13.6b Make sure the compressor is a good fit both on the top ...



13.6c ... and the bottom of the valve assembly



13.6d Remove the collets with needle-nose pliers, tweezers, a magnet or a screwdriver with a dab of grease on it

haven't already done so (see Section 9). Store the components in such a way that they can be returned to their original locations without getting mixed up.

4 Carefully scrape all carbon deposits out of the combustion chamber area. A hand held wire brush or a piece of fine emery cloth can be used once the majority of deposits have been scraped away. Do not use a wire brush mounted in a drill motor, or one with extremely stiff bristles, as the head material is soft and may be eroded away or scratched by the wire brush.

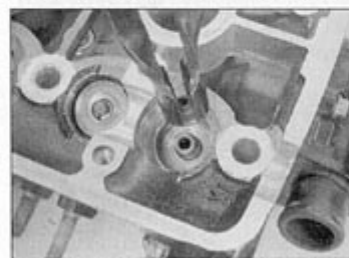
5 Arrange to label and store the valves along with their related components so they can be kept separate and reinstalled in the same valve guides they are removed from (labelled plastic bags work well for this).

6 Compress the valve spring on the first valve with a spring compressor, then remove the collets from the valve assembly (see

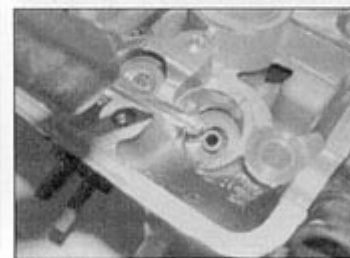
illustrations). **Note:** Take great care not to mark the follower bore with the spring compressor. Do not compress the springs any more than is necessary. Carefully release the valve spring compressor, then remove the spring retainer and the springs and the valve from the head. If the valve binds in the guide (won't pull through), push it back into the head and deburr the area around the collet groove with a very fine file or whetstone (see illustration).

7 Repeat the procedure for the other valves. Keep the parts for each valve together so they can be reinstalled in the same location.

8 Pull the valve stem seals off the top of the valve guides with pliers and discard them (the old seals should never be reused) (see illustration). Remove the spring seat – using a magnet is the easiest way to lift the seat off the head (see illustration).



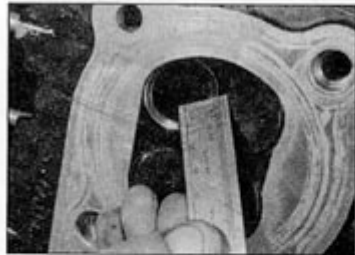
13.8a Pull the seal off the top of the guide ...



13.8b ... then remove the spring seat



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**13.14** Measure the valve seat width with a ruler (or for greater precision use a vernier caliper)

9 Next, clean the cylinder head with solvent and dry it thoroughly. Compressed air will speed the drying process and ensure that all holes and recessed areas are clean. Clean any traces of old gasket material from the cylinder head. If a scraper is used, take care not to scratch or gouge the soft aluminium.



**Refer to Tools and Workshop Tips (Section 7) for details of gasket removal methods.**

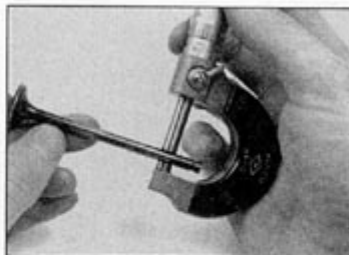
10 Clean all of the valve springs, collets, retainers and spring seats with solvent and dry them thoroughly. Do the parts from one valve at a time so that no mixing of parts between valves occurs.

11 Scrape off any deposits that may have formed on the valve, then use a motorised wire brush to remove deposits from the valve heads and stems. Again, make sure the valves do not get mixed up.

### Inspection

12 Inspect the head very carefully for cracks and other damage. If cracks are found, a new head will be required. Check the cam bearing surfaces for wear and evidence of seizure. Check the camshafts for wear as well (see Section 9).

13 Using a precision straight-edge and a feeler gauge, check the head gasket mating surface for warpage. Refer to *Tools and*

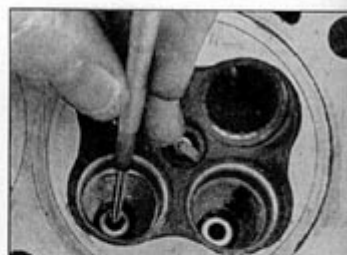


**13.15a** Measure the valve stem diameter with a micrometer

*Workshop Tips* (Section 3) in the Reference section for details of how to use the straight-edge. If the head is warped, but not excessively so, it should be possible to resurface it using a 400 to 600 grade wet and dry paper on a large surface plate, moving the cylinder head in a figure of eight rotation, and turning it frequently to ensure an even coverage. Take the head to a specialist repair shop if you lack the necessary equipment. If the head is excessively warped, replace it with a new one.

14 Examine the valve seats in the combustion chamber. If they are pitted, cracked or burned, the head will require work beyond the scope of the home mechanic. Measure the valve seat width and compare it to this Chapter's Specifications (see *Illustration*). If it exceeds the service limit, or if it varies around its circumference, valve overhaul is required. If available, use Prussian blue to determine the extent of valve seat wear. Uniformly coat the seat with the Prussian blue, then install the valve and rotate it back and forth using a lapping tool. Remove the valve and check whether the ring of blue on the valve is uniform and continuous around the valve, and of the correct width as specified.

15 Measure the valve stem diameter (see *Illustration*). Clean the valve guides to remove any carbon build-up, then measure the inside diameters of the guides (at both ends and the centre of the guide) with a small



**13.15b** Insert a small hole gauge into the valve guide and expand it so there's a slight drag when it's pulled out

hole gauge and micrometer (see *Illustrations*). The guides are measured at the ends and at the centre to determine if they are worn in a bell-mouth pattern (more wear at the ends). Subtract the stem diameter from the valve guide diameter to obtain the valve stem-to-guide clearance. If the stem-to-guide clearance is greater than listed in this Chapter's Specifications, renew whichever components are worn beyond their specification limits. If the valve guide is within specifications, but is worn unevenly, it should be renewed.

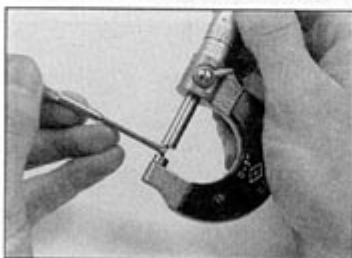


**Refer to Tools and Workshop Tips in the Reference Section for details on how to use a micrometer.**

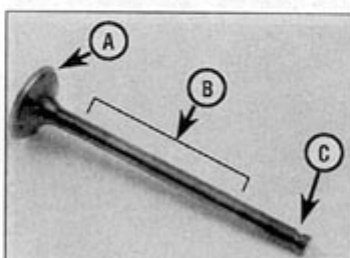
16 Carefully inspect each valve face, stem and collet groove area for cracks, pits and burned spots (see *Illustration*).

17 Rotate the valve and check for any obvious indication that it is bent. Use V-blocks and a dial gauge if available (see *Illustration*). If the valve is bent, it must be replaced with a new one. Check the end of the stem for pitting and excessive wear. The presence of any of the above conditions indicates the need for valve servicing. The stem end can be ground down, provided that the amount of stem above the collet groove after grinding is sufficient.

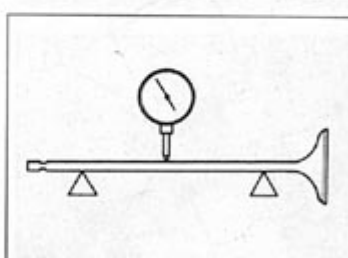
18 Check the end of each valve spring for



**13.15c** Measure the small hole gauge with a micrometer

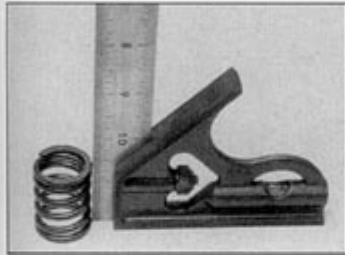


**13.16** Check the valve face (A), stem (B) and collet groove (C) for signs of wear and damage



**13.17** Check the valve stem for runout using V-blocks and a dial gauge





13.18 Check the valve springs for squareness

wear and pitting. Measure the spring length with the specified load for the spring being measured (see Specifications) and compare it to that listed. If any spring compresses further than specified it has sagged and must be replaced with a new one. Also place the spring upright on a flat surface and check it for bend by placing a ruler against it (see illustration). If the bend in any spring is excessive, it must be replaced with a new one.

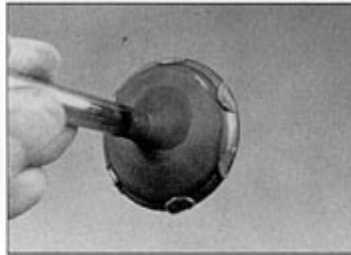
19 Check the spring retainers and collets for obvious wear and cracks. Any questionable parts should not be reused, as extensive damage will occur in the event of failure during engine operation.

20 If the inspection indicates that no overhaul work is required, the valve components can be reinstalled in the head.

#### Reassembly

21 Unless a valve service has been performed, before installing the valves in the head they should be ground in (lapped) to ensure a positive seal between the valves and seats. This procedure requires coarse and fine valve grinding compound and a valve grinding tool. If a grinding tool is not available, a piece of rubber or plastic hose can be slipped over the valve stem (after the valve has been installed in the guide) and used to turn the valve.

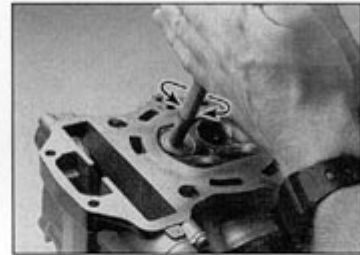
22 Apply a small amount of coarse grinding compound to the valve face and some molybdenum disulphide oil (a 50/50 mixture of



13.22 Apply the lapping compound very sparingly, in small dabs, to the valve face only

molybdenum disulphide grease and engine oil) to the valve stem, then slip the valve into the guide (see illustration). **Note:** Make sure each valve is installed in its correct guide and be careful not to get any grinding compound on the valve stem.

23 Attach the grinding tool (or hose) to the valve and rotate the tool between the palms of your hands. Use a back-and-forth motion (as though rubbing your hands together) rather than a circular motion (i.e. so that the valve rotates alternately clockwise and anti-clockwise rather than in one direction only) (see illustration). Lift the valve off the seat and turn it at regular intervals to distribute the grinding compound properly. Continue the grinding procedure until the valve face and seat contact area is of uniform and correct width and unbroken around the entire



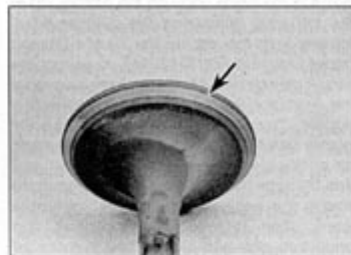
13.23a Rotate the valve grinding tool back and forth between the palms of your hands

circumference of the valve face and seat (see illustrations). If required, use Prussian Blue as described in Step 14 to check the valve seat.

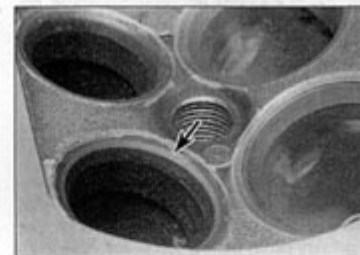
24 Carefully remove the valve from the guide and wipe off all traces of grinding compound. Use solvent to clean the valve and wipe the seat area thoroughly with a solvent soaked cloth.

25 Repeat the procedure with fine valve grinding compound, then repeat the entire procedure for the remaining valves.

26 Working on one valve at a time, lay the spring seat in place in the cylinder head (see illustration). Fit a new valve stem seal onto the guide (see illustration). Use an appropriate size deep socket to push the seal over the end of the valve guide until it is felt to clip into place (see illustration). Don't twist or



13.23b The valve face and seat should show a uniform unbroken ring ...



13.23c ... and the seat (arrowed) should be the specified width all the way round

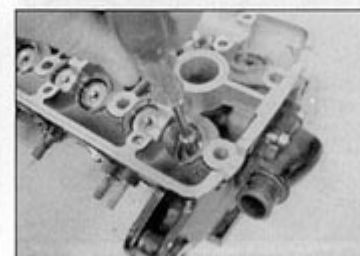
2



13.26a Fit the spring seat ...

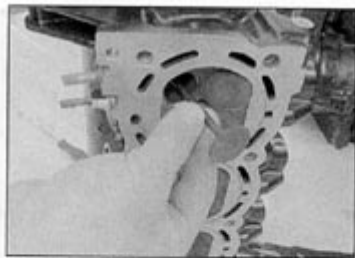


13.26b ... followed by the valve stem seal



13.26c Press the seal into position using a suitable deep socket

## 2•24 Engine, clutch and transmission



13.27a Lubricate the stem and slide the valve into its correct location

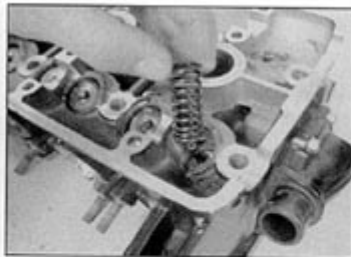
cock the seal, or it will not seal properly against the valve stem. Also, don't remove it again or it will be damaged. Note that there are different size seals for the intake and exhaust valves – make sure you have the correct size for the valve being installed (the intake valve seals are slightly smaller).

27 Coat the valve stem with molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and engine oil), then install it into its guide, rotating it slowly to avoid damaging the seal (see illustration). Check that the valve moves up and down freely in the guide. Install the inner spring, with its closer-wound coils facing down into the cylinder head, followed by the outer spring, also with its closer-wound coils facing down into the cylinder head (see illustrations). Now fit the spring retainer, with its shouldered side facing down so that it fits into the top of the springs (see illustration).

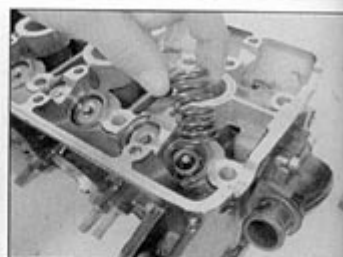
28 Apply a small amount of grease to the inside of the collets – this will help to hold them in place as the pressure is released from the spring (see illustration). Compress the spring with the valve spring compressor and install the collets (see illustration). When compressing the spring, do so only as far as is necessary to slip the collets into place. Make certain that the collets are securely locked in the retaining groove.

29 Support the cylinder head on blocks so the valves can't contact the workbench top, then very gently tap the top of the valve stem to help seat the collets in the groove.

30 Repeat the procedure for the remaining



13.27b Fit the inner valve spring ...

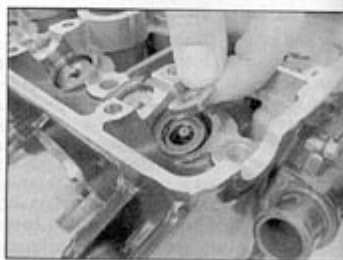


13.27c ... and the outer valve spring with their closer-wound coils facing down

valves. Remember to keep the parts for each valve together and separate from the other valves so they can be reinstalled in the same location.



**HAYNES HINT** Check for proper sealing of the valves by pouring a small amount of solvent into each of the valve ports. If the solvent leaks past any valve into the combustion chamber area the valve grinding operation on that valve should be repeated.



13.27d ... then fit the spring retainer

#### 14 Cylinder liners – removal, inspection and installation

**Note:** This procedure can be performed with the engine in the frame and with the pistons still in situ, following removal of the cylinder head. However to do this requires the use of a Triumph special tool, Part No. T3880315, to extract the liners. It may be possible to purchase a universal liner extractor from a good automotive tool supplier, though make sure it is suitable for engines below 1000cc. A suitable home-made tool can be used to release the liners, but as it uses the drawbolt principle it is necessary to remove the engine, separate the crankcase halves, then remove the crankshaft and connecting rods and pistons before it can be applied. If the liners are being removed as part of a complete engine overhaul and the engine is

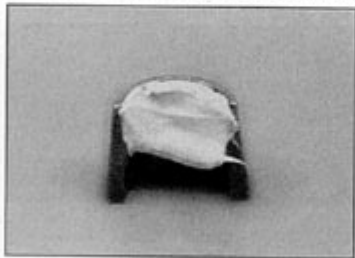
therefore removed anyway, then no extra work is involved, apart from making up the tool.

#### Removal

1 If the Triumph special tool or a liner extractor is being used, just remove the cylinder head (see Section 11). Otherwise (see **Note** above), remove the engine from the frame, separate the crankcase halves, then remove the crankshaft and connecting rods and pistons, referring to the relevant Sections of this Chapter.

2 Before removing the liners, mark the top edge of each liner at the front with a felt marker pen or similar, which will not damage the gasket surfaces. Indicate the cylinder number and front face of each liner.

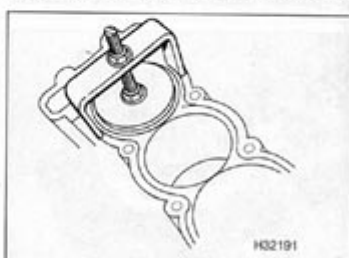
3 If the Triumph tool or a liner extractor is being used, turn the engine so that the piston in the liner being removed is at bottom dead centre (i.e. the bottom of its stroke). Gently draw each liner out of the cylinder block (see illustration). Do not resort to the use of metal



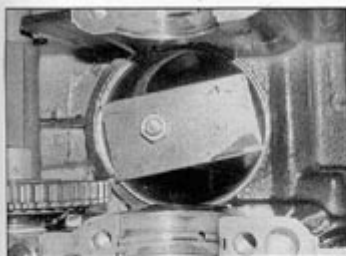
13.28a A small dab of grease will help to keep the collets in place on the valve while the spring is released



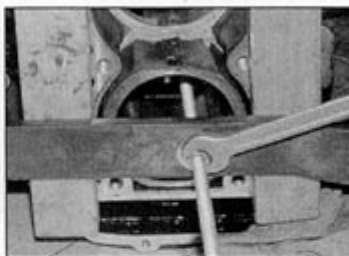
13.28b Compress the springs and install the collets, making sure they locate in the groove



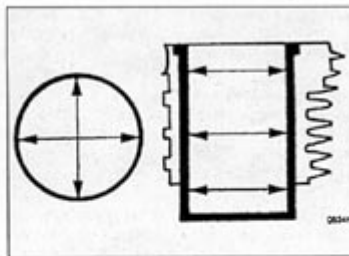
14.3 Extracting a liner using the Triumph tool



14.4a Make sure the bottom plate is accurately cut and fitted



14.4b Thread the nut clockwise and draw the liner up until the seal is broken



14.7 Measure the cylinder bore in the directions shown with a telescoping gauge, then measure the gauge with a micrometer

levers because the gasket surfaces will be damaged.

4 If the home-made drawbolt tool is being used (see **Tool Tip**), assemble the tool as shown, making sure the bottom plate is accurately fitted so that it bears on the bottom rim of the liner only, and equally on each corner, so there is no danger of it cocking sideways or slipping off the rim and scratching the inner surface of the liner (see illustration). Tighten the top nut and gently draw the liner out of the cylinder block (see illustration). Do not resort to the use of metal levers because something will end up damaged. As each liner is removed, stuff the crankcase aperture with clean rag to cushion the piston (if in situ) and prevent anything falling into the crankcase.

#### TOOL TIP

A drawbolt tool can be made using a section of steel plate, accurately cut so that it bears on the bottom rim of the liner (see illustration 14.4a). You will also need a length of steel strap of a suitable thickness, a length of threaded rod, some washers and nuts, and two pieces of wood (see illustration 14.4b). The thickness of the pieces of wood will determine by how much the liners can be extracted before they contact the metal strap, so make sure they are thick enough to allow the seal on the liner to be broken, and thereafter they can be removed by hand. Assemble the tool as shown and described in Step 4.

#### Inspection

5 Check the liner walls carefully for scratches and score marks. Using telescoping gauges and a micrometer (see Section 3 of *Tools and Workshop Tips*), check the dimensions of each cylinder to assess the amount of wear, taper and ovality. Measure near the top (but below the level of the top piston ring at TDC), centre and bottom (but above the level of the oil ring at BDC) of the bore, both parallel to and across the crankshaft axis (see illustration). Compare the results to the specifications at the beginning of the Chapter. If the precision measuring tools are not available, take the crankcase to a Triumph

dealer or specialist motorcycle repair shop for assessment and advice. If the liners are worn beyond the service limit, or badly scratched, scuffed or scored, replace them with new ones. The liners cannot be re-bored.

6 Cast iron liners (as fitted to early models) can be honed to remove minor scratches and glazing, and to allow new piston rings to bed in. To perform the honing operation you will need the proper size flexible hone with fine stones (see Specialist Tools in *Tools and Workshop Tips* in the Reference section), or a bottle-brush type hone, plenty of light oil or honing oil, some clean rags and an electric drill motor. Note that the aluminium liners fitted to later models should not be honed.

7 Securely hold the liner so that the bore is horizontal rather than vertical in a vice with soft jaws or cushioned with wooden blocks. Mount the hone in the drill motor, compress the stones and insert the hone into the cylinder. Thoroughly lubricate the cylinder, then turn on the drill and move the hone up and down in the cylinder at a pace which produces a fine cross-hatch pattern on the cylinder wall with the lines intersecting at an angle of approximately 60°. Be sure to use plenty of lubricant and do not take off any more material than is necessary to produce the desired effect. Do not withdraw the hone from the cylinder while it is still turning. Switch off the drill and continue to move it up and down in the cylinder until it has stopped turning, then compress the stones and withdraw the hone.

8 Wipe the oil from the cylinder and repeat the procedure on the other cylinder. Remember, do not take too much material from the cylinder wall. Wash the cylinders thoroughly with warm soapy water to remove all traces of the abrasive grit produced during the honing operation. After rinsing, dry the cylinders thoroughly and apply a thin coat of light, rust-preventative oil to all machined surfaces. If you do not have the equipment or desire to perform the honing operation, take the crankcase to a Triumph dealer or specialist motorcycle repair shop.

#### Installation

**Note:** If the crankcases were separated and the piston/connecting rod assemblies removed in order to remove the liners, you can either fit the piston/connecting rod assemblies

into the liners before the liners are installed, then install them as an assembly (method 2) – or you can install the liners, then fit the piston/connecting rod assemblies into them afterwards (method 3).

9 Remove all traces of old sealant from the mating surfaces of the liners and the crankcase. If the connecting rods and pistons are still in situ, this will be tricky because you must avoid old sealant dropping into the sump. Remove any rag from the crankcase and make sure the mating surfaces of the liner and crankcase are clean, oil-free and dry. Check that the piston rings are correctly positioned in relation to the front of the engine (see illustration 15.27).

#### Method 1 – piston/connecting rod assemblies in situ

10 Apply a continuous bead of a suitable silicone sealant to the liner mating surface as shown, following any instructions on the sealant package regarding use (see illustration 14.16).

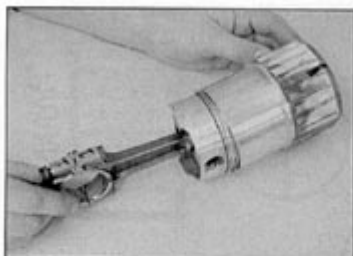
11 Lubricate the bore surface of the liner with engine oil. Make sure that the No. 1 liner is matched with the No. 1 piston/connecting rod assembly and so on, and that it is installed with the previously made mark at the front (see Step 2). Make sure that the piston is at top dead centre (i.e. at the top of its stroke).

12 Slip the liner over the piston, compressing each ring with your fingers as it enters the liner, and use a gentle rocking motion as the liner is pushed downwards (see illustration).



14.12 Carefully fit the liner down over the piston, making sure the rings enter correctly

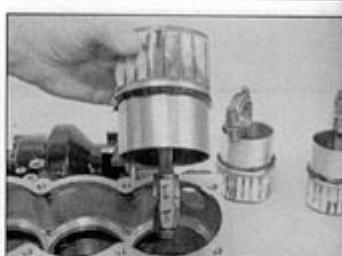
## 2•26 Engine, clutch and transmission



14.15 Carefully feed the piston into the liner, making sure the rings enter correctly



14.16 Apply the silicone sealant as shown ...



14.17 ... then fit the liner into the crankcase

The liner has a chamfered lead-in to enable the pistons to be installed without the use of ring compressors. Press the liner fully down until it is felt to seat. Clamp the liner in place using suitable bolts, nuts and washers threaded into the head bolt holes as shown to prevent it lifting (see illustration 11.13) – do not overtighten the clamps as the mating surface of the head could be indented, causing leakage and compression problems.

13 Turn the crankshaft to position the next piston at TDC, then install the next liner in the same way. As the crankshaft is rotated, make sure that the installed liner does not lift off its seating. If this happens, the liner must be removed, cleaned and fresh sealant applied.

#### Method 2 – piston/connecting rod assemblies removed

14 Lubricate the bore surface of the liner with engine oil. Make sure that the No. 1 piston/connecting rod assembly is matched with the No. 1 liner and so on, and that they are installed the correct way round – the arrow on the piston crown must point to the front of the liner and the front of the engine, while the oil hole in the connecting rod must point to the rear of each.

15 Slip the piston into the liner, compressing each ring with your fingers as it enters, and use a gentle rocking motion as the liner is pushed downwards (see illustration). The liner has a chamfered lead-in to enable the pistons to be installed without the use of ring compressors. Position the piston near the top of the liner.

16 Apply a continuous bead of a suitable silicone sealant to the liner mating surface as shown, following any instructions on the sealant package regarding use (see illustration).

17 Fit the liner into the crankcase and press it down until it is felt to seat (see illustration). Clamp the liner in place using suitable bolts, nuts and washers threaded into the head bolt holes as shown to prevent it lifting (see illustration 11.13) – do not overtighten the clamps as the mating surface of the head could be indented, causing leakage and compression problems.

18 Install the other liners in the same way.

#### Method 3 – piston/connecting rod assemblies removed

19 Apply a continuous bead of a suitable silicone sealant to the liner mating surface as shown, following any instructions on the sealant package regarding use (see illustration 14.16).

20 Fit the liner into the crankcase and press it down until it is felt to seat. Clamp the liner in place using suitable bolts, nuts and washers threaded into the head bolt holes as shown to prevent it lifting (see illustration 11.13) – do not overtighten the clamps as the mating surface of the head could be indented, causing leakage and compression problems.

21 Lubricate the bore surface of the liner with engine oil. Make sure that the No. 1 piston/connecting rod assembly is matched with the No. 1 liner and so on, and that they are installed the correct way round – the arrow

on the piston crown must point to the front of the liner and the front of the engine, while the oil hole in the connecting rod must point to the rear of each.

22 Slip the piston into the liner, making sure the connecting rod does not scratch the surface, then carefully compress and feed each piston ring into the liner until the piston crown is flush with the top (see illustrations). If available, a piston ring compressor makes installation a lot easier.

**HAYNES HINT** To ease entry of the pistons, carefully remove any ridge of carbon built up on the top of each liner bore using a scraper. If there is a pronounced wear ridge, remove it using a ridge reamer.

23 Install the other liners in the same way.

#### All methods

24 When all liners are installed, check that their top surfaces are all exactly level with the cylinder block using a precision straight-edge as shown (see illustration).

25 Install all components and assemblies according to your removal procedure, referring to the relevant Sections of the Chapter.

#### 15 Pistons and piston rings – removal, inspection and installation

**Note:** This procedure can be performed with the engine in the frame.



14.22a Carefully lower the connecting rod and piston into the liner ...

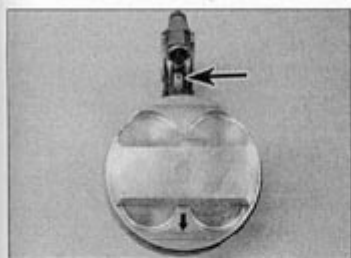


14.22b ... feeding each ring in as you do



14.24 Check that the liners are all flush using a straight-edge





15.3 The arrow on the piston must point to the front, and the oil hole in the connecting rod (arrowed) must face the rear

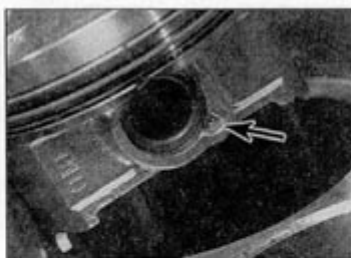
### Removal

1 Remove the cylinder head (see Section 11). If the engine is in the frame, also remove the cylinder liners (see Section 14). If the engine has been removed and the cranks are being separated, it may not be necessary to remove the liners if you are 100% certain that the liner seals are intact (see Section 11, Step 13) – instead separate the connecting rods from the crankshaft and remove them with the pistons from the tops of the liners, then separate the pistons from the rods. If the liners, pistons and connecting rods are all being removed as part of a complete engine overhaul, choose the method you prefer, though it is easier to separate the pistons from the connecting rods after the rods themselves have been removed (see Section 24).

2 If the engine is not being fully disassembled, make sure that all apertures into the crankcase are well blocked with rag.

3 Before removing the pistons, use a felt marker pen to write the cylinder number on the crown of each piston. Also note the arrow or triangle on each crown which points to the front of the engine – if the mark is not visible, make your own as the piston must be installed the correct way round (see illustration). If the connecting rods have been removed, also note there is an oil hole in the rod which must face the rear of the engine.

4 Carefully prise out the circlip on one side of the piston using needle-nose pliers or a small flat-bladed screwdriver inserted into the notch (see illustrations). Push the piston pin out



15.4a Use a small screwdriver or pointed instrument inserted in the notch (arrowed) . . .

from the other side to free the piston from the connecting rod (see illustration). Remove the other circlip and discard them as new ones must be used. When the piston has been removed, install its pin back into its bore so that related parts do not get mixed up. If the connecting rods are still in the engine, rotate the crankshaft so that the best access is obtained for each piston. On the outer pistons, the pins will have to be extracted inwards. Remember the importance of the rag in preventing dropped circlips from falling into the crankcase.

### HAYNES HINT

To prevent the circlip from ping-pong away, pass a rod or screwdriver, whose diameter is greater than the gap between the circlip ends, through the piston pin. This will trap the circlip if it springs out.

If a piston pin is a tight fit in the piston bosses, soak a rag in boiling water then wring it out and wrap it around the piston – this will expand the alloy piston sufficiently to release its grip of the pin. Alternatively purchase (or make up) a piston pin drawbolt tool – see 'Tools and Workshop Tips' in the Reference section.

### Inspection

#### Pistons

5 Before the inspection process can be

carried out, the pistons must be cleaned and the old piston rings removed.

6 Using your thumbs or a piston ring removal and installation tool, carefully remove the rings from the pistons (see illustration). Do not nick or gouge the pistons in the process. Carefully note which way up each ring fits and in which groove as they must be installed in their original positions if being re-used. The upper surface of each ring should have a manufacturer's mark or letter at one end – if the mark on each ring is different, note which mark is for the top ring and which is for the second. The rings can also be distinguished by their different profiles (see illustration 15.25a).

7 Scrape all traces of carbon from the tops of the pistons. A hand-held wire brush or a piece of fine emery cloth can be used once most of the deposits have been scraped away. Do not, under any circumstances, use a wire brush mounted in a drill motor to remove deposits from the pistons; the piston material is soft and will be eroded away by the wire brush.

8 Use a piston ring groove cleaning tool to remove any carbon deposits from the ring grooves. If a tool is not available, a piece broken off an old ring will do the job. Be very careful to remove only the carbon deposits. Do not remove any metal and do not nick or gouge the sides of the ring grooves.

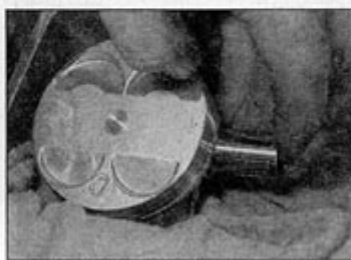
9 Once the deposits have been removed, clean the pistons with solvent and dry them thoroughly. Make sure the oil return holes below the oil ring groove are clear.

10 Carefully inspect each piston for cracks around the skirt, at the pin bosses and at the ring lands. Normal piston wear appears as even, vertical wear on the thrust surfaces of the piston and slight looseness of the top ring in its groove. If the skirt is scored or scuffed, the engine may have been suffering from overheating and/or abnormal combustion, which caused excessively high operating temperatures. The oil pump and cooling systems should be checked thoroughly.

11 A hole in the piston crown, an extreme to be sure, is an indication that abnormal combustion (pre-ignition) was occurring. Burned areas at the edge of the piston crown are usually evidence of spark knock (detonation). If any of the above



15.4b . . . to lever out the circlip



15.4c Withdraw the pin and remove the piston



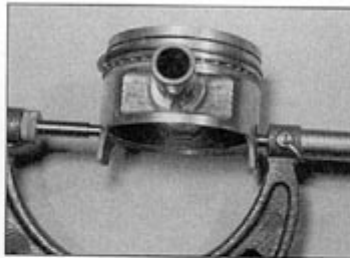
15.6 Removing the piston rings using a ring removal and installation tool



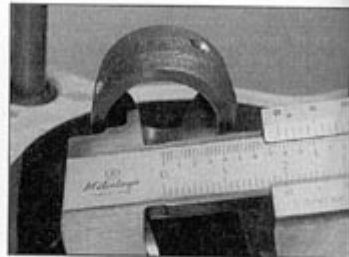
## 2•28 Engine, clutch and transmission



15.12 Measure the piston ring-to-groove clearance with a feeler gauge



15.13 Measure the piston diameter with a micrometer at the specified distance from the bottom of the skirt



15.14a Measure the internal diameter of the small-end bore ...

problems exist, the causes must be corrected or the damage will occur again.

**12** Measure the piston ring-to-groove clearance by laying a new piston ring in the ring groove and slipping a feeler blade in beside it (see illustration). Check the clearance at three or four locations around the groove. If the clearance is greater than that specified, the piston is worn. Confirm this by measuring the piston ring groove width and comparing with the specification. **Note:** Make sure you have the correct ring for the groove – the two compression rings can be identified by their profile (see illustration 15.25a).

**13** Measure the piston diameter 5 mm up from the bottom of the skirt and at 90° to the piston pin axis (see illustration). If outside of the specified figure, the piston must be renewed.

**14** If the necessary measuring equipment is available, measure the connecting rod small-end bore diameter, the piston pin outside diameter and the inside diameter of the pin bore in the piston (see illustrations). Renew any component that has worn beyond the specified limits.

#### Piston rings

**15** It is good practice to renew the piston rings when an engine is being overhauled. Before installing the new piston rings, the ring end gaps must be checked.

**16** Lay out the pistons and the new ring sets so the rings will be matched with the same piston and cylinder during the end gap measurement procedure and engine assembly.

**17** Insert the top ring into the top of the first

liner and square it up with the cylinder walls by pushing it in with the top of the piston. The ring should be about 20 mm below the top edge of the liner. To measure the end gap, slip a feeler blade between the ends of the ring and compare the measurement to the Specification (see illustration).

**18** If the gap is larger or smaller than specified, double check to make sure that you have the correct rings before proceeding.

**19** If the gap is too small, it must be enlarged or the ring ends may come in contact with each other during engine operation, which can cause serious damage. The end gap can be increased by filing the ring ends very carefully with a fine file. When performing this operation, file only from the outside in (see illustration).

**20** Excess end gap is not critical unless it is greater than 1 mm. Again, double check to make sure you have the correct rings for your engine and check that the bore is not worn.

**21** Repeat the procedure for each ring that will be installed in the first cylinder and for each ring in the remaining cylinders. Remember to keep the rings, pistons and cylinders matched up.

**22** Once the ring end gaps have been checked/corrected, the rings can be installed on the pistons.

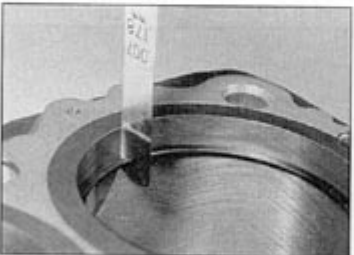
**23** The oil control ring (lowest on the piston) is installed first. It is composed of three separate components. Slip the expander into the groove, then install the upper side rail (see illustrations). Do not use a piston ring



15.14b ... the external diameter of the pin ...



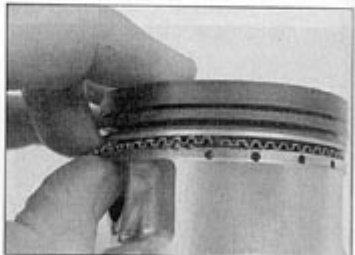
15.14c ... and the internal diameter of the bore in the piston



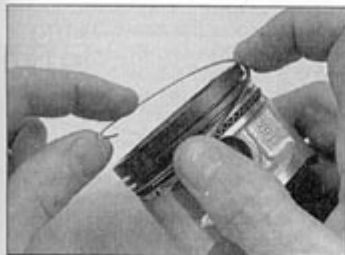
15.17 Measuring piston ring installed end gap



15.19 Ring end gap can be enlarged by clamping a file in a vice and filing the ring ends



15.23a Fit the oil ring expander in its groove ...



15.23b ... then fit the lower side rail and the upper side rail each side of it. The oil ring components must be installed by hand

installation tool on the oil ring side rails as they may be damaged. Instead, place one end of the side rail into the groove between the expander and the ring land. Hold it firmly in place and slide a finger around the piston while pushing the rail into the groove. Next, install the lower side rail in the same manner.

24 After the three oil ring components have been installed, check to make sure that both the upper and lower side rails can be turned smoothly in the ring groove.

25 Install the second (middle) ring next. **Note:** The second ring and top rings are slightly different in profile. Make sure that the letter N near the end gap is facing up (see illustration). Fit the ring into the middle groove on the piston. Either use your thumbs to hold the ring ends apart when installing the ring over the piston, or slip sections of old feeler gauge blades between the ring and piston to guide it into its groove (see illustration), or use a ring removal/installation tool (see illustration 15.6).

**Caution:** Do not expand the ring any more than is necessary to slide it into place – the ring material is brittle and is easily broken if overstressed.

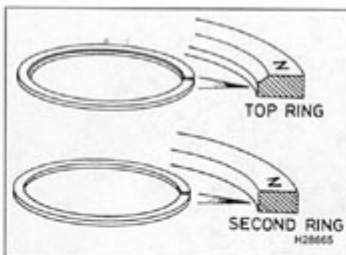
26 Finally, install the top ring in the same manner. The top ring can be distinguished from the second ring by its chamfer and chromed finish (see illustration 15.25a). Make sure the letter N near the end gap is facing up.

27 Correct positioning of the ring end gaps is important (see illustration).

### Installation

28 If the connecting rods have not been removed from the engine, stuff clean rag into the crankcase mouth to prevent any dropped circlips falling in (and see **Haynes Hint** above). Lubricate the connecting rod small-end bore with engine oil.

29 Insert a new circlip in one side of the piston bore and install the piston on its rod so that the arrow marking on its crown is facing forwards, and opposite to the oilway in the connecting rod (see illustration 15.3). Push



15.25a The rings can be identified by their different profiles – the N mark must face up

the piston pin fully into the piston and secure with a second new circlip – make sure the circlip is fully seated in its groove (see illustrations 15.4c, b and a).

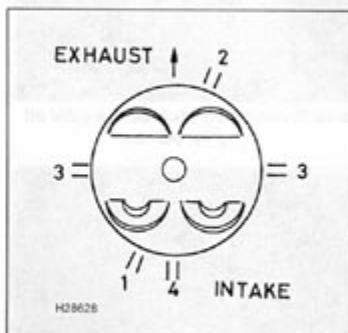
30 Install the other pistons in the same way. If the connecting rods have not been removed from the engine, rotate the crankshaft to gain the best access.

31 Check that the piston rings are still correctly positioned in relation to the front of the engine (see illustration 15.27).

32 Install all components and assemblies according to your removal procedure, referring to the relevant Sections of the Chapter.

### 16 Clutch – removal, inspection and installation

**Note:** This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply.



15.27 Stagger the ring end gaps as shown

- 1 Top ring end gap
- 2 Second (middle) ring end gap
- 3 Oil ring side rail end gaps
- 4 Oil ring expander ends



15.25b Old pieces of feeler gauge blade can be used to guide the ring over the piston

### Removal

1 On Daytona models, remove the belly-pan and the right-hand fairing side panel (see Chapter 7). On Sprint ST models, remove the belly-pan (see Chapter 7).

2 Drain the engine oil (Chapter 1).

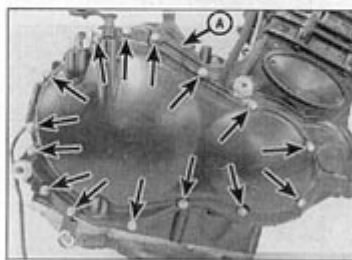
3 Detach the clutch cable from the release lever on the clutch cover (see Section 17).

4 Working in a criss-cross pattern, evenly slacken the clutch cover bolts, noting how the cable bracket is secured (see illustration). Lift the cover away from the engine, being prepared to catch any residual oil that may be released as the cover is removed.

5 Remove the gasket and discard it. Note the two locating dowels fitted to the crankcase and remove them for safe-keeping if they are loose.

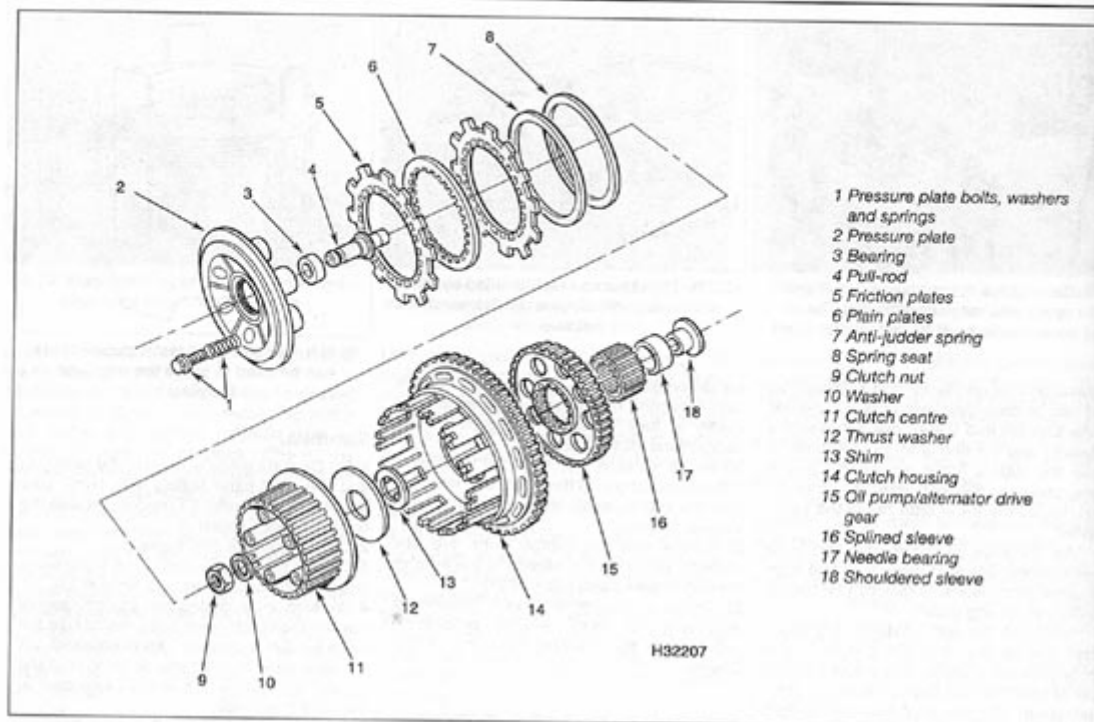
6 Remove the crankshaft position sensor (see Chapter 4). **Note:** If the clutch is being removed in preparation for separating the crankcase halves, remove the sensor complete with its mounting bracket as it bridges the halves. Otherwise, the sensor can be drawn out of its bracket, which avoids having to reset the air gap on installation (though it should be checked as a matter of course).

7 Working in a criss-cross pattern, gradually slacken the clutch spring retaining bolts until

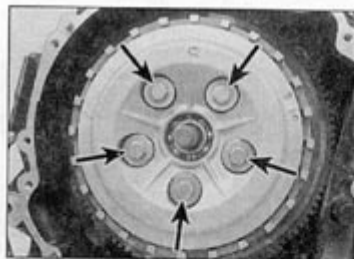


16.4 Clutch cover bolts (arrowed) – note the cable bracket (A) secured by two of the bolts

## 2•30 Engine, clutch and transmission



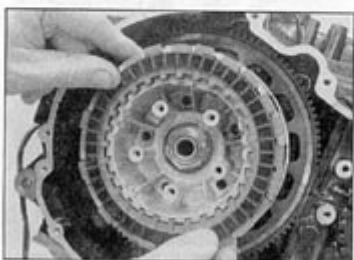
16.7a Clutch components



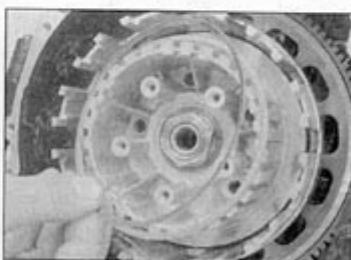
16.7b Unscrew the pressure plate bolts (arrowed) ...



16.7c ... and draw the pressure plate off using the pull-rod



16.8a Remove the clutch plates ...

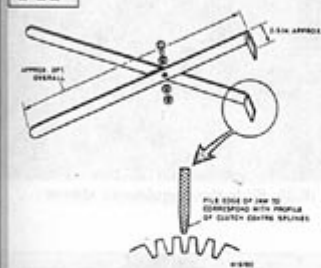


16.8b ... and the anti-judder spring and its seat

spring pressure is released (see illustrations). Remove the bolts, washers and springs, then lift out the clutch pressure plate complete with pull-rod end piece (see illustration).

8 Grasp the complete set of clutch plates and remove them as a pack – you may have to hook the inner plates out using a piece of wire, otherwise remove them after the clutch centre has been removed (see illustration). Similarly remove the anti-judder spring and spring seat, noting how they fit (see illustration). Unless the plates are being renewed, keep them in their original order. Note that the outer and inner friction plates are different in colour to the rest, and that the tabs on the outer plate locate in the shallow slots in the housing, not in the deep slots with the rest of the plates.

9 The transmission input shaft must be locked to enable the clutch nut to be slackened. This can be done in several ways. If the engine is in the frame, engage 1st gear and have an assistant hold the rear brake on hard with the rear tyre in firm contact with the ground. Triumph market a service tool (Pt. No. 3880305) that can be located between the clutch centre and clutch housing to lock them together, although you still need to engage 1st gear and have an assistant hold the rear brake on. If the engine is out of the frame, a

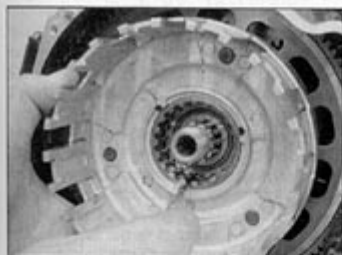
**TOOL TIP**

A clutch centre holding tool can easily be made using two strips of steel with the ends bent over, and bolted together in the middle.

commercially available or home-made tool (see Tool tip) can be used to stop the clutch centre from turning whilst the nut is slackened. Unscrew the nut and remove the washer from the input shaft (see illustrations). Discard the washer as a new one must be used on installation.

10 Slide the clutch centre off the input shaft, followed by the large thrust washer and the shim (see illustrations 16.26a, 25b and 25a).

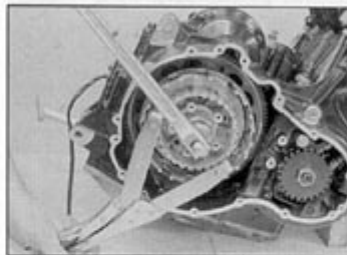
11 Slide the clutch housing off the shaft, using a small screwdriver to prevent the



16.11a Draw the housing off the shaft as described ...



16.13 Measuring clutch friction plate thickness



16.9a Using a commercially available holding tool to hold the clutch

splined sleeve coming with it, and manoeuvre it out of the crankcase (see illustrations).

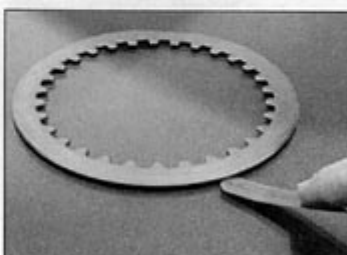
12 Remove the oil pump/alternator drive gear, then slide the splined sleeve, the needle bearing and the shouldered sleeve off the shaft (see illustrations 16.23b, 22b, 22a and 21).

### Inspection

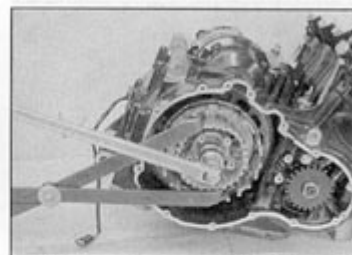
13 After an extended period of service the clutch friction plates will wear and promote clutch slip. Measure the thickness of each friction plate using a vernier caliper (see illustration). If any plate has worn to or beyond the service limit given in the Specifications, the friction plates must be renewed as a set. If the plates are good, but the clutch has been slipping, it could be that the springs have sagged. Unfortunately Triumph provide no Specification for the



16.11b ... and manoeuvre it out of the crankcase



16.14 Check the plain plates for warpage



16.9b Using the home-made holding tool to hold the clutch

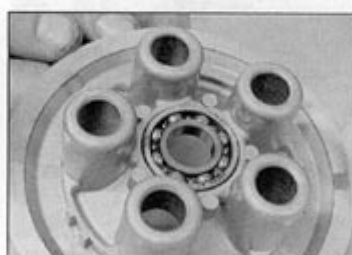
spring free length, though it is worth taking yours to a Triumph dealer and asking them to compare them to new ones off the shelf. Replace the springs with new ones if necessary, or if in doubt.

14 The plain plates should not show any signs of excess heating (bluing). Check for warpage using a flat surface and feeler blades (see illustration). If any plate exceeds the maximum permissible amount of warpage, or shows signs of bluing, all plain plates must be renewed as a set.

15 Inspect the clutch assembly for burrs and indentations on the edges of the protruding tangs of the friction plates and/or slots in the edge of the outer drum with which they engage. Similarly check for wear between the inner tongues of the plain plates and the slots in the clutch centre. Wear of this nature will cause clutch drag and slow disengagement during gear changes, as the plates will snag when the pressure plate is lifted. With care a small amount of wear can be corrected by dressing with a fine file, but if this is excessive the worn components should be renewed.

16 Inspect the input shaft end, the shouldered sleeve and the splined sleeve bearing surfaces for signs of wear and damage. Similarly, check the condition of the needle roller bearing.

17 Check the pressure plate for signs of damage and its bearing for wear (see illustration). Ensure that the inner race of the bearing spins freely without any sign of notchiness. Push the bearing out of the pressure plate if renewal is required.



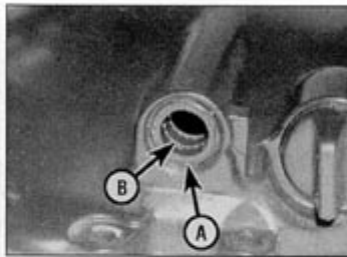
16.17 Check the pressure plate and its bearing as described



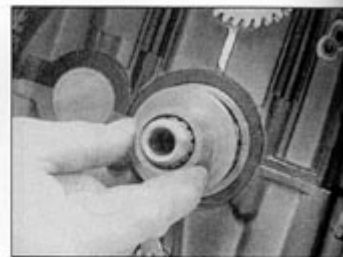
## 2•32 Engine, clutch and transmission



16.18a Check the release mechanism in the cover as described



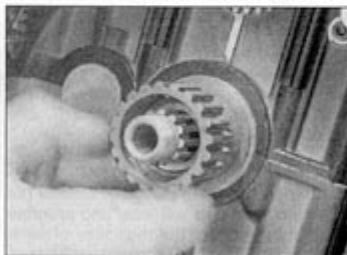
16.18b Check the oil seal (A) and bearing (B)



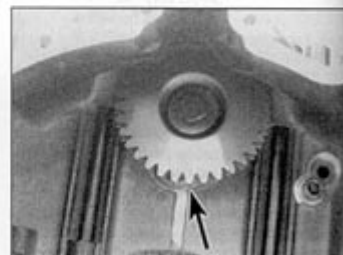
16.21 Slide the shouldered sleeve ...



16.22a ... the needle bearing ...



16.22b ... and the splined sleeve onto the shaft



16.23a Align the gear teeth at the bottom (arrow) ...

18 Check the clutch release mechanism in the clutch cover for smooth operation. If necessary, withdraw the shaft from the cover, noting the washer and how the return spring ends locate (see illustration). Check the condition of the oil seal and bearing, replacing them with new ones if necessary (see illustration). Check the pull-rod end and its locating cutout in the shaft for signs of wear and damage, and replace them with new ones if necessary. Clean all components and lubricate the seal and bearing with grease. Installation is the reverse of removal.

19 The clutch cover incorporates a noise damper. If necessary, remove the screws securing the noise damper plates, then lift out the damping pad.

### Installation

20 Remove all traces of gasket material from the crankcase and clutch cover surfaces.

21 Lubricate the shouldered sleeve with engine oil and slide it on the input shaft so that its shouldered end faces the crankcase (see illustration).

22 Lubricate the needle roller bearing with engine oil and slide it over the shouldered sleeve (see illustration). Now slide the splined sleeve over the bearing (see illustration).

23 The alternator driven gear has a backlash eliminator gear on its inside, which works by having one less tooth than the driven gear, and by using friction between the two gears to

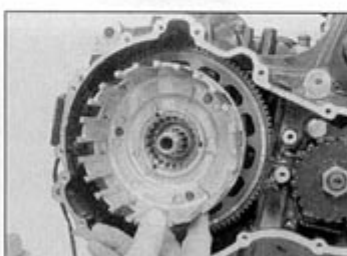
create a rolling cushion. In order for the large drive gear to mesh, the teeth on the driven gear and eliminator gear must be aligned at the bottom – this can be done using a screwdriver inserted between the teeth and used as a lever against the friction (see illustration). Slide the oil pump/alternator drive gear, with its dished side facing the crankcase, onto the splined sleeve, meshing it with the oil pump driven gear and alternator driven gear (see illustration).

24 Slide the clutch housing onto the splined sleeve and engage the primary driven gear on the back of the housing with the primary drive gear on the crankshaft (see illustration).

25 Slide the shim and large thrustwasher over the input shaft (see illustrations).



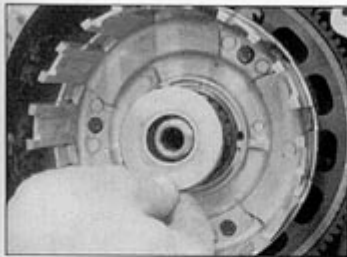
16.23b ... then slide the drive gear onto the shaft, making sure it engages correctly with both driven gears



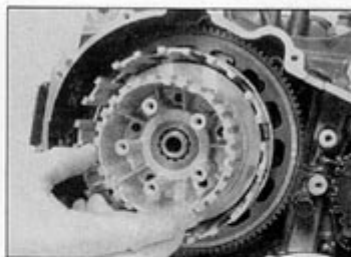
16.24 Slide the clutch housing onto the shaft ...



16.25a ... then fit the shim ...



16.25b ... and the thrust washer



16.26a Slide the clutch centre onto the shaft ...

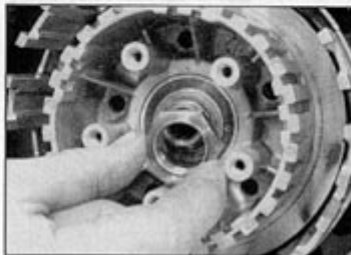


16.26b ... then fit the washer with the OUT mark facing out

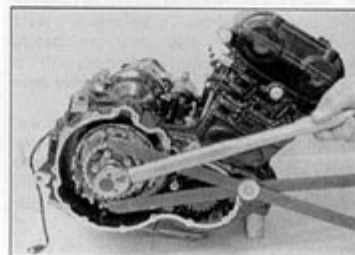
26 Slide the clutch centre onto the input shaft splines, then install the new washer, with its OUT marking facing outwards, followed by the clutch nut (see illustrations). Using the method employed on removal to lock the input shaft, tighten the nut to the specified torque setting (see illustration). **Note:** Check that the clutch centre rotates freely after tightening, but without any freeplay in it. If the centre is tight, fit a thicker shim between the thrust washer and the clutch housing. If there is freeplay, fit a thinner shim. Shims are available in 0.05 mm increments from 0.10 mm to 0.35 mm. Remove the clutch centre, thrust washer and shim, then measure the shim using a micrometer to determine its thickness, and fit a replacement accordingly.

27 Fit the anti-judder spring seat into the clutch centre, followed by the anti-judder spring (see illustration 16.8b), fitting the spring so that its outer edge is raised off the spring seat (see illustration).

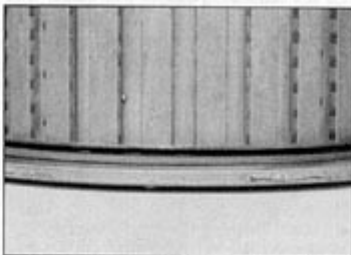
28 Coat each clutch plate with engine oil prior to installation. Build up the clutch plates, starting with the inner friction plate that is darker in colour, then a plain plate and alternating normal friction and plain plates until all but the last friction plate are installed (see illustrations). Fit the outer friction plate (also darker in colour), locating its tabs in the shallow slots, rather in the deep slots with the other friction plates (see illustration).



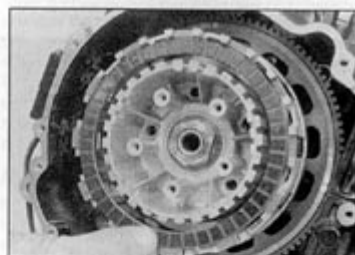
16.26c Thread the clutch nut onto the shaft ...



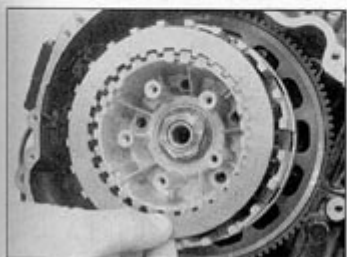
16.26d ... and tighten it to the specified torque



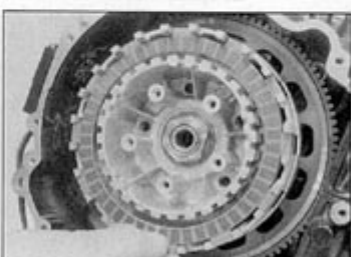
16.27 Fit the anti-judder spring so the outer edge is raised off the seat



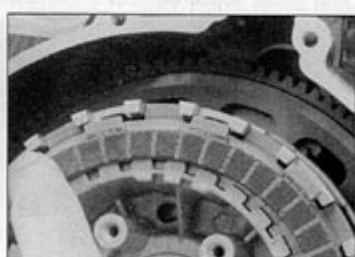
16.28a Fit the dark inner friction plate ...



16.28b ... then a plain plate ...

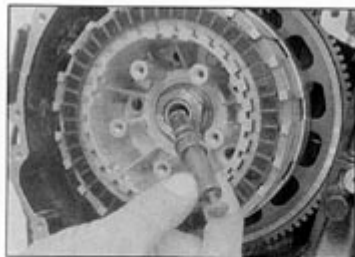


16.28c ... then a normal friction plate, and so on

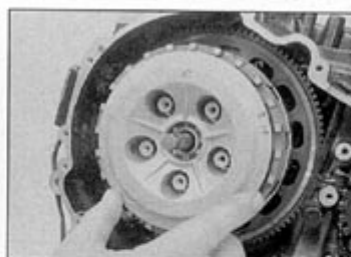


16.28d Fit the dark outer friction plate tabs into the shallow slots in the housing

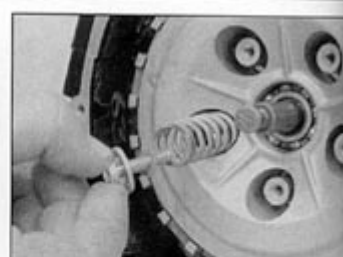
## 2•34 Engine, clutch and transmission



16.29a Insert the pull-rod into the shaft . . .



16.29b . . . then fit the pressure plate



16.30 Fit the springs, washers and bolts, and tighten the bolts as described to the specified torque

29 Insert the pull-rod into the end of the input shaft (see illustration). Fit the pressure plate over the pull-rod and onto the clutch, engaging the notches on its inner rim with the slots in the inside of the clutch centre (see illustration).

30 Install the springs, washers and bolts and tighten the bolts evenly in a criss-cross sequence to the specified torque setting (see illustration).

31 Install the crankshaft position sensor (see Chapter 4).

32 Insert the dowels in the crankcase. Place a new gasket on the crankcase, locating it over the dowels (see illustration). Install the cover, angling the release lever to the rear of the cover as shown (see illustrations). Tighten the cover bolts evenly in a criss-cross sequence to the specified torque setting, not

forgetting to secure the cable bracket (see illustration 16.4). Push the release lever forwards and make sure it picks up the end of the pull-rod correctly – it should come up solid when it is pointing across the engine.

33 Attach the clutch cable to the release lever on the clutch cover (see Section 17).

34 Refill the engine with oil (see *Daily (pre-ride) checks*).

35 Where applicable, install the fairing side panels and belly-pan (see Chapter 7).

### 17 Clutch cable – removal and installation

1 On Daytona models, remove the belly-pan and the right-hand fairing side panel (see

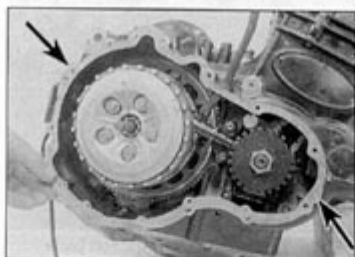
Chapter 7). On Sprint ST models, remove the belly-pan (see Chapter 7). On Tiger models, remove the clutch lever (see Chapter 5) – this must be done to remove the handguard, which is secured by the same bolt.

2 Slacken the rear locknut securing the cable in the bracket on the engine and thread it off the cable (see illustration).

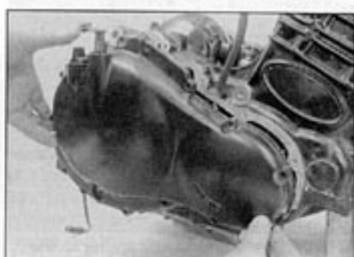
3 Slip the cable end out of the retainer, noting how it fits, then draw the cable out of the bracket, collecting the rear locknut as you do (see illustrations).

4 Fully slacken the adjuster locking and screw the adjuster at the handlebar end of the cable fully in to the lever bracket, then turn the adjuster and locking as required to align the slots with that in the lever bracket (see illustration).

5 Pull the outer cable end from the socket in



16.32a Locate the gasket over the dowels (arrowed) . . .



16.32b . . . then install the cover



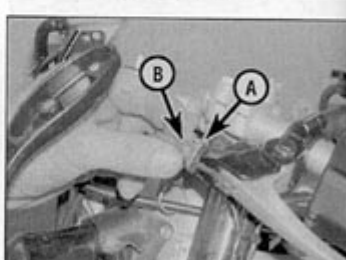
17.2 Slacken the locknut (arrowed) and thread it off the cable



17.3a Release the cable end from the retainer . . .



17.3b . . . and draw the cable out of the bracket, feeding the locknut off the end



17.4 Slacken the locking (A) and set the adjuster (B) and locking as described

the adjuster and release the inner cable from the lever (except Tiger models) (see illustrations). Remove the cable from the machine, noting its routing and any guides or clips.



**Before removing the cable from the bike, tape the lower end of the new cable to the upper end of the old cable. Slowly pull the lower end of the old cable out, guiding the new cable down into position. Using this method will ensure the cable is routed correctly.**

6 Installation is the reverse of removal. Apply grease to the cable ends. Make sure the cable is correctly routed. Make sure the cable lower end is properly located in the retainer on the release mechanism arm. Check the clutch release mechanism for smooth operation and any signs of wear or damage. Remove it for cleaning and re-greasing if required (see Section 16).

7 Adjust the clutch lever freeplay (see Chapter 1). Where applicable, install the fairing side panels and belly-pan (see Chapter 7).

#### 18 Sump and oil strainer – removal and installation

**Note:** The sump can be removed with the engine in the frame. If work is being carried out with the engine removed ignore the steps which don't apply.

##### Removal

- 1 On Daytona and Sprint ST models, remove the belly-pan and the fairing side panels (see Chapter 7).
- 2 Drain the engine oil and remove the oil filter (see Chapter 1).
- 3 Remove the exhaust system (Chapter 4).
- 4 Unscrew the oil cooler hose banjo bolts and detach the hoses from the sump, noting which fits where (see illustration 20.3). Discard the sealing washers as new ones must be used.
- 5 Unscrew the sump bolts, slackening them evenly in a criss-cross sequence to prevent distortion (see illustration). Remove the



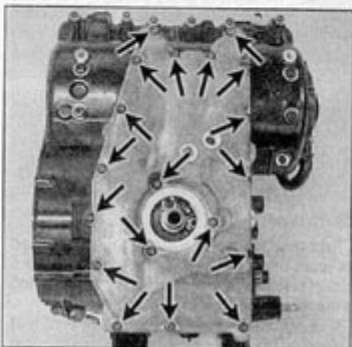
18.7a Pull the nozzle out of its socket, noting the O-rings



17.5a Draw the outer cable end from the adjuster and slip the inner cable out via the slots ...



17.5b ... then detach the inner cable end from the lever



18.5 Sump bolts (arrowed)

sump and discard its gasket – a new one must be used. **Note:** The internal oil pipe nozzle and gearbox oil feed nozzle locate in the sump – they have O-rings and are a push fit. It is possible for them to stick in the sump – carefully ease them free with a long flat-bladed screwdriver rather than risk distorting them by pulling the sump off forcibly.

6 Draw the oil strainer out of its socket, then remove the rubber seal (see illustration). Check the condition of the seal and discard it if it is damaged, distorted or deteriorated in any way. Clean the strainer in solvent and remove any debris caught in the gauze. Note that lots of metal caught in the strainer, or in the bottom of the sump, is indicative of engine wear that should be investigated.



18.7b Unscrew the banjo bolts (arrowed) and remove the pipe ...

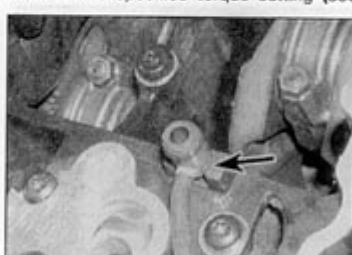


18.6 Pull the strainer out of its socket

7 If required, remove the gearbox oil feed nozzle if required – it is a push fit in the crankcase (see illustration). Also if required, unscrew the banjo bolts securing the internal oil pipe and remove the pipe, noting how the nozzle end locates in its seat (see illustrations). Discard the banjo bolt sealing washers as new ones must be used. Check the condition of the nozzle O-rings and discard them if they are damaged, distorted or deteriorated in any way.

##### Installation

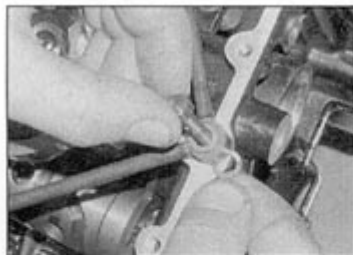
- 8 Remove all traces of gasket material from the sump and crankcase mating surfaces.
- 9 If removed, fit the gearbox oil feed nozzle into the crankcase, using new O-rings if necessary (see illustration 18.7a). Install the internal oil pipe using new sealing washers on each side of the unions, and tighten the banjo bolts to the specified torque setting (see



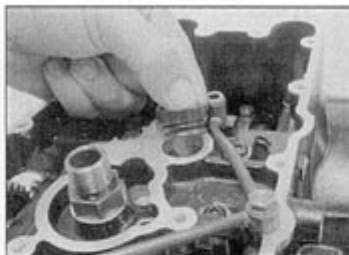
18.7c ... noting how the nozzle locates (arrow)



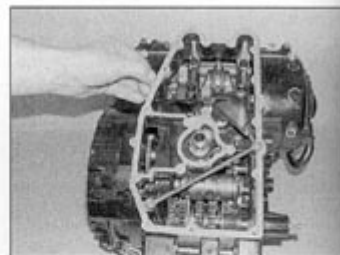
## 2•36 Engine, clutch and transmission



18.9 Use a new sealing washer on each side of the union



18.10 Fit the strainer seal into the crankcase



18.11a Fit a new gasket...

illustration). Make sure the nozzle end locates in its seat, and fit a new O-ring to it if necessary (see illustration 18.7c).

10 Fit the rubber seal for the strainer into its socket in the crankcase, using a new one if necessary (see illustration). Fit the strainer into the seal (see illustration 18.6).

11 Place a new gasket on the crankcase and install the sump (see illustrations); if the engine is in the frame, use a smear of grease on the gasket to hold it in place as the sump is installed. Install the bolts and tighten them evenly in a criss-cross sequence to the specified torque setting.

12 Attach the oil cooler hoses using new sealing washers on each side of the unions, and tighten the banjo bolts to the specified torque setting (see illustration 20.7a).

13 Install the exhaust system (see Chapter 4).

14 Install a new oil filter, then fill the engine with the correct type and quantity of oil (see

Chapter 1 and Daily (pre-ride) checks). Start the engine and check that there are no leaks.

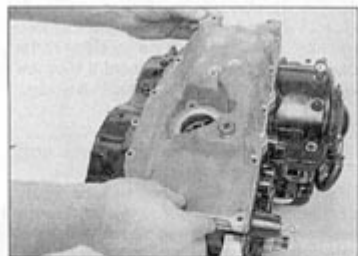
15 On Daytona and Sprint ST models, refit the belly-pan and the fairing side panels (see Chapter 7).

### 19 Oil pressure relief valve – removal, inspection and installation

#### Removal

1 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21). Remove the selector forks, referring to the relevant Steps in Section 29.

2 Use a socket on the relief valve hex and unscrew it from the crankcase – depending on your tools it may be necessary to remove the oil pump (see Section 30) to access the hex on the relief valve (see illustration).



18.11b ... then install the sump



19.2 Unscrew the valve using a socket on the hex (arrowed)

#### Inspection

3 Push the relief valve plunger into the valve body and check that it moves smoothly and freely against the spring pressure (see illustration). If not, remove the circlip, noting that it is under spring pressure, and remove the spring seat, spring and plunger (see illustration). Clean all the components in solvent and check them for scoring, wear or damage. If any is found, renew the relief valve – individual components are not available. Otherwise, coat the inside of the valve body and the plunger with clean engine oil, then insert the plunger, spring and spring seat and secure them with the circlip. Check the action of the valve plunger again – if it is still suspect, replace the valve with a new one.

#### Installation

4 Apply a drop of non-permanent thread locking compound to the pressure relief valve threads and tighten the valve to the specified torque setting (see illustration).

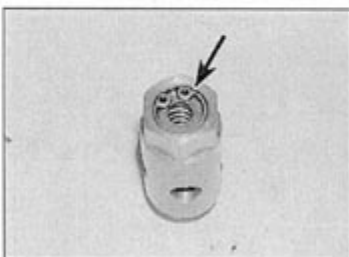
5 Install the remaining components and assemblies in a reverse of the removal procedure, referring to the relevant Sections.

### 20 Oil cooler – removal and installation

**Note:** The oil cooler can be removed with the engine in the frame. If work is being carried out with the engine removed ignore the preliminary steps.



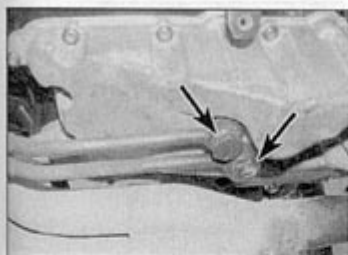
19.3a Push the plunger into the valve and check its action



19.3b Remove the circlip (arrowed), noting it is under spring pressure



19.4 Install the valve and tighten it to the specified torque



20.3 Unscrew the banjo bolts (arrowed) and detach the hoses, noting the washers

### Removal

1 On Daytona and Sprint ST models, remove the belly-pan and the fairing side panels (see Chapter 7).

2 Drain the engine oil (see Chapter 1). Keep the container below the sump to catch any residual oil in the cooler and hoses.

3 To detach the hoses from the sump, unscrew the banjo bolts and detach the hoses, noting which fits where (see illustration). Discard the sealing washers as new ones must be used.

4 To detach the hoses from the cooler, counter-hold the large hex on the base of each union, then unscrew the banjo bolts and detach the hoses (see illustration). Discard the sealing washers as new ones must be used.

5 To remove the cooler, first detach the hoses from either the sump or the cooler itself. Unscrew the nuts and/or bolts (according to model) securing the oil cooler, noting the arrangement of the collars and grommets (see illustrations).

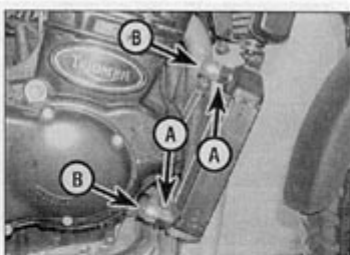
**Caution:** Always counter-hold the hex on the oil cooler when slackening or tightening the banjo bolts or the cooler could be damaged.

6 Check the cooler for leaks and other damage. Check the cooler fins for mud, dirt and insects, which will impede the flow of air through it. If the fins are dirty, clean them using water or low pressure compressed air directed through from the rear face. If the fins are bent or distorted, straighten them carefully with a screwdriver. If the air flow is restricted by bent or damaged fins over more than 30% of the cooler's surface area, or if the cooler is leaking, replace it with a new one.

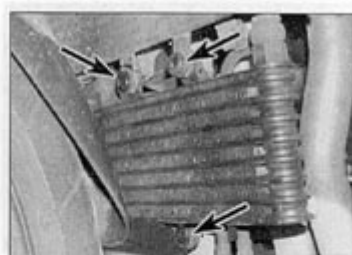
### Installation

7 Installation is a reverse of the removal procedure, noting the following:

- Use new sealing washers on each side of the banjo unions (see illustration).
- Tighten the banjo bolts to the specified torque settings.
- Refill the engine with oil (see Chapter 1 and 'Daily (pre-ride) checks') and check that there are no leaks from the oil cooler hose connections when the engine is run.



20.4 Counter-hold the base hex (A), then unscrew the banjo bolt (B) - Tiger shown



20.5a Cooler mounting bolts (arrowed) - Daytona models



20.5b Cooler mounting bolts (arrowed) - Tiger models



20.7 Use a new sealing washer on each side of the union

## 21 Crankcase - separation and reassembly

### Separation

1 To access the crankshaft and connecting rods, bearings, balancer shaft, alternator/starter clutch drive, starter clutch, oil pump and pressure relief valve, transmission shafts, gearchange mechanism and selector drum and forks, the crankcase must be split into two parts.

2 To enable the crankcases to be separated, remove the engine from the frame (see Section 5) and remove the following components with reference to the relevant Sections.

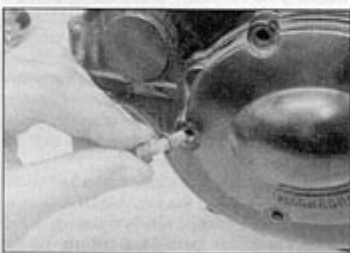
- Camshafts and followers

- Cam chain and tensioner blade
- Cylinder head and cam chain guide blade\*
- Cylinder liners and pistons\*
- Clutch
- Sump

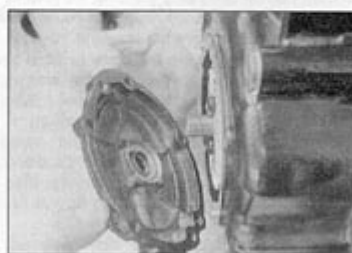
g) Alternator and starter motor (Chapter 8)  
\*If the crankcase halves are being separated just to examine the transmission components, crankshaft, balancer shaft, oil pump or alternator/starter clutch drive, then there is no need to remove the cylinder head, liners and pistons. If a complete engine overhaul is planned, also remove the water pump (see Chapter 3), and the neutral and oil pressure switches (see Chapter 8).

3 Unscrew the bolts securing the crankcase breather cover on the left-hand side of the crankcase and remove the cover, noting the washer with the front bolt (see illustrations). Discard the gasket as a new one must be

2

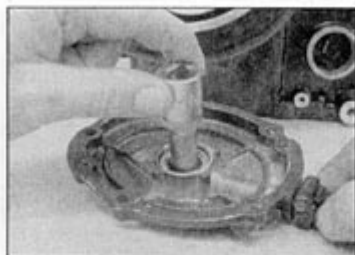


21.3a Unscrew the bolts, noting the washer with the front one...

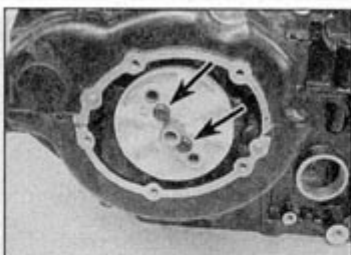


21.3b ... and remove the cover

## 2•38 Engine, clutch and transmission



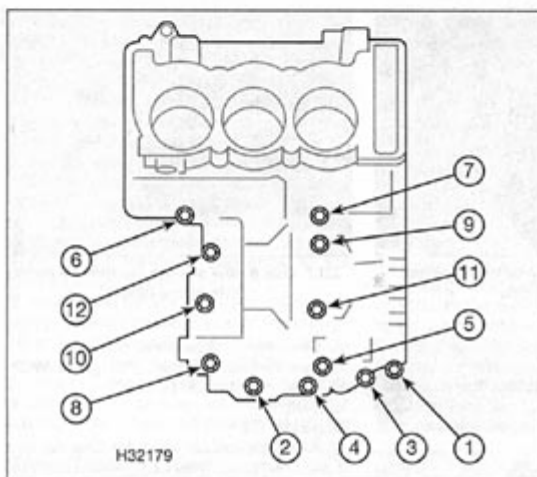
21.3c A suitable socket can be used as a mandrel for the seal



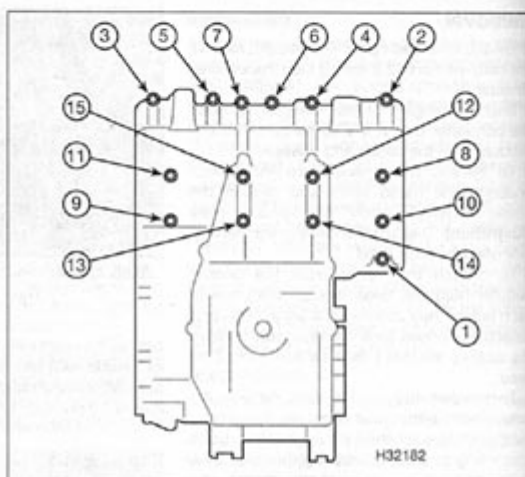
21.3d Undo the screws (arrowed) and remove the breather disc if required



21.4 Remove the damper plate and pad



21.5 Upper crankcase bolt slackening sequence



21.6 Lower crankcase bolt slackening sequence

used. Note the two locating pins and remove them for safekeeping if loose. There is an oil seal in the cover, which, if it is in perfect condition and is being reused, must have a mandrel inserted in it immediately after the cover is removed (see illustration). If not, the rim of the seal will distort and not reseal around the shaft on installation. This could result in high oil consumption. A suitable socket can be used as a mandrel. Otherwise, a new seal must be installed in the cover (see Step 28). Only remove the mandrel from the seal immediately before the cover is fitted to the engine. If required, undo the screws securing the breather disc and remove it from the end of the crankshaft (see illustration).

4 Unscrew the bolts securing the noise damper plate to the top of the crankcase and remove the plate, noting the washers, then remove the damper pad, noting how it fits (see illustration).

5 With the crankcase the right way up, slacken and remove all bolts from the upper crankcase half following the numbered

sequence (see illustration). **Note:** As each bolt is removed, store it in its relative position in a cardboard template of the crankcase halves. This will ensure that all bolts are installed in the correct location on reassembly. Also, take note of any mounting brackets on the bolts and store them with the bolts to ensure correct reassembly.

6 Turn the crankcase upside down. Again, following the numbered sequence, slacken and remove all bolts from the lower crankcase half (see illustration). **Note:** As each bolt is removed, store it in its relative position in a cardboard template of the crankcase halves. This will ensure that all bolts are installed in the correct location on reassembly. Also, take note of any mounting brackets on the bolts and store them with the bolts to ensure correct reassembly.

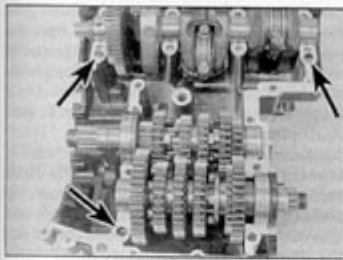
7 Carefully lift the lower crankcase half off the upper half, leaving the crankshaft, balancer shaft and transmission shafts in the upper half of the crankcase (see illustration). As the lower half is lifted away take care not to dislodge or lose any main bearing shells.

**Note:** If the halves don't separate easily, make sure all fasteners have been removed. Don't lever between the crankcase mating surfaces or they will leak; initial separation can be achieved by tapping gently around the joint with a soft-faced mallet.

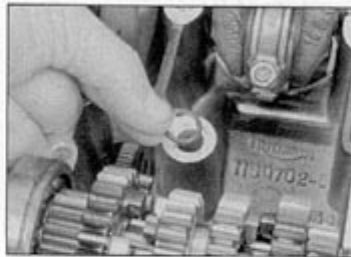
8 Remove the three locating dowels if they are loose – they could be in either crankcase



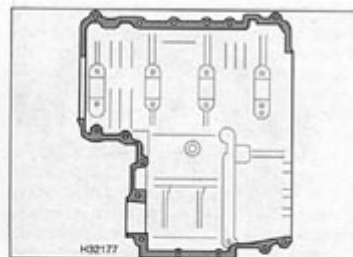
21.7 Carefully lift the lower half off the upper half, noting how the selector forks locate in the transmission shafts



21.12 Make sure the dowels (arrowed) are installed



21.13 Fit the O-ring into the oil passage



21.14 Apply the sealant to the shaded areas shown

half (see illustration 21.12). Remove the O-ring from the oil passage joint (see illustration 21.13). Check its condition and replace it with a new one if it is in any way damaged, deformed or deteriorated.

#### Reassembly

9 Remove all traces of sealant from the crankcase mating surfaces.

10 Ensure that all components are in place in the upper and lower crankcase halves. If the transmission shafts have not been removed, check the condition of the oil seal on the left-hand end of the output shaft and replace it with a new one if it is damaged, deformed or deteriorated (see Section 27) – it is always good practice to renew this seal whenever the crankcases have been separated. Also note the instructions in Section 27 concerning applying thread lock to the transmission shaft bearing outer races. Check the position of the selector drum and forks and transmission shafts – make sure they're in the neutral position (i.e. the transmission shafts rotate independently of each other – see Section 29).

11 Lubricate the transmission shafts and

crankshaft journals with clean engine oil, then use a rag soaked in high flash-point solvent to wipe over the mating surfaces of both halves to remove all traces of oil.

12 If removed, fit the three locating dowels into one crankcase half (see illustration).

13 Fit the O-ring onto the oil passage joint, using a new one if necessary (see illustration).

14 Apply a small amount of suitable sealant to the indicated areas of the mating surface of one crankcase half (see illustration).

**Caution:** Take care not to apply an excessive amount of sealant, as it will ooze out when the case halves are assembled and may obstruct oil passages and prevent the bearings from seating.

15 Make sure that the main bearing shells are in position, then carefully guide the lower crankcase half onto the upper half (see illustration 21.7). Make sure the selector forks engage with their respective slots in the transmission gears as the halves are joined.

16 Check that the lower crankcase half is correctly seated and that all shafts are free to rotate. **Note:** If the casings are not correctly seated, remove the lower crankcase half and

investigate the problem. Do not attempt to pull them together using the crankcase bolts as the casing will crack and be ruined.

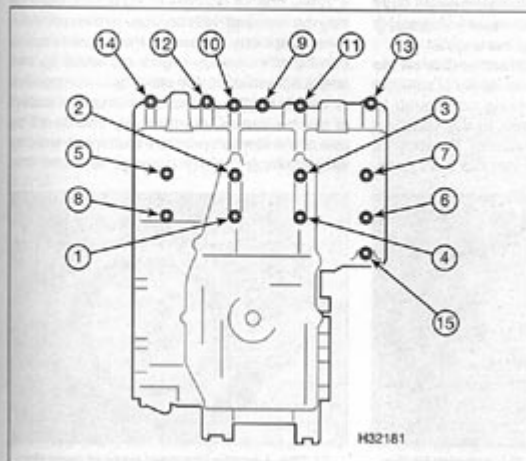
17 Clean the threads of the lower crankcase bolts and insert them in their original locations, including any brackets. Secure all bolts finger-tight at this stage.

18 Turn the crankcase over so that it is upright. Clean the threads of the upper crankcase bolts and install them in their original locations. Secure all bolts finger-tight at this stage.

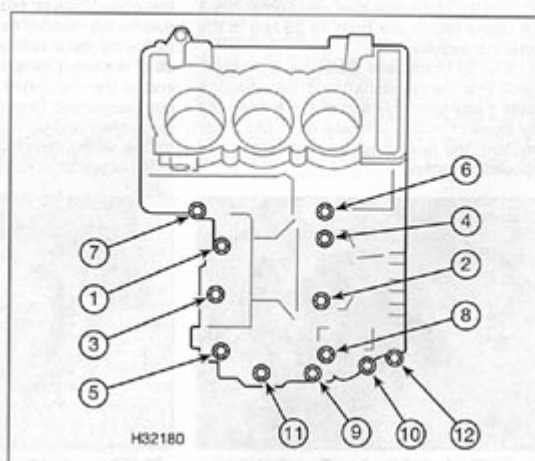
**Caution:** Note that two sizes of bolt are used, 6 mm and 8 mm. Care must be taken to distinguish between them during the tightening sequence, as the larger 8 mm bolts are set much tighter, and if a 6 mm bolt is mistaken for an 8 mm bolt, it may shear.

19 Turn the crankcase over and tighten all lower crankcase bolts to 10 Nm, tightening them in the correct numbered sequence (see illustration).

20 Turn the crankcase over and tighten all upper crankcase bolts to 10 Nm, tightening them in the correct numbered sequence (see illustration).



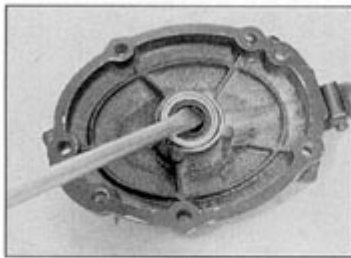
21.19 Lower crankcase bolt tightening sequence



21.20 Upper crankcase bolt tightening sequence



## 2•40 Engine, clutch and transmission



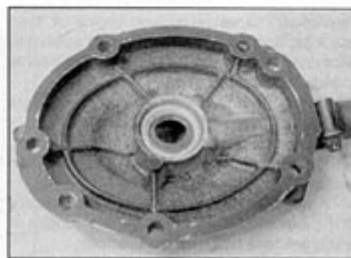
21.28a Lever out the old seal ...



21.28b ... then fit the new one, leaving the mandrel in place ...



21.28c ... and press or drive it squarely into place ...



21.28d ... setting it below the rim of its housing as shown

21 Turn the crankcase over and tighten all lower crankcase bolts to 12 Nm, tightening them in the correct numbered sequence (see illustration 21.19).

22 Turn the crankcase over and tighten all upper crankcase bolts to 12 Nm, tightening them in the correct numbered sequence (see illustration 21.20).

23 Turn the crankcase over and tighten the 8 mm lower crankcase bolts to 28 Nm in the numerical sequence. The 8 mm bolts are the ones with the larger heads.

24 Turn the crankcase over and tighten the 8 mm upper crankcase bolts to 28 Nm in the numerical sequence.

25 With all crankcase fasteners tightened, check that the crankshaft and transmission shafts rotate smoothly and easily. If there are any signs of undue stiffness or of any other problem, the fault must be rectified before proceeding further.

26 Install the noise damper pad and plate and tighten the bolts securely (see illustration 21.4).

27 Install all other removed assemblies in the reverse of the sequence in Step 2.

28 If a new seal is being installed in the crankcase breather cover, prise the old seal out with a flat-bladed screwdriver (see illustration). The new seal is supplied complete with a shaped mandrel; leaving the mandrel in place, press the seal squarely into the cover so that it lies just below the face of the cover recess (see illustrations). Only remove the mandrel from the seal immediately before the cover is fitted to the engine.

29 If removed, install the breather disc on the end of the crankshaft, then apply a suitable non-permanent thread locking compound to the screws and tighten them to the specified torque setting (see illustrations). If removed, fit the cover locating pins into the crankcase,

then locate the new gasket onto them (see illustration). Remove the mandrel from the seal in the cover, then install the cover, making sure it is correctly and squarely aligned so as not to distort the seal rim as it fits onto the shaft, and tighten the bolts (see illustrations 21.3b and a).

**Caution:** It is important that the seal is allowed 15 minutes to form on the shaft before the engine is turned from its present position – the breather will not operate correctly if this precaution is not observed. If care is not taken with installation, engine oil may leak past the seal and into the crankcase breather system.

## 22 Crankcase – inspection

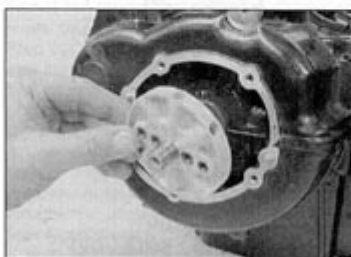
1 After the crankcases have been separated and the crankshaft, balancer shaft, alternator/starter clutch drive, oil pump, gearchange mechanism, selector drum and forks and transmission components have been removed, clean the crankcases thoroughly with new solvent and dry them with compressed air.

2 Remove the oil gallery plugs and blow through all oil passages with compressed air. Where fitted, replace the plug sealing washers with new ones.

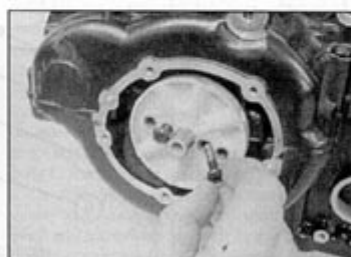
3 Remove all traces of old gasket sealant from the mating surfaces. Minor damage to the surfaces can be cleaned up with a fine sharpening stone or grindstone.

**Caution:** Be very careful not to nick or gouge the crankcase mating surfaces or leaks will result. Check both crankcase halves very carefully for cracks and other damage.

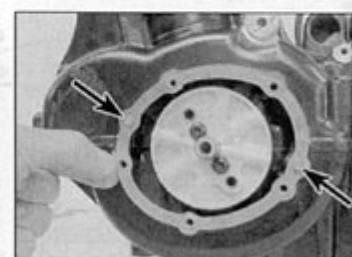
4 Small cracks or holes in aluminium castings may be repaired with an epoxy resin adhesive as a temporary measure. Permanent repairs can be effected by argon-arc welding, and only a specialist in this process is in a position to advise on the economy or practical aspect of such a repair. Alternatively you could try one of the low temperature aluminium welding kits available. If any damage is found that



21.29a Install the breather disc ...



21.29b ... and tighten the screws to the specified torque



21.29c Locate the new gasket over the pins (arrowed)

can't be repaired, renew the crankcase halves as a set.

5 Damaged threads can be economically reclaimed by using a diamond section wire insert, of the Helicoil type, which is easily fitted after drilling and re-tapping the affected thread.

6 Sheared studs or screws can usually be removed with screw extractors, which consist of a tapered, left thread screws of very hard steel. These are inserted into a pre-drilled hole in the stud, and usually succeed in dislodging the most stubborn stud or screw. If a problem arises which seems beyond your scope, it is worth consulting a professional engineering firm before condemning an otherwise sound casing. Many of these firms advertise regularly in the motorcycle press.



Refer to 'Tools and Workshop Tips' in the Reference section for details of how to install a thread insert and use a screw extractor.

### 23 Main and connecting rod bearings – general information

1 Even though main and connecting rod bearings are generally renewed during the engine overhaul, the old bearings should be retained for close examination as they may reveal valuable information about the condition of the engine.

2 Bearing failure occurs mainly because of lack of lubrication, the presence of dirt or other foreign particles, overloading the engine and/or corrosion. Regardless of the cause of bearing failure, it must be corrected before the engine is reassembled to prevent it from happening again.

3 When examining the bearings, remove the main bearings from the crankcase halves and the rod bearings from the connecting rods and caps and lay them out on a clean surface in the same general position as their location on the crankshaft journals. This will make it possible for you to match any noted bearing problems with the corresponding crankshaft journal.

4 Dirt and other foreign particles get into the engine in a variety of ways. It may be left in the engine during assembly or it may pass through filters or breathers. It may get into the oil and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning operations, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up imbedded in the soft bearing material and are easily recognised. Large particles will not imbed in the bearing and will score or gouge

the bearing and journal. The best prevention for this cause of bearing failure is to clean all parts thoroughly and keep everything spotlessly clean during engine reassembly. Frequent and regular oil and filter changes are also recommended.

5 Lack of lubrication or lubrication breakdown has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage or throw off from excessive bearing clearances, worn oil pump or high engine speeds all contribute to lubrication breakdown. Blocked oil passages will also starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing and the journal turn blue from overheating.

6 Riding habits can have a definite effect on bearing life. Full throttle low speed operation, or labouring the engine, puts very high loads on bearings, which tend to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually the bearing material will loosen in places and tear away from the steel backing. Short trip riding leads to corrosion of bearings, as insufficient engine heat is produced to drive off the condensed water and corrosive gases produced. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

7 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight fitting bearings which leave insufficient bearing oil clearances result in oil starvation. Dirt or foreign particles trapped behind a bearing insert result in high spots on the bearing which lead to failure.

8 To avoid bearing problems, clean all parts thoroughly before reassembly, double check all bearing clearance measurements and lubricate the new bearings with clean engine oil during installation.

### 24 Connecting rods – removal, inspection and installation

**Note 1:** There are a number of different ways in which the connecting rods can be removed, and your best approach will depend on what other work, if any, you are doing on the engine.

● If the pistons have already been separated from the rods, then you can either remove the crankshaft with the rods still attached, and then separate them afterwards, or you can leave the crankshaft in situ, remove the rod caps and then remove the rods from the top of the crankcase (but bear in mind that if you need to tilt the crankcase at all to remove the rods from the top, then the crankshaft could fall out).

● If the pistons have not been separated from the rods, they cannot be removed along with the crankshaft as the pistons will not fit through. Remove the crankshaft, then remove the rod and piston assemblies from the top of the crankcase (do not leave the crankshaft in situ as the crankcase will have to be tilted to remove the rod and piston assemblies from the top). You will also have to make a decision regarding removal of the liners – they do not have to be removed unless you are separating the pistons from the rods before removing the rods. The pistons and rods can be removed together out of the top of the liners, and can be installed in the same way, but bear in mind the information given in Section 11, Step 13, and in Section 14, regarding the liners and their seals.

● If it makes no difference, we advise removing the crankshaft first, then drawing the rod and piston assemblies out of the top of the liners, then removing the liners. The rods can then be separated from the pistons.

**Note 2:** The connecting rod bolts must be discarded and new ones used on installation – it is best to obtain the bolts in advance. The old bolts can however be used for the oil clearance check.

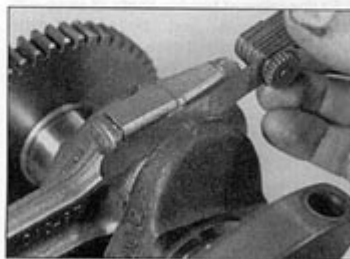
#### Removal

1 Remove the engine from the frame (see Section 5) and separate the crankcase halves (see Section 21). If required (see **Note** above), remove the liners (see Section 14), then remove the pistons (see Section 15), and the crankshaft (see Section 25).

2 Before separating the rods from the crankshaft, measure the side clearance on each rod with a feeler gauge (see **illustration**). If the clearance on any rod is greater than the service limit listed in this Chapter's Specifications, replace that rod with a new one.

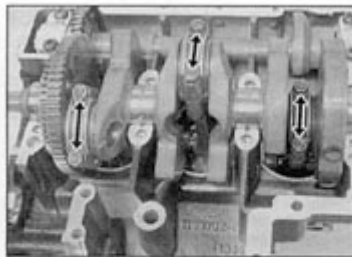
3 Using paint or a felt marker pen, mark the relevant cylinder identity across the join between each connecting rod and cap. Note the oil hole in the rear of each connecting rod which must face to the rear of the engine, and the arrow on the piston which points to the front of the engine – these ensure that the cap and rod are fitted the correct way around on reassembly (see **illustration 15.3**). Note that

2



24.2 Measure the connecting rod side clearance using a feeler gauge

## 2•42 Engine, clutch and transmission



**24.4** Unscrew the nuts (arrowed) and pull the caps off the connecting rods

the number and letter already across the rod and cap indicate rod size and weight grade respectively, not cylinder number. If there is no arrow on the piston (apparently a number of engines were assembled without markings), mark or scribe your own as the piston must be installed the correct way round.

**4** Unscrew the connecting rod cap nuts and separate the cap and rod from the crankpin (see illustration). If the cap appears stuck, tap it on one end with a hammer while pulling it. If it is in situ, lift the crankshaft out of the upper crankcase half, taking care not to dislodge the main bearing shells (see illustration 25.3).

**5** If required (according to your chosen method), turn the crankcase on its side. Push each piston/connecting rod assembly up and remove it from the top of the liner, making sure the connecting rod does not mark the liner bore (see illustration 14.22a).



**HINT** If required, to ease removal of the pistons from the tops of the liners, carefully remove any ridge of carbon built up on the top of each liner bore using a scraper. If there is a pronounced wear ridge, remove it using a ridge reamer.

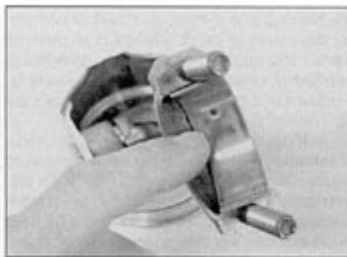
**Caution:** Do not try to remove the piston/connecting rod from the bottom of the crankcase. The piston will not pass the crankcase main bearing webs.

**6** Fit the relevant bearing shells (if removed), cap, and nuts and bolts on each piston/connecting rod assembly so that they are all kept together as a matched set.

**7** If required and not already done, separate the pistons from the connecting rods (see Section 15).

### Inspection

**8** Check the connecting rods for cracks and other obvious damage. Refer to Section 15, Step 14 and check the piston pin and connecting rod small-end bore dimensions for wear. Renew any components that are worn beyond the specified limit.



**24.12** To remove a big-end bearing shell, push it sideways and lift it out

**9** Refer to Section 23 and examine the connecting rod bearing shells. If they are scored, badly scuffed or appear to have seized, new shells must be installed. Always renew the shells in the connecting rods as a set. If they are badly damaged, check the corresponding crankpin. Evidence of extreme heat, such as discoloration, indicates that lubrication failure has occurred. Be sure to thoroughly check the oil pump and pressure relief valve as well as all oil holes and passages before reassembling the engine.

**10** Have the rods checked for twist and bending by a Triumph dealer if you are in doubt about their straightness.

### Oil clearance check

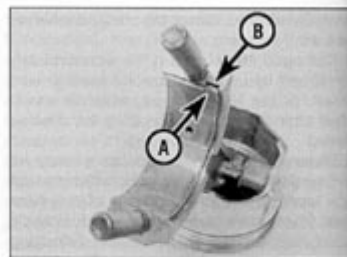
**11** Whether new bearing shells are being fitted or the original ones are being re-used, the connecting rod bearing oil clearance should be checked prior to reassembly. Work on one rod at a time when checking the clearances.

**12** Remove the bearing shells from the rods and caps, keeping them in order (see illustration). Clean the backs of the shells and the bearing locations in both the connecting rod and cap, and the crankpin journal.

**13** Press the bearing shells into their locations, ensuring that the tab on each shell engages the notch in the connecting rod/cap (see illustration). Make sure the bearings are fitted in the correct locations and take care not to touch any shell's bearing surface with your fingers.



**24.15** Measure the crushed Plastigauge using the scale on the pack – be sure to use the correct one as both metric and imperial are included



**24.13** Make sure the tab (A) locates in the notch (B)

**14** Cut a length of the appropriate size Plastigauge (it should be slightly shorter than the width of the crankpin). Place a strand of Plastigauge on the crankpin journal for the rod being checked. Fit the rod onto its crankpin, then install the cap, making sure it is fitted the correct way around so the previously made markings align (see illustration 24.26a and b). Note that the accuracy of this check is dependant on the rod not turning on the crankpin while it is installed and tightened – if it does, the Plastigauge will be disturbed and an inaccurate reading will result. Apply a smear of molybdenum disulphide grease to the bolt threads and to the underside of the nuts. Fit the nuts and tighten them first to the specified torque setting, and then by the specified angle using a degree disc, whilst ensuring that the connecting rod does not rotate (see illustrations 24.26c, d and e). Slacken the cap nuts and remove the connecting rod caps, again taking great care not to rotate the crankshaft.

**15** Compare the width of the crushed Plastigauge on each crankpin to the scale printed on the Plastigauge envelope to obtain the connecting rod bearing oil clearance (see illustration).

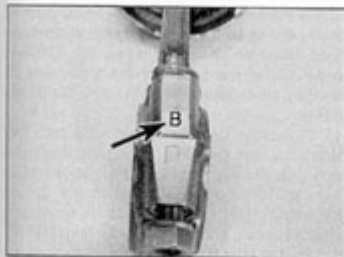
**16** On completion carefully scrape away all traces of the Plastigauge material from the crankpin and bearing shells using a fingernail or other object which is unlikely to score the shells.

**17** If the clearance is within the range listed in this Chapter's Specifications and the bearings are in perfect condition, they can be reused. If the clearance is not within the specified limits, the bearing shells may be the wrong grade (or excessively worn if the original shells are being reused). Before deciding that different grade shells are needed, make sure that no dirt or oil was trapped between the bearing shells and the connecting rod or cap when the clearance was measured. If the clearance is excessive, even with new shells (of the correct size), the crankpin is worn and the crankshaft should be renewed.

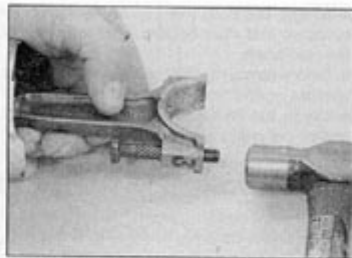
**18** Repeat the procedure for the remaining connecting rods.

### Bearing shell selection

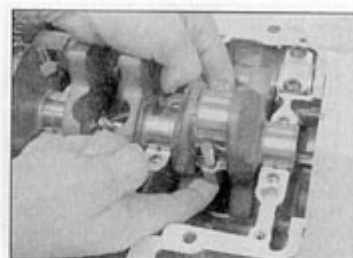
**19** The connecting rod big-end bearing oil clearance is controlled in production by selecting one of three grades of bearing shell. The grades



24.20 Connecting rod size letter (arrowed)



24.24 Tap out the old bolts and install new ones



24.26a Fit the rod onto its correct crankpin ...

are indicated by a colour-coding marked on the edge of each shell (see illustration 25.19). New bearing inserts are selected as follows using the crankpin journal diameter and connecting rod size marking.

20 Measure the crankpin journal diameter using a micrometer and record the result. Inspect the connecting rod for its size marking, either the letter A or B (see illustration).

21 Match the rod marking with the measured journal diameter and select a new set of bearing shells using the following table.

| Con-rod marking | Crankpin journal diameter | Shell colour |
|-----------------|---------------------------|--------------|
| A               | 40.954 to 40.960 mm       | White        |
| A               | 40.946 to 40.953 mm       | Red          |
| B               | 40.954 to 40.960 mm       | Red          |
| B               | 40.946 to 40.953 mm       | Blue         |

#### Installation

**Note 1:** There are a number of different ways in which the connecting rods can be installed, and your best approach will depend on what other work, if any, you are doing on the engine.

● If the pistons have been separated from the rods and the crankshaft has been removed, then you can either fit the rods onto the crankshaft and then install the crankshaft, or you can install the crankshaft and then install the rods from the top of the crankcase (but bear in mind that if you need to tilt the crankcase at all to install the rods from the top, then the crankshaft could fall out).

● If the pistons have not been separated from the rods, the rod and piston assemblies cannot be installed attached to the crankshaft as the pistons will not fit through. Install the

rod and piston assemblies from the top of the crankcase then install the crankshaft. You will also have to make a decision regarding installation of the liners, if they have been removed, as the rod and piston assemblies can be installed before them, with them or after them – see Section 14 for details.

● If it makes no difference, we advise fitting the pistons onto the rods first, then fitting the rod and piston assemblies into the liners, then installing the liners, followed by the crankshaft.

**Note 2:** New connecting rod bolts and nuts must be used whenever the rods have been disassembled.

22 Remove the bearing shells from the rods and caps, keeping them in order (see illustration 24.12). Clean the backs of the shells and the bearing locations in both the connecting rod and cap, and the crankpin journal. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin (kerosene). Wipe the shells, cap and rod dry with a clean lint free cloth.

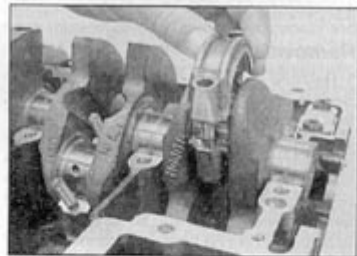
23 Press the bearing shells into their locations, ensuring that the tab on each shell engages the notch in the connecting rod/cap (see illustration 24.13). Make sure the bearings are fitted in the correct locations and take care not to touch any shell's bearing surface with your fingers.

24 Remove the old bolts from the rods and discard them, then fit the new ones – it will probably be necessary to tap the old bolts out using a hammer (see illustration).

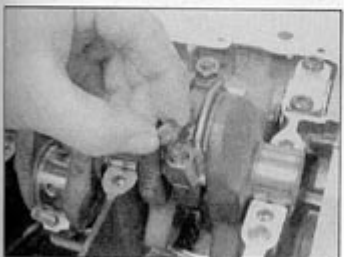
25 Decide upon your installation procedure, then assemble the rods and pistons and/or install the liners and crankshaft as required,

referring to the relevant Sections. **Note:** When installing the connecting rods on the crankshaft, remember that the oil hole in the connecting rod must face to the rear of the engine, on the opposite side to the arrow on the piston crown which must point to the front of the engine (see illustration 15.3).

26 Lubricate the shells with new engine oil. Fit the rod onto its crankpin, then install the cap, making sure it is fitted the correct way around so the previously made markings align (see illustrations). Apply a smear of molybdenum disulphide grease to the bolt threads and to the underside of the nuts. Fit the nuts and tighten them finger-tight at this stage. Check to make sure that all components have been returned to their original locations using the marks made on disassembly. Now tighten the nuts evenly, in two or three stages, first to the specified torque setting, and then by a further 120° using a degree disc (see illustrations).



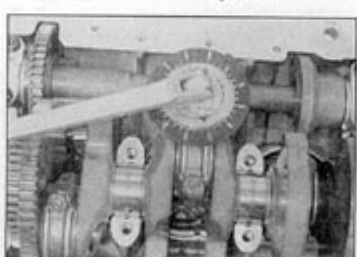
24.26b ... then fit the cap, making sure it is the correct way round



24.26c Fit the nuts ...



24.26d ... and tighten them first to the specified torque ...



24.26e ... and then by the specified angle



## 2•44 Engine, clutch and transmission

**HAYNES  
HINT**

If a degree disc is not available, the angle can be determined by using the points on the connecting rod cap nut. There are six points on the nut, so the angle between each point is 60°. Select one point as a reference and mark it with paint or a marker. Now select the second point clockwise from it and mark its position on the connecting rod cap. Tighten the nut – when the mark on the first point aligns with the mark made on the connecting rod cap, it will have turned through 120°.

27 Check that the crankshaft is free to rotate easily, then install the other connecting rods in the same way. Check to make sure that all components have been returned to their original locations using the marks made on disassembly.

28 Check that the rods rotate smoothly and freely on the crankpin. If there are any signs of roughness or tightness, remove the rods and re-check the bearing clearance. Sometimes tapping the bottom of the connecting rod cap will relieve tightness, but if in doubt, recheck the clearances.

29 Reassemble the crankcase halves and the rest of the engine according to your removal procedure, referring to the relevant Sections.

## 25 Crankshaft and main bearings – removal, inspection and installation

**Removal**

1 Remove the engine from the frame (see Section 5) and separate the crankcase halves (see Section 21).

2 Refer to Section 24 and separate the connecting rods from the crankpin (unless the pistons have been removed, in which case the rods can remain attached for now, and removed later if required). **Note:** If no work is to be carried out on the piston/connecting rod assemblies there is no need to remove them from the bores (unless the liners have been

removed), but push them up to the top of the bores so that their bottom ends are clear of the crankshaft.

3 Before removing the crankshaft, check the amount of end-float using a dial gauge. If it exceeds the limit specified, the crankshaft and/or the crankcases must be replaced with new ones. Lift the crankshaft out of the upper crankcase half, taking care not to dislodge the main bearing shells, then remove the cam chain if not already done (see illustration).

4 If required, remove the bearing shells from the crankcase halves by pushing their centres to the side, then lifting them out (see illustration). Keep the shells in order.

5 If required and not already done, undo the screws securing the breather disc and remove it from the end of the crankshaft (see illustration 21.3d).

**Inspection**

6 Clean the crankshaft with solvent, using a rifle-cleaning brush to scrub out the oil passages. If available, blow the crank dry with compressed air.

7 Refer to Section 23 and examine the main bearing shells. If they are scored, badly scuffed or appear to have been seized, new bearings must be installed. Always renew the main bearings as a set. If they are badly damaged, check the corresponding crankshaft journal. Evidence of extreme heat, such as discoloration, indicates that lubrication failure has occurred. Be sure to thoroughly check the oil pump and pressure relief valve as well as all oil holes and passages before reassembling the engine.

8 The crankshaft journals should be given a close visual examination, paying particular attention where damaged bearing shells have been discovered. If the journals are scored or pitted in any way a new crankshaft will be required. Note that oversize shells are not available, precluding the option of re-grinding the crankshaft.

**Oil clearance check**

9 Whether new bearing shells are being fitted or the original ones are being re-used, the main bearing oil clearance should be checked prior to reassembly.

10 If not already done, remove the bearing

shells from the crankcase halves by pushing their centres to the side, then lifting them out (see illustration 25.4). Keep the shells in order. Clean the backs of the shells and the bearing locations in both the crankcase halves.

11 Press the bearing shells back into their locations, ensuring that the tab on each shell engages in the notch (see illustration). Make sure the bearings are fitted in the correct locations and take care not to touch any shell's bearing surface with your fingers.

12 Ensure that the shells and crankshaft are clean and dry. Lay the crankshaft in position in the upper crankcase (see illustration 25.3).

13 Cut several lengths of the appropriate size Plastigauge (they should be slightly shorter than the width of the crankshaft journal). Place a strand of Plastigauge on each (cleaned) crankshaft journal.

14 If removed, fit the three locating dowels into one crankcase half (see illustration 21.12). Carefully guide the lower crankcase half onto the upper half. Make sure that the selector forks (if fitted) engage with their respective slots in the transmission gears as the halves are joined. Check that the lower crankcase half is correctly seated. **Note:** If the casings are not correctly seated, remove the lower crankcase half and investigate the problem. Do not attempt to pull them together using the crankcase bolts as the casing will crack and be ruined. Install the eight 8 mm lower crankcase bolts in their original locations and tighten them in the correct numerical sequence in three stages to the torque settings specified in Section 21 (see illustration 21.19). Make sure that the crankshaft is not rotated as the bolts are tightened.

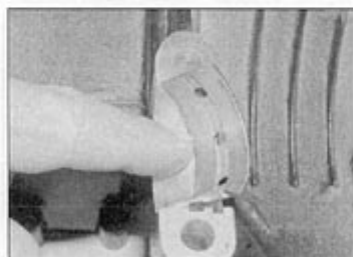
15 Slacken and remove the crankcase bolts, working in a criss-cross pattern from the outside in, then carefully lift off the lower crankcase half, making sure the Plastigauge is not disturbed.

16 Compare the width of the crushed Plastigauge on each crankshaft journal to the scale printed on the Plastigauge envelope to obtain the main bearing oil clearance (see illustration 24.15).

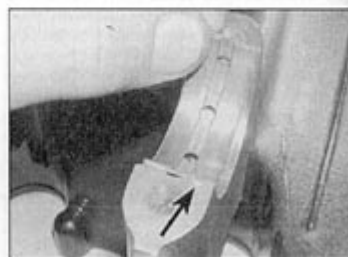
17 If the clearance is not within the specified limits, the bearing shells may be the wrong



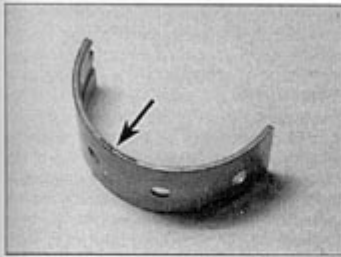
25.3 Carefully lift the crankshaft out of the crankcase



25.4 To remove a main bearing shell, push it sideways and lift it out



25.11 Press each shell into place, locating the tab in the notch (arrowed)



25.19 The colour code is marked on the side of the shell (arrowed)

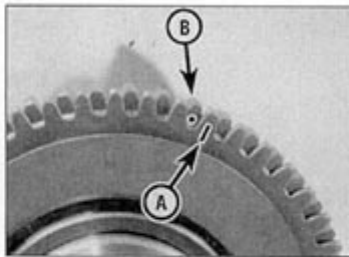
grade (or excessively worn if the original inserts are being reused). Before deciding that different grade shells are needed, make sure that no dirt or oil was trapped between the bearing shells and the crankcase halves when the clearance was measured. If the clearance is excessive, even with new shells (of the correct size), the crankshaft journal is worn and the crankshaft should be renewed.

18 On completion carefully scrape away all traces of the Plastigauge material from the crankshaft journal and bearing shells; use a fingernail or other object which is unlikely to score them.

#### Bearing shell selection

19 The main bearing oil clearance is controlled in production by selecting one of four grades of bearing shell. The grades are indicated by a colour-coding marked on the edge of each shell (see illustration). New bearing inserts are selected with reference to the following chart, having measured the crankshaft journal diameter and the crankcase bore diameter.

20 Measure the diameter of each crankshaft journal with a micrometer and record the results. Assemble the crankcase halves with the shells and crankshaft removed, and tighten the 8 mm crankshaft journal bolts in the correct numerical sequence in three stages to the torque settings specified in Section 21. Now measure each crankshaft journal bore diameter using a bore gauge and



25.23a The eliminator gear tooth with the line (A) must be directly in front of the driven gear tooth with the dot (B) ...



25.23b ... use a screwdriver between the teeth as a lever to align them

micrometer and record the results. Refer to *Tools and Workshop Tips* in the Reference Section for details on how to use the measuring equipment.

| Crankcase bore dia. | Crankshaft journal dia. | Shell colour |
|---------------------|-------------------------|--------------|
| 41.118 to 41.126 mm | 37.969 to 37.976 mm     | White        |
| 41.118 to 41.126 mm | 37.960 to 37.968 mm     | Red          |
| 41.127 to 41.135 mm | 37.969 to 37.976 mm     | Red          |
| 41.127 to 41.135 mm | 37.960 to 37.968 mm     | Blue         |
| 41.136 to 41.144 mm | 37.969 to 37.976 mm     | Blue         |
| 41.136 to 41.144 mm | 37.960 to 37.968 mm     | Green        |

#### Installation

21 Clean the backs of the bearing shells and the bearing recesses in both crankcase halves. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin (kerosene). Wipe the shells and crankcase halves dry with a lint-free cloth.

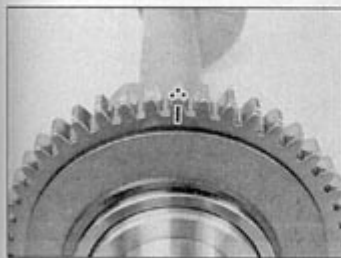
22 Press the bearing shells into their locations, ensuring that the tab on each shell engages in the notch (see illustration 25.11). Make sure the bearings are fitted in the correct locations and take care not to touch

any shell's bearing surface with your fingers. Lubricate all the shells with clean engine oil.

23 Before installing the crankshaft, the balancer shaft must be correctly aligned. The shaft driven gear has a backlash eliminator gear on its outside, which works by having one less tooth than the driven gear, and by using friction between the two gears to create a rolling cushion. First of all, align the tooth on the eliminator gear that is marked with a line with the tooth on the driven gear marked with a dot (see illustration) – this can be done using a screwdriver inserted between the teeth and used as a lever against the friction (see illustration). Once they are aligned, make a mark on the top or side of the driven gear tooth – as the dot on the outside is now covered by the eliminator gear tooth, this serves as an easy way of double checking the alignment (see illustration).

24 Identify the two teeth on the drive gear on the crankshaft marked with a dot – these two teeth must sit on each side of the marked and aligned teeth on the driven gear of the balancer shaft. Lower the crankshaft into position in the upper crankcase, engaging the teeth as described (see illustration). **Note:** If you turn the crankshaft through one full turn, you will notice that when the marked teeth on the crankshaft drive gear align with the lined tooth on the eliminator gear, the lined tooth on the eliminator gear no longer aligns with the marked tooth on the balancer shaft driven gear – do not be alarmed, this is correct, and happens because of the one tooth difference in the gears.

25 Reassemble the crankcase halves and the rest of the engine according to your removal procedure, referring to the relevant Sections.



25.23c As the dot on the driven gear will be covered, make some other dots on the tooth as a double-check

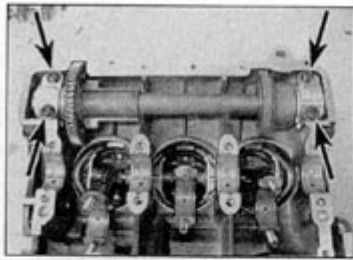


25.24 Crankshaft drive gear and balancer shaft driven gear alignment marks

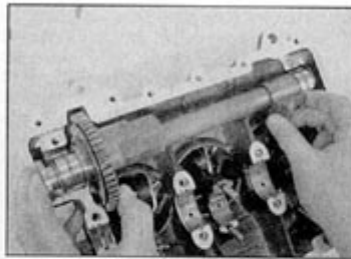
#### 26 Balancer shaft – removal, inspection and installation

**Note:** References to the right-hand and left-hand ends of the shaft are made as though the engine is the correct way up – remember that when the crankcases are split and the upper half is upside down, these references will appear to be the wrong way round.

## 2•46 Engine, clutch and transmission



26.3 Unscrew the holder bolts (arrowed) and remove the holders ...



26.4 ... then lift the shaft out of the crankcase

### Removal

- 1 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21).
- 2 Remove the crankshaft (see Section 25).
- 3 Before disturbing the balancer shaft holders, make some identification markings on their top surfaces to ensure that they can be installed on their original journals on

installation, and the correct way round. Unscrew the holder bolts, noting the bearing retainer brackets where fitted (earlier models), and remove the holders (see illustration).  
 4 Lift the shaft out of the crankcase (see illustration), on later models noting the retaining ring for the left-hand bearing in the groove in the crankcase (see illustration 26.6). Remove the ring for safekeeping. On all

models, the ring for the other bearing comes away with the shaft, and is retained by the end cap.

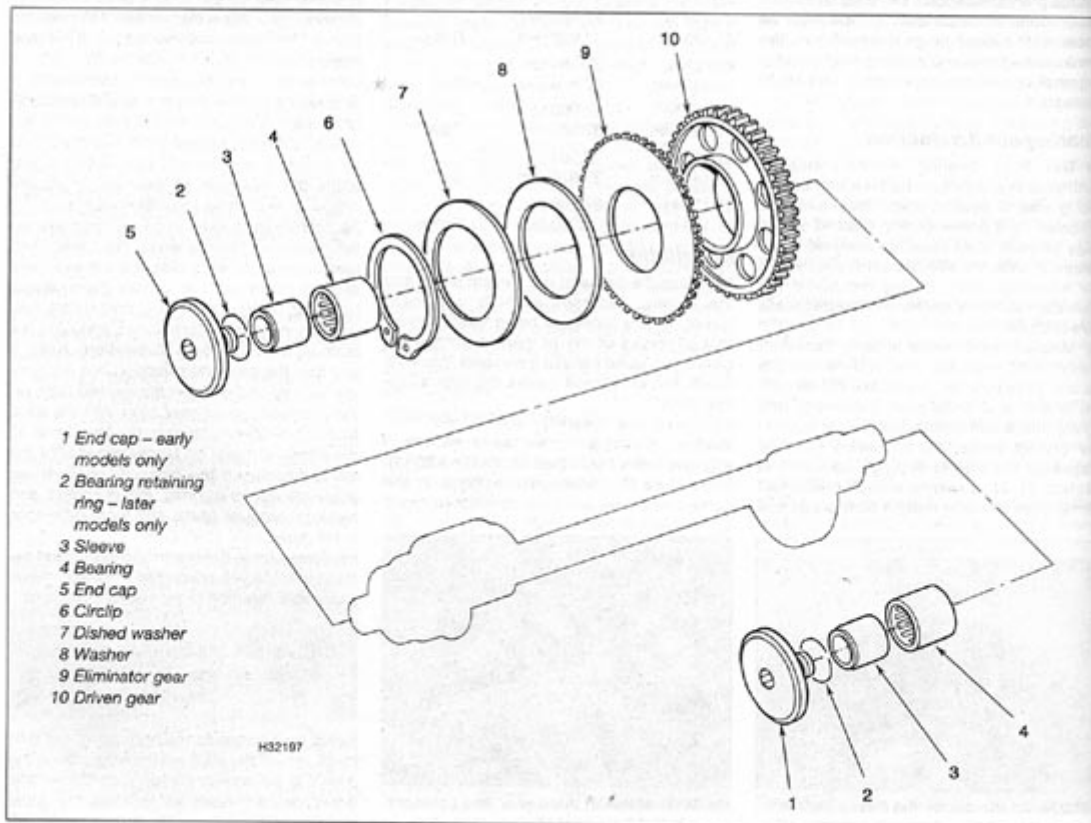
### Inspection

5 Inspect the teeth of both gears for signs of wear or damage, and replace them with new ones if necessary. If damage is found, check the teeth of the drive gear on the crankshaft. The shaft can be disassembled if required – all components are available individually (see illustration). On assembly, apply a suitable non-permanent thread locking compound to the end cap threads and tighten them to the torque setting specified at the beginning of the Chapter.

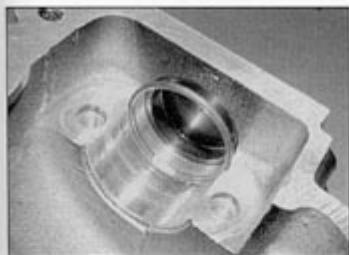
6 Check the bearing on each end and replace them with new ones if necessary.

### Installation

- 7 Before installing the balancer shaft, refer to Section 25, Step 23 and align the eliminator gear with the driven gear as described.
- 8 On later models, make sure the bearing



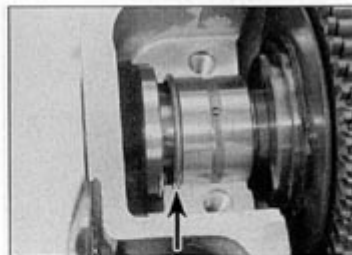
26.5 Balancer shaft components



26.8 Make sure the retaining ring is fitted in its groove



26.9 Apply the locking compound to the cutouts for the bearings



26.10 Make sure the ring locates correctly in its groove (arrowed)

retainer ring is correctly positioned in its groove in the crankcase (see illustration).

9 Apply a bearing locking compound to the bearing seats in the upper crankcase half only (see illustration).

10 Lay the shaft in the crankcase, facing the oil holes in the outer races of the bearings away from the bearing locking compound (see illustration 26.4). Make sure the retaining ring on the right-hand end locates in its groove, and the ring for the left-hand bearing is not dislodged from its groove (see illustration).



26.11a Install the holders, making sure the right-hand one locates correctly over the ring

11 Fit the shaft holders, making sure they are the correct way round, on early models not forgetting the bearing retainer brackets (see illustration). Lubricate the threads of the bolts with clean engine oil. Install the bolts, with their washers where fitted, and tighten them evenly to the torque setting specified at the beginning of the Chapter (see illustration).

12 Reassemble the crankcase halves and the rest of the engine according to your removal procedure, referring to the relevant Sections.

## 27 Transmission shafts – removal and installation

**Note:** References to the right-hand and left-hand ends of the shafts are made as though the engine is the correct way up – remember that when the crankcases are split and the upper half is upside down, these references will appear to be the wrong way round.

### Removal

1 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21).

2 Lift the output shaft out of the crankcase (see illustration 27.7b). Remove the needle

bearing locating pin for safekeeping if it is loose – it could be in the bearing or the crankcase. The ball bearing on the left-hand end of the shaft is located by a complete ring which remains loose on the shaft.

3 Lift the input shaft out of the crankcase (see illustration 27.6). Remove the ball bearing half ring retainer from the right-hand end and the dowel pin from the left-hand end for safekeeping if they are loose – they could be in the bearing outer races or the crankcase.

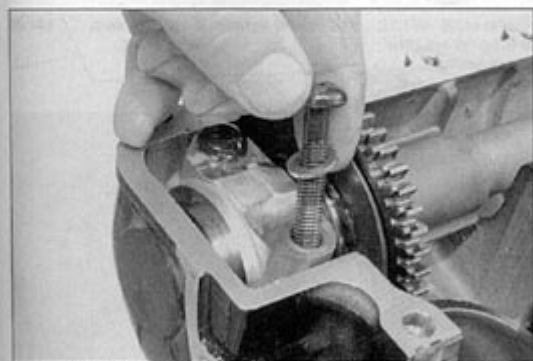
4 If necessary, the transmission shafts can be disassembled and inspected for wear or damage as described in Section 28.

### Installation

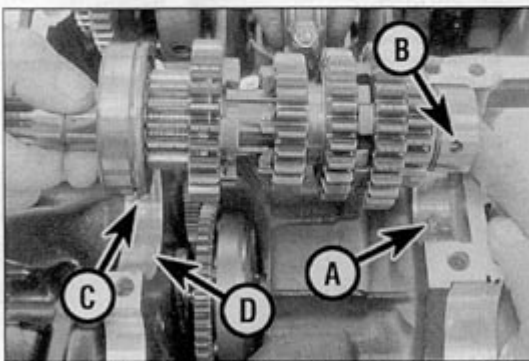
5 If removed, fit the needle bearing locating pins into either the upper crankcase or the bearing outer races. Fit the input shaft ball bearing retainer into its slot in the bearing. Apply a smear of a suitable non-permanent thread locking compound to the bearing locations in the upper crankcase half only.

6 Install the input shaft, making sure the pin locates in its hole and the half ring locates in its groove (see illustration). Position the half ring in the ball bearing groove so that it will bridge both casing halves when reassembled.

7 If not already done, slip the old oil seal off the left-hand end of the output shaft and



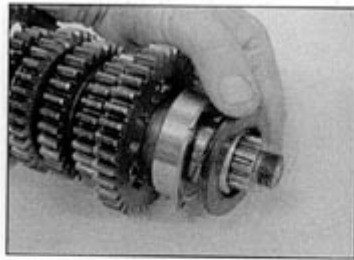
26.11b Lubricate the bolt threads and tighten them to the specified torque



27.6 Locate the pin (A) in the hole (B) and the half-ring (C) in the groove (D)



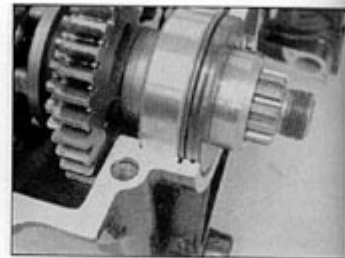
## 2•48 Engine, clutch and transmission



27.7a Fit a new oil seal on to the shaft



27.7b Locate the pin in the hole . . .



27.7c . . . and the ring and seal lip in the grooves

replace it with a new one (see illustration). Install the output shaft, making sure the pin locates in its hole, and the retaining ring and oil seal lip locate in their grooves (see illustrations).

8 Ensure that the gears of both shafts mesh correctly and that they're in the neutral position (i.e. the input shaft can be turned whilst the output shaft is held stationary).

9 Reassemble the crankcase halves and the rest of the engine according to your removal procedure, referring to the relevant Sections.

### 28 Transmission shafts – disassembly, inspection and reassembly

1 Remove the shafts from the crankcase as described in Section 27.

#### Input shaft Disassembly



*When disassembling the transmission shafts, place the parts on a long rod or thread a wire through them to keep them in order and facing the proper direction.*

2 Slide the needle roller bearing outer race off the left-hand end of the shaft (see illustration and 28.17e).

3 Remove the circlip from the shaft end, then slide the needle roller bearing, the thrust washer and the second gear pinion off the shaft (see illustrations 28.17d, c, b and a).

4 Slide the 6th gear pinion and its bush off the shaft, followed by the thrust washer (see illustrations 28.16b and a and 28.15c).

5 Remove the circlip securing the combined 3rd/4th gear pinion and slide it off the shaft (see illustrations 28.15b and a).

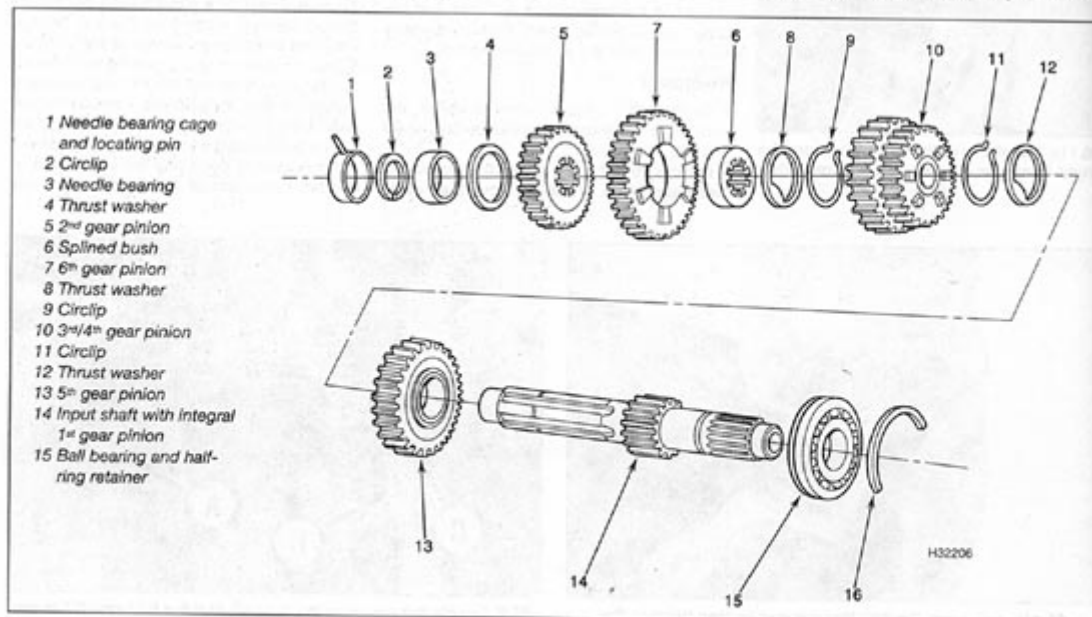
6 Remove the circlip securing the 5th gear pinion, then slide the thrust washer and the pinion off the shaft (see illustrations 28.14c, b and a).

#### Inspection

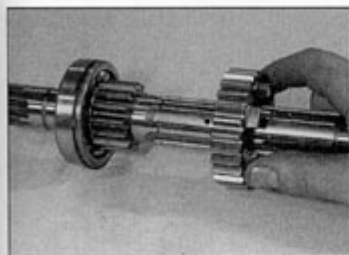
7 Wash all of the components in clean solvent and dry them off.

8 Check the gear teeth for cracking and other obvious damage. Check the 6th gear bush and the surface in the inner diameter of the gear for scoring or heat discoloration. If the gear or bush is damaged, renew it.

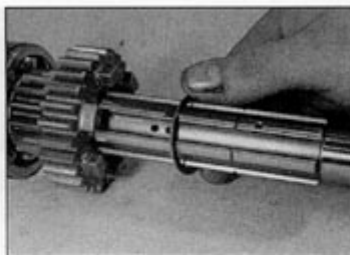
9 Inspect the dogs and the dog holes in the



28.2 Transmission input shaft components



28.14a Slide the 5<sup>th</sup> gear on the shaft with its dogs away from the integral 1<sup>st</sup> gear



28.14b Slide on the thrustwasher ...



28.14c ... and then fit the circlip ...

gears for excessive wear. Renew the paired gears as a set if necessary.

10 Measure the gearchange fork groove width in the 3rd/4th gear pinion as described in Section 29.

11 The shaft is unlikely to sustain damage unless the engine has seized, placing an unusually high loading on the transmission, or the machine has covered a very high mileage. Check the surface of the shaft, especially where a pinion turns on it, and renew the shaft if it has scored or picked up. Damage of any kind can only be cured by renewal.

12 If the ball bearing requires renewal, a bearing puller will be required to extract the bearing from its shaft. Note the position of the

locating groove in the outer race of the bearing prior to removing it and ensure that the new bearing is fitted with the groove in the same position. Pull the bearing off the shaft and install the new bearing using a press. Replace the needle bearing with a new one if it is worn or damaged, or does not run freely.

#### Reassembly

13 During reassembly, always use new circlips. Lubricate the components with the correct grade of engine oil before assembling them.

14 Slide on the 5th gear with its dogs facing away from the integral 1st gear pinion (see illustration). Install the thrustwasher and

circlip, making sure that the circlip locates in the shaft groove (see illustrations).

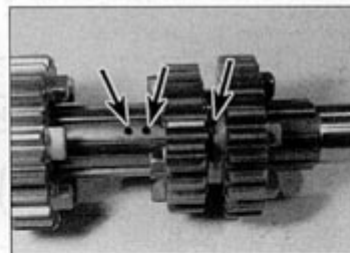
15 Install the combined 3rd/4th gear pinion so that the smaller (3rd) gear faces the 5th gear pinion and so that the oilway in the gearchange fork groove aligns with the two oilways in the shaft (see illustration). Locate the circlip in the shaft groove and slide the thrustwasher on the shaft so that it abuts the circlip (see illustrations).

16 Install the 6th gear pinion bush so that its oilway aligns with the shaft oilway, then slide on the 6th gear pinion with its dogs facing the 4th gear (see illustrations).

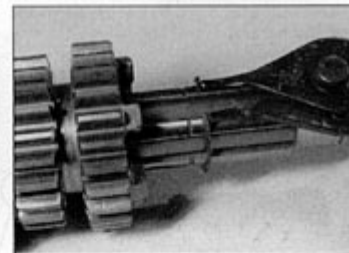
17 Install the 2nd gear pinion with its stepped side facing away from the 6th gear pinion (see



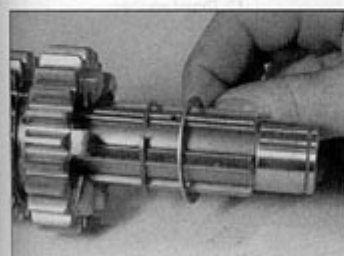
28.14d ... making sure it locates correctly in its groove



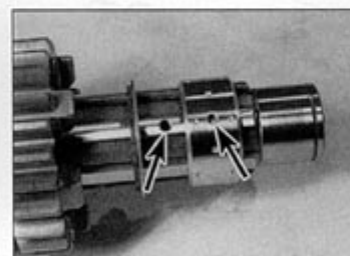
28.15a Slide on the combined 3<sup>rd</sup>/4<sup>th</sup> gear with the 3<sup>rd</sup> gear facing the 5<sup>th</sup> gear, and aligning the oil holes (arrowed)



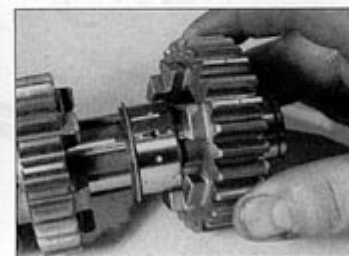
28.15b Fit the circlip into the groove ...



28.15c ... and slide the thrustwasher against it

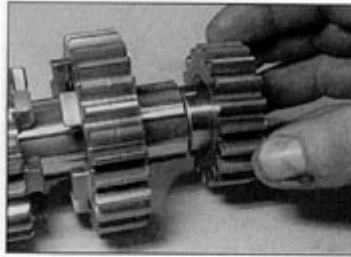


28.16a Slide the bush onto the shaft so the oil holes (arrowed) align ...

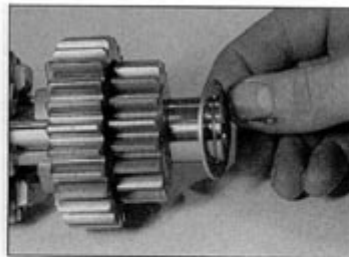


28.16b ... then slide the 6<sup>th</sup> gear onto the bush

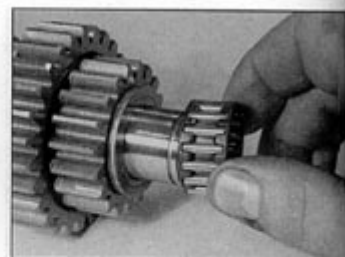
## 2•50 Engine, clutch and transmission



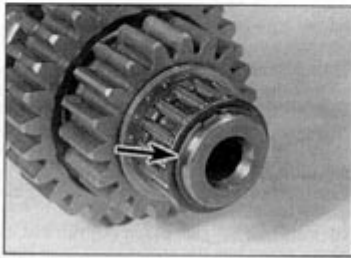
28.17a Install the 2<sup>nd</sup> gear with its stepped side facing away from the 6<sup>th</sup> gear



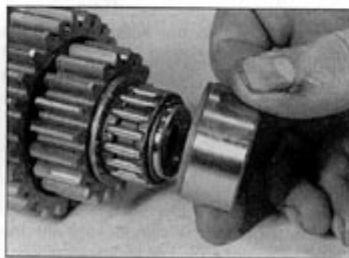
28.17b Slide the thrustwasher onto the shaft ...



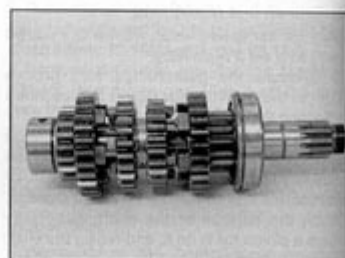
28.17c ... followed by the needle bearing



28.17d Fit the circlip into the groove (arrowed) ...



28.17e ... then slide the outer race over the bearing



28.17f The assembled input shaft

illustration). Slide on a thrustwasher and the needle roller bearing, then secure them with the circlip (see illustrations). Slide the outer race over the bearing (see illustration). The assembled input shaft should be as shown (see illustration).

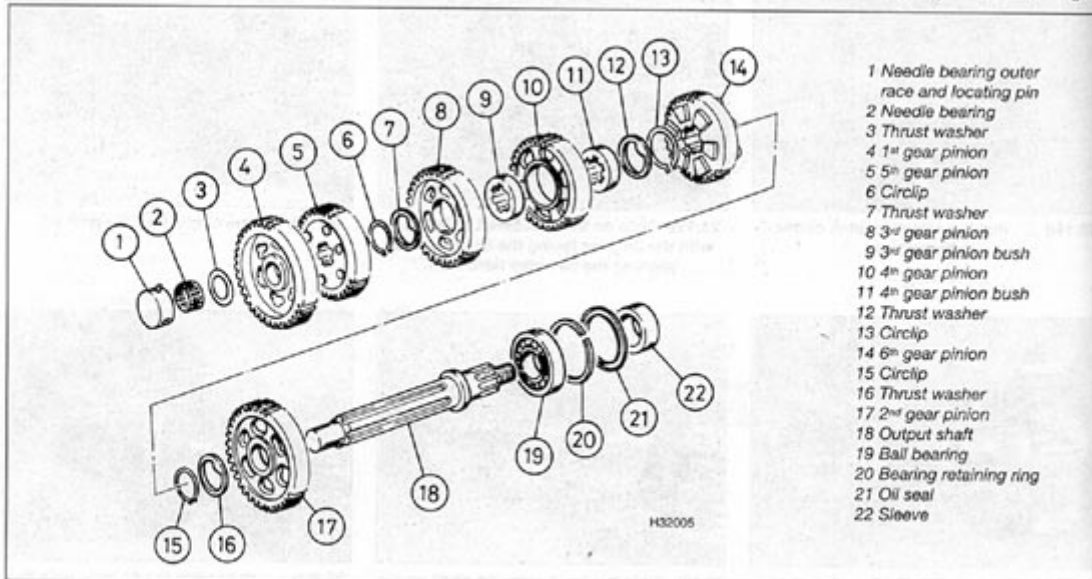
### Output shaft

#### Disassembly

18 Slide the needle bearing outer race, bearing and thrustwasher off the right-hand end of the shaft (see illustrations 28.36c and b).

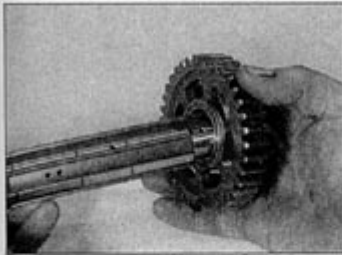
19 Make a paint mark on the outer face of the 1st gear pinion, then slide it off the shaft, followed by the 5th gear pinion (see illustrations 28.36a and 28.35).

20 Remove the circlip, then slide off the thrustwasher, 3rd gear pinion, bush, 4th gear



- 1 Needle bearing outer race and locating pin
- 2 Needle bearing
- 3 Thrust washer
- 4 1<sup>st</sup> gear pinion
- 5 5<sup>th</sup> gear pinion
- 6 Circlip
- 7 Thrust washer
- 8 3<sup>rd</sup> gear pinion
- 9 3<sup>rd</sup> gear pinion bush
- 10 4<sup>th</sup> gear pinion
- 11 4<sup>th</sup> gear pinion bush
- 12 Thrust washer
- 13 Circlip
- 14 6<sup>th</sup> gear pinion
- 15 Circlip
- 16 Thrust washer
- 17 2<sup>nd</sup> gear pinion
- 18 Output shaft
- 19 Ball bearing
- 20 Bearing retaining ring
- 21 Oil seal
- 22 Sleeve

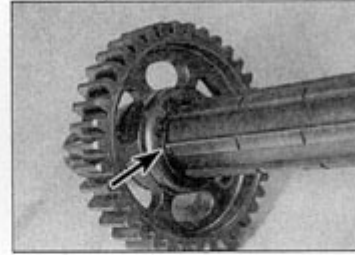
28.18 Transmission output shaft components



28.31a Fit the 2<sup>nd</sup> gear pinion with its dished side facing away from the bearing



28.31b Slide on the thrust washer ...



28.31c ... then fit the circlip, locating it in its groove (arrowed)

pinion, bush and thrustwasher (see illustrations 28.34d, c, b and a, and 28.33c, b and a).

21 Remove the circlip and slide off the 6th gear pinion (see illustrations 28.32b and a).

22 Remove the circlip, then slide off the thrustwasher and the 2nd gear pinion (see illustrations 28.31c, b and a).

23 Moving to the left-hand end of the shaft, remove the oil seal and discard it (see illustration 27.7a), then remove the bearing retaining ring (see illustration 28.37c); a new seal must be installed on reassembly. If required, slide the sleeve off the shaft (see illustration 28.37b).

#### Inspection

24 Wash all of the components in clean solvent and dry them off.

25 Check the gear teeth for cracking and other obvious damage. Check the 3rd and 4th gear bushes and the surface in the inner diameter of each gear for scoring or heat discoloration. If the gear or bush is damaged, renew it.

26 Inspect the dogs and the dog holes in the gears for excessive wear. Renew the paired gears as a set if necessary.

27 Measure the gearchange fork groove width in the 5th and 6th gear pinions (see Section 29).

28 The shaft is unlikely to sustain damage unless the engine has seized, placing an unusually high loading on the transmission, or the machine has covered a very high mileage. Check the surface of the shaft, especially

where a pinion turns on it, and renew the shaft if it has scored or picked up. Damage of any kind can only be cured by renewal.

29 The ball bearing on the left-hand end of the shaft is a press fit. Refer to *Tools and Workshop Tips* in the Reference Section for more information on bearing removal and installation methods. Replace the needle bearing with a new one if it is worn or damaged, or does not run freely.

#### Reassembly

30 During reassembly, always use new circlips. Lubricate the components with engine oil before assembling them.

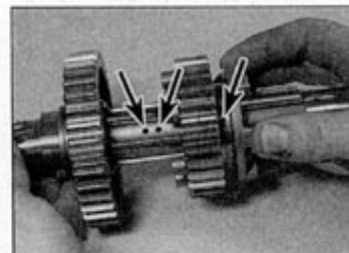
31 Slide the 2nd gear pinion on the shaft with its dished side facing away from the ball bearing (see illustration). Install a

thrustwasher and secure with a circlip, making sure it seats in the shaft groove (see illustrations).

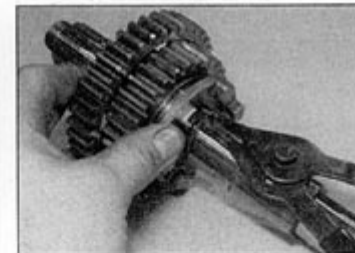
32 Slide 6th gear pinion on the shaft with its gearchange fork groove facing away from the 2nd gear pinion, and so that the oilway in the fork groove aligns with the two oilways in the shaft (see illustration). Secure the gear with the circlip, making sure it locates in the shaft groove (see illustration).

33 Slide a thrustwasher on the shaft, followed by the 4th gear pinion bush, aligning the bush oilway with the shaft oilway (see illustrations). Slide 4th gear pinion on the shaft so that its stepped side faces away from the 6th gear pinion (see illustration).

34 Install the 3rd gear pinion bush so that its oilway aligns with the shaft oilway



28.32a Fit the 6<sup>th</sup> gear pinion with its selector fork groove facing away from the 2<sup>nd</sup> gear pinion, aligning the oil holes (arrowed)



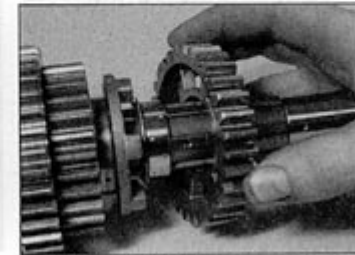
28.32b Fit the circlip, locating it in its groove



28.33a Slide the thrust washer onto the shaft ...



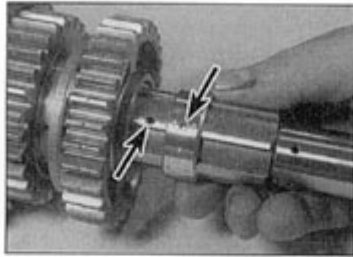
28.33b ... followed by the 4<sup>th</sup> gear bush, aligning the oil holes (arrowed)



28.33c Install the 4<sup>th</sup> gear pinion with its stepped centre facing away from the 6<sup>th</sup> gear

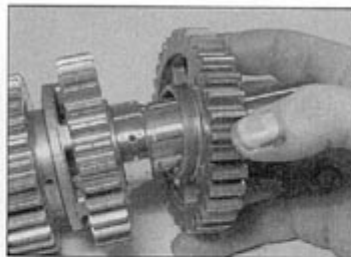


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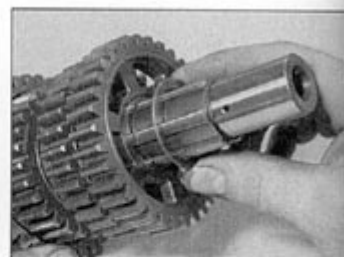
28.34a Slide on the 3rd gear pinion bush, aligning the oil holes (arrowed) ...

(see illustration). Slide on the 3rd gear pinion so that its stepped side faces the 4th gear (see illustration). Install a



28.34b ... then install the 3rd gear pinion with its stepped centre facing the 4th gear pinion

thrustwasher and retain with a circlip, making sure it locates in the shaft groove (see illustrations).

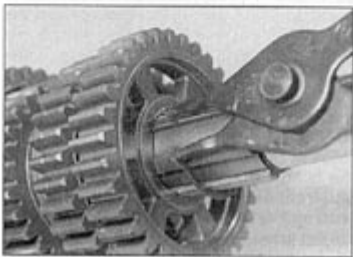


28.34c Slide the thrust washer onto the shaft ...

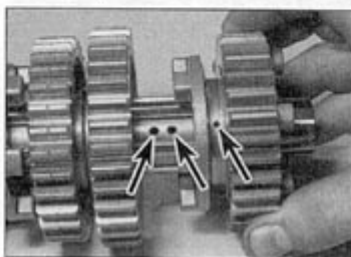
35 Slide the 5th gear pinion on the shaft so that its gearchange fork groove faces the 3rd gear pinion and so that the oilway in the groove aligns with the two oilways in the shaft (see illustration).

36 Install the 1st gear pinion on the shaft, with the paint mark made on removal facing out (see illustration). Install the thrustwasher, needle roller bearing and outer race (see illustrations).

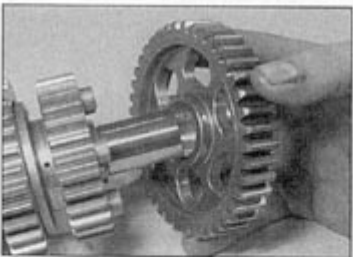
37 At the left end of the shaft, fit the bearing onto the shaft using a press, if removed and not already installed (see illustration). Install the sleeve with its chamfered edge facing outwards then fit the bearing locating ring (the ring will float on the shaft until the countershaft is installed in the crankcase) (see illustrations). Install a new oil seal over the sleeve with its marked side facing out



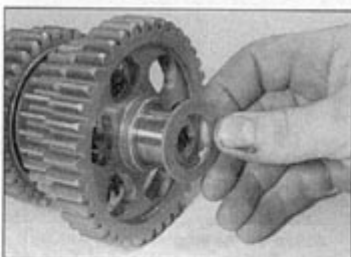
28.34d ... then fit the circlip, locating it in its groove



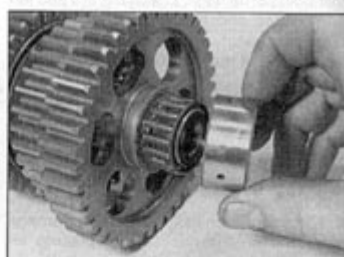
28.35 Install the 5th gear pinion with its selector fork groove facing the 3rd gear, aligning the oil holes



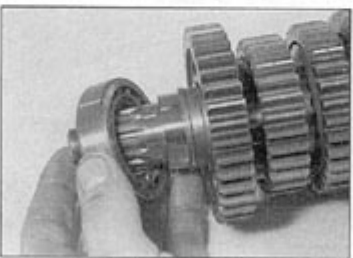
28.36a Install the 1st gear pinion ...



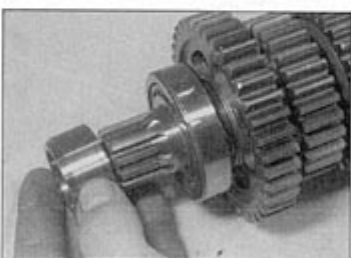
28.36b ... followed by the thrust washer ...



28.36c ... the needle bearing, and its outer race



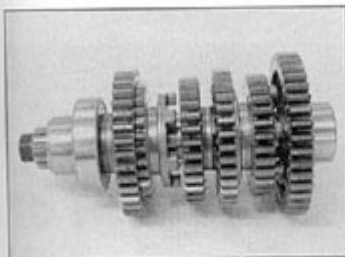
28.37a Fit the bearing ...



28.37b ... followed by the sleeve, with its chamfered side facing out



28.37c Fit the locating ring onto the end of the shaft, then fit the oil seal



28.37d The assembled output shaft

(see illustration 27.7a). The assembled output shaft should be as shown (see illustration).

## 29 Gearchange mechanism – removal, inspection and installation

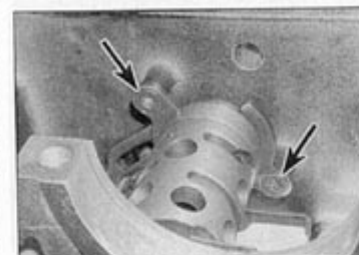
**Note:** Access can be gained to the detent cam and stopper arms with the engine in the frame and the clutch removed (see Section 16). All other operations require the crankcases to be separated.

### Removal

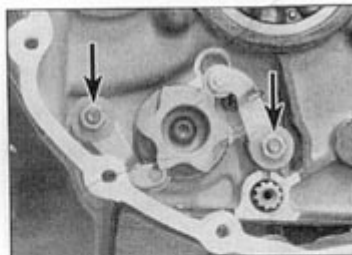
- 1 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21). The gearchange mechanism and selector drum and forks are all housed in the lower crankcase half.
- 2 Remove the screw and retaining plate from the left-hand side of the crankcase to free the selector fork shaft (see illustration). Slide the rod out of the crankcase and lift each fork out as it clears the rod (see illustrations 29.27e, d and c). Install the forks back on the rod the correct way round as a guide to reassembly.
- 3 Remove the oil pump and its middle gear assembly (see Section 30), and the pressure relief valve (see Section 19).
- 4 Unscrew the nuts securing the neutral and gear stopper arm assemblies in the right-hand

side of the crankcase, then remove the outer washers, stopper arms (noting how the rollers locate in the detents in the cam), return springs and inner washers (see illustration). Keep the components of each assembly separate to avoid their parts being interchanged – note that the neutral arm spring is a different colour for identification. **Note:** If this is the only part of the mechanism that is being removed (see Note above), first remove the clutch (see Section 16). Now plug the aperture into the sump with rags to prevent the possibility of one of the washers or other components dropping into it – two of the washers involved are very small and are easy to drop.

- 5 Remove the two screws which secure the



29.5 Undo the screws (arrowed) and remove the plate as described

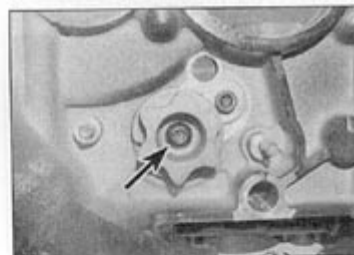


29.4 Unscrew the nuts (arrowed) and remove the stopper arm assemblies – note how they fit and keep the components for each assembly separate

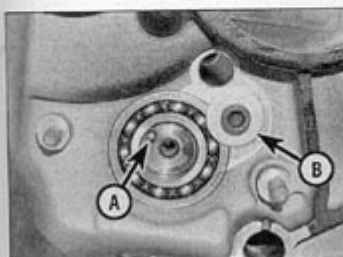
pawl retainer plate to the crankcase (see illustration). Rotate the plate clockwise, then slide it out to the rear of the drum and remove it, noting how it fits (see illustration 29.22a).

- 6 Remove the screw securing the detent cam to the right-hand end of the selector drum and remove the cam, noting how it is located by a pin (see illustration). Remove the pin for safekeeping if it is loose (see illustration 29.7a).

- 7 Remove the bolt and washer which retain the ball bearing in the right side of the crankcase (see illustration). Push the bearing out from inside of the crankcase, using the selector drum to dislodge it, then lift the drum out of the crankcase, noting how it fits (see illustrations).



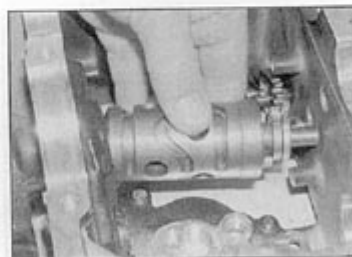
29.6 Undo the screw (arrowed) and remove the detent cam



29.7a Detent cam locating pin (A). Bearing retainer bolt and washer (B)

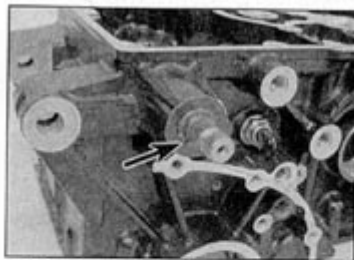


29.7b Remove the bearing, sliding the selector drum against it to dislodge it...

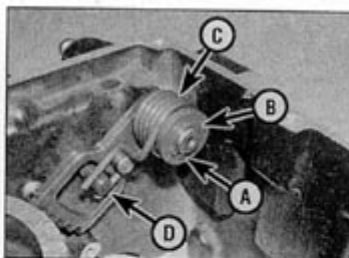


29.7c ... then remove the drum, noting how it locates

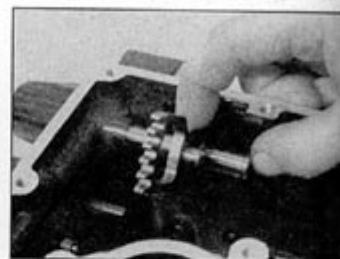
## 2•54 Engine, clutch and transmission



29.8a Remove the circlip (arrowed) and the washer from the outer end of the shaft



29.8b If required, remove the circlip (A), spring guide (B) and spring (C), noting how the ends locate (D)



29.8c Withdraw the shaft from the crankcase

8 Remove the circlip and washer from the outer end of the gearchange shaft (see illustration). If required, remove the circlip, spring guide and return spring from the inner end of the shaft, noting how the spring ends locate (see illustration). Withdraw the shaft from the crankcase (see illustration).

9 If the pawl carrier requires removal from the left-hand end of the selector drum, remove the circlip and lift off the neutral disc. Drive out the roll pin in the shaft. Carefully withdraw the pawl carrier from the drum, taking care not to lose the spring-loaded pawls.

### Inspection

10 Check the selector forks and shaft for wear and damage.

11 Locate each selector fork in its corresponding gear groove and measure the gearchange fork-to-groove clearance using a

feeler gauge (see illustration). If the clearance is outside the maximum specified, measure the selector fork end widths and the groove in the gear using a vernier caliper (see illustrations). Renew any component which is worn beyond the service limit (see Specifications).

12 Check the selector fork shaft for bending by rolling it along a flat surface. A bent shaft will cause difficulty in selecting gears and make the gearchange action heavy. Replace the shaft with a new one if it is at all bent.

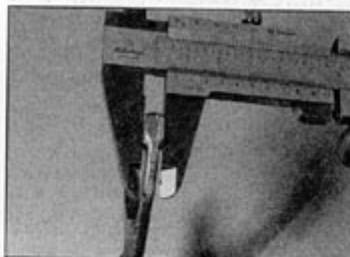
13 Inspect the selector drum grooves and selector fork guide pins for wear and damage. If they show signs of wear or damage the selector fork(s) and drum must be renewed.

14 Check that the selector drum bearing rotates freely and has no sign of freeplay between its inner and outer race. Renew the bearing if necessary.

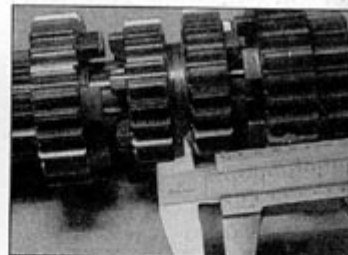
15 Check the gearchange shaft for distortion and damage to the splines. If the shaft is bent you can attempt to straighten it, but if the splines are damaged it must be renewed. Slide the gearchange shaft into the crankcase and check that it turns smoothly and freely in its bore. If it feels rough, prise out the oil seal, then clean and lubricate the needle bearing and check it again (see illustration). If it is still rough, replace the bearing with a new one – refer to *Tools and Workshop Tips* in the Reference Section for information on bearing check, removal and installation methods. Check the condition of the oil seal and look for signs of oil leakage from it. Replace it with a new one if necessary – prise out the old seal and press the new one into place (see illustrations). If the seal is removed to access the bearing, use a new seal – the old one is likely to leak if it is reused.



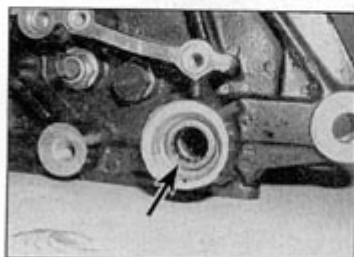
29.11a Measure the fork-to-groove clearance using a feeler gauge



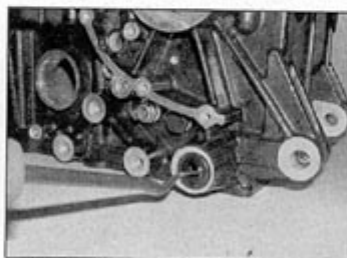
29.11b If the clearance exceeds the limit, measure the thickness of the fork ends ...



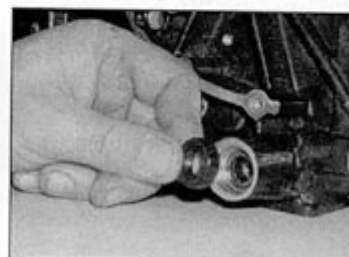
29.11c ... and the width of the groove, and renew whichever component is worn



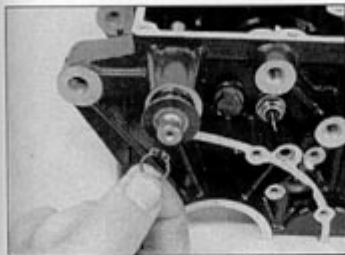
29.15a Check the condition of the bearing (arrowed)



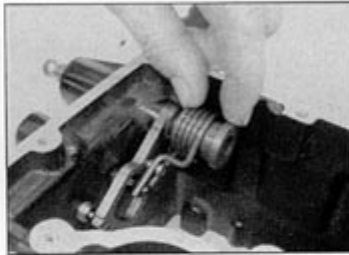
29.15b Prise out the old oil seal ...



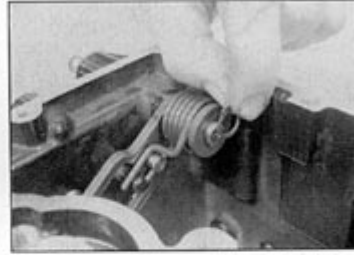
29.15c ... and press in a new one so that it is flush with the housing



29.19a Secure the shaft with the washer and circlip



29.19b Fit the return spring and guide ...



29.19c ... and secure them with the circlip

16 Check the selector arm for cracks, distortion and wear of its teeth, and check for any corresponding wear on the teeth on the pawl carrier on the selector drum. Check the pawl assembly components for wear and damage. Also check the stopper arm rollers and the detents in the selector drum for any wear or damage, and make sure the rollers turn freely. Replace any components that are worn or damaged with new ones.

17 Inspect the shaft centralising spring and the stopper arm return springs for fatigue, wear or damage. If any faults are found, renew the components. Also check that the centralising spring locating pin in the crankcase is securely tightened. If it is loose, remove it and apply a non-permanent thread locking compound to its threads, then fit a new sealing washer and tighten it to the torque setting specified at the beginning of the Chapter.

#### Installation

18 If the pawl assembly was disturbed, install the springs plungers and pawls in the carrier, then hold them compressed and insert the carrier in the end of the selector drum. Drift the roll pin into the hole in the shaft to retain the carrier. Fit the neutral disc over the drum end so that its cutout aligns with the roll pin. Secure the disc with the circlip.

19 Slide the gearchange shaft into the crankcase (see illustration 29.8c). Fit the washer onto the outer end of the shaft, then

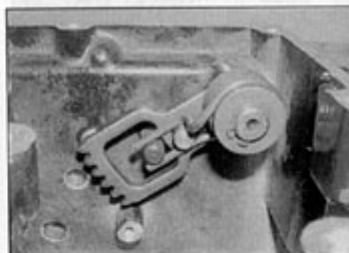
secure the shaft with the circlip, making sure it is correctly located in its groove (see illustration). If removed, fit the return spring and spring guide onto the inner end of the shaft and secure them with the circlip, making sure it locates correctly in its groove (see illustrations). Make sure the return spring ends are correctly located (see illustration).

20 Install the selector drum in the lower crankcase, locating its shaft end in the casing bore, and aligning the teeth on the selector arm with those on the pawl carrier (see illustration 29.7c) – it is important that the centre tooth on the pawl carrier locates between the 3rd and 4th teeth on the selector arm (see illustration). Fit the ball bearing into the right-hand side of the crankcase, noting that it must be installed from the outside (see

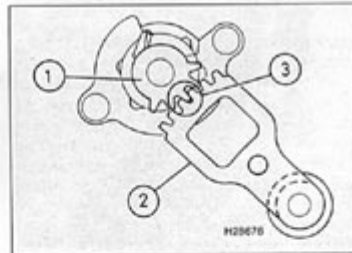
illustration 29.7b). Apply a suitable non-permanent thread locking compound to the threads of the bearing retainer bolt, then fit the bolt with its washer and tighten it to the torque setting specified at the beginning of the Chapter (see illustration).

21 If removed, fit the detent cam locating pin into the selector drum (see illustration 29.7a). Install the cam, making sure the hole in the back of the cam fits over the locating pin (see illustration). Apply a suitable non-permanent thread locking compound to the threads of the cam screw and tighten it to the torque setting specified at the beginning of the Chapter (see illustration).

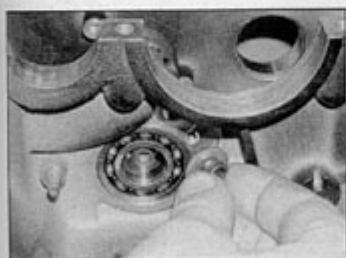
22 Locate the pawl retainer plate around the pawls in the selector drum, then rotate it anti-clockwise to align its mounting holes with



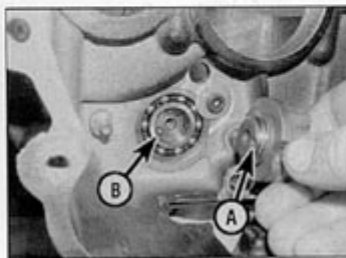
29.19d Make sure the spring ends are correctly located



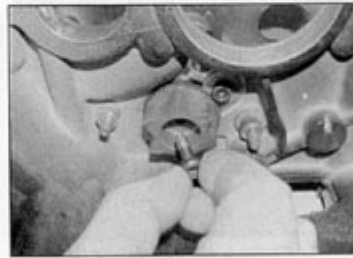
29.20a Make sure the centre tooth on the pawl carrier (1) locates between the central teeth (3) on the selector arm (2)



29.20b Secure the bearing with the washer and bolt



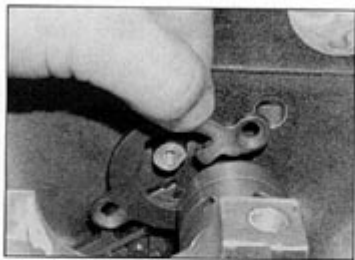
29.21a Locate the hole (A) in the detent cam over the locating pin (B)



29.21b Secure the cam with its screw



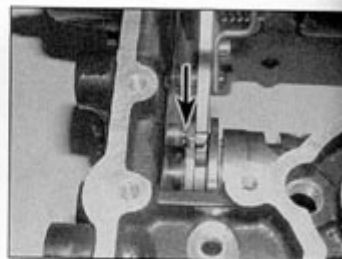
## 2•56 Engine, clutch and transmission



29.22a Fit the plate around the pawls as shown ...



29.22b ... then rotate it to the position shown and install the screws



29.23a Locate the neutral switch plunger against the contact on the disc (arrowed)

those in the crankcase (see illustrations). Apply a suitable non-permanent thread locking compound to the threads of the screws and tighten them to the torque setting specified at the beginning of the Chapter.

23 Rotate the selector drum so that the neutral switch plunger will be against the contact on the disc on the end of the drum (see illustration) – in this position the neutral detent in the detent cam is facing down and slightly back, roughly in the seven o'clock position. Fit the neutral stopper arm inner washer, then fit the spring, locating its straight end against the crankcase – in case you have muddled up the neutral and stopper arm assemblies, the spring for the neutral arm is painted white (see illustrations). Fit the

stopper arm, locating its lower edge in the bent end of the spring (see illustration). Press the arm down against the spring, then locate the roller in the neutral detent in the cam and hold it there while you install the outer washer and nut (see illustration). Tighten the nut to the specified torque setting.

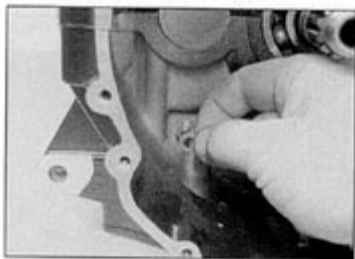
24 Build up the gear stopper arm assembly in the same way as the neutral arm. Note that in the neutral position, the roller for the gear arm locates on the top of the flattened lobe. Check that the installed arms are located as shown (see illustration 29.4).

25 Install the oil pressure relief valve (see Section 19), and the oil pump and its middle gear assembly (see Section 30).

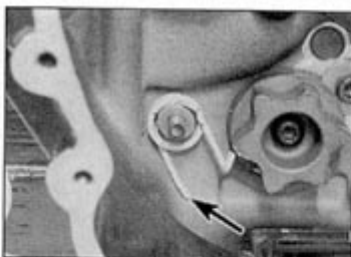
26 Temporarily fit the gearchange lever onto

the shaft end and rotate the selector drum fully in both directions. Check that when fully extended, the selector arm and pawl carrier teeth engage as shown (see illustration). If the teeth do not engage correctly, check the pawl carrier and selector arm teeth for accurate alignment as described in Step 20.

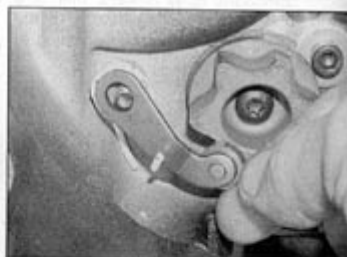
27 Check the condition of the O-ring on the selector fork shaft and replace it with a new one if it is damaged or deteriorated (see illustration). The selector forks are marked 1, 2 and 3 from left to right to correspond with the cylinder numbers, and the numbers must face the right-hand side of the engine (see illustration). Slide the selector fork shaft into its bore in the crankcase and engage the forks in turn on the shaft in the correct order and



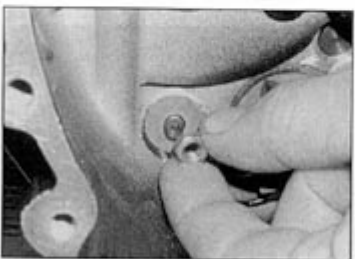
29.23b Fit the inner washer ...



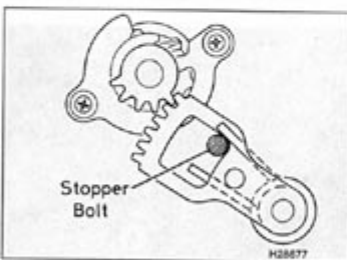
29.23c ... and the spring, locating the straight end against the crankcase (arrowed)



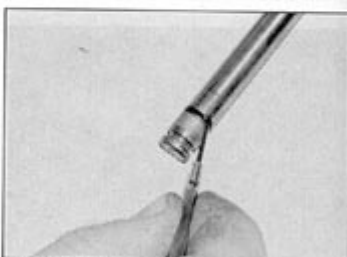
29.23d Fit the stopper arm, locating it in the bent end of the spring



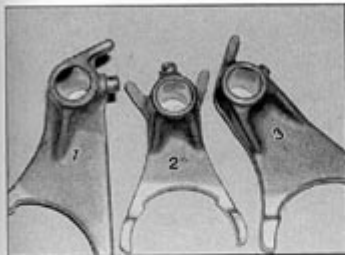
29.23e Fit the outer washer and tighten the nut to the specified torque



29.26 Check that the pawl carrier teeth and the selector arm teeth remain engaged at the full extent of movement



29.27a Replace the O-ring with a new one if necessary



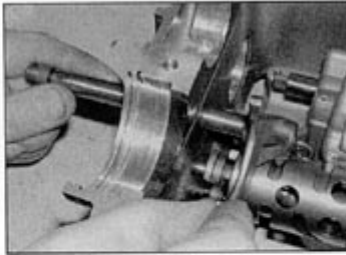
29.27b The forks are numbered 1 to 3 from left to right, and the numbers must face the right-hand side of the engine

way round – locate the fork guide pins in the selector drum tracks (see illustrations). Lock the shaft in position with the retaining plate, locating the cutout in the plate into the groove in the end of the shaft, and tighten the screw to the specified torque (see illustration).  
28 Assemble the crankcase halves (see Section 21).

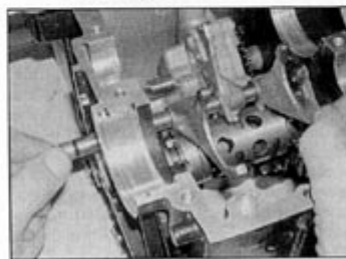
### 30 Oil pump – pressure check, removal, inspection and installation

#### Pressure check

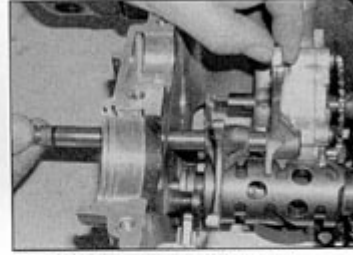
- 1 To check the oil pressure, a suitable gauge and adapter that screws into the oil pressure switch will be needed. Triumph do not list an adapter as a spare part, but it is worth checking with a dealer as to availability. Otherwise, remove the pressure switch (see Chapter 8), and take it to an accessory dealer to match it up – if you are buying a pressure gauge, it may well come with a range of adapters.
- 2 Warm the engine up to normal operating temperature then stop it. Remove the right-hand fairing side panel on Daytona and Sprint ST models (see Chapter 7).
- 3 Remove the oil pressure switch (see Chapter 8) and screw the adapter in its place. Connect the gauge to the adapter.
- 4 Start the engine and increase the engine speed to 5000 rpm whilst watching the gauge



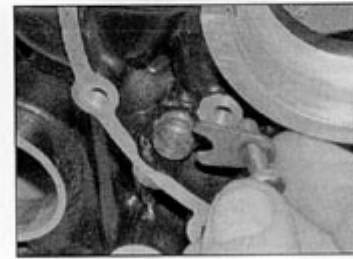
29.27c Slide the shaft into the crankcase and through the No. 1 fork ...



29.27e ... and the No. 3 fork, and then into the other side of the crankcase. Locate the guide pin on each fork in its track



29.27d ... then the No. 2 fork ...



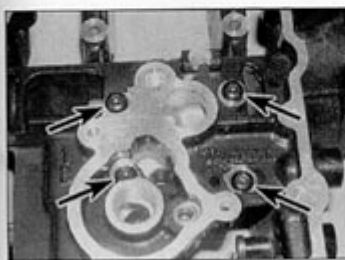
29.27f Fit the retainers plate into the groove in the end of the shaft and secure it with the screw

reading. The oil pressure should be similar to that given in the Specifications at the start of this Chapter.

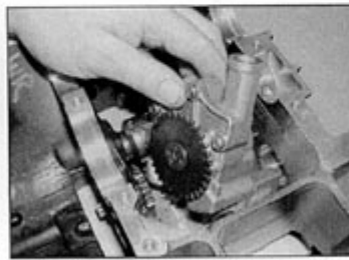
- 5 If the pressure is significantly lower than the standard, either the relief valve is stuck open, the oil pump is faulty, the oil pump pick-up strainer is blocked or there is other engine damage. Begin diagnosis by checking the oil pump pick-up strainer and relief valve (see Sections 18 and 19), then the oil pump. If those items check out okay, chances are the bearing oil clearances are excessive and the engine needs to be overhauled.
- 6 If the pressure is too high, the relief valve is stuck closed. To check it, see Section 19.
- 7 Stop the engine and unscrew the gauge and adapter from the crankcase. Install the oil pressure switch (see Chapter 8).
- 8 On Daytona and Sprint ST models install the fairing panel (see Chapter 8).

#### Removal

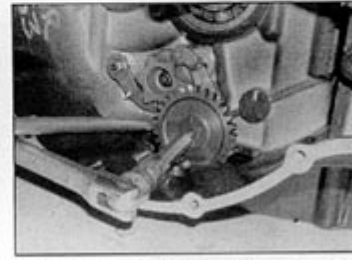
- 9 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21).
- 10 The oil pump is housed in the crankcase lower half. Remove the selector fork shaft and forks (see Section 29, Step 2).
- 11 Turn the oil pump so that the tab on the end of its shaft that locates into the water pump shaft is vertical. Remove the four screws from the underside of the crankcase and remove the oil pump from the top (see illustrations). Remove the pump locating dowels from the underside of the pump if they are loose (see illustration 30.21a).
- 12 If required, undo the screw and remove the washer securing the oil pump middle drive gear, then slide the gear off its shaft (see illustrations). Withdraw the middle driven



30.11a Undo the screws (arrowed) ...

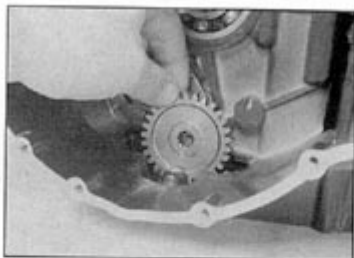


30.11b ... and remove the oil pump

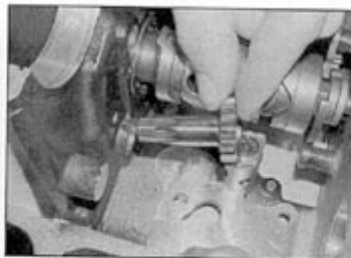


30.12a Counter-hold the gear and undo the screw ...

## 2•58 Engine, clutch and transmission



30.12b ... then slide the gear off the shaft



30.12c Withdraw the middle gear from the crankcase



30.15a Measuring rotor tip clearance

gear from inside the crankcase (see illustration).

### Inspection

**Note:** Individual internal parts are not available for the oil pump; if the checks described below indicate that the pump is worn, it must be renewed as a complete unit. The various drive gears are available individually.

13 Counter-hold the oil pump driven gear, then undo the screw and remove the washer securing it on the pump shaft and slide it off.

14 Undo the four screws securing the pump cover and remove the cover. Remove the dowels for safekeeping if they are loose.

15 Measure the clearance between the inner

rotor tip and the outer rotor tip with a feeler gauge (see illustration). Also measure the clearance between the outer rotor and the pump body (see illustration). Finally, lay a straight-edge across the rotors and pump body and measure the rotor end-float (gap between the rotors and pump body) with a feeler gauge (see illustration). If any of the results are outside the limits listed in this Chapter's Specifications, replace the pump with a new one.

16 Pick the inner and outer rotors out of the pump. Examine them for scoring and wear (see illustration).

17 Before reassembling the pump, make sure that all parts are clean. Have a supply of the correct grade of engine oil on hand to

lubricate the rotors as they are installed. Install the outer rotor so that the side with the dot faces outwards.

18 If removed, fit the dowels into the pump, then locate the cover onto them and tighten the screws securely.

19 Inspect the oil pump drive gear, middle drive and driven gears, and the oil pump driven gear for signs of wear or damage, and replace them with new ones if necessary. Fit the oil pump driven gear onto the pump shaft, then fit the washer and tighten the screw to the torque setting specified at the beginning of the Chapter.

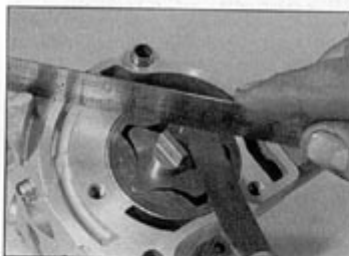
### Installation

20 If removed, lubricate the middle gear shaft with clean oil and insert it in the crankcase (see illustration 30.12c). Slide the drive gear onto the end of the shaft (see illustration 30.12b), then fit the washer and tighten the screw to the torque setting specified at the beginning of the Chapter (see illustration).

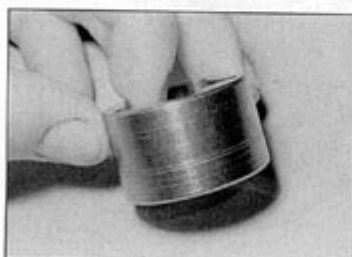
21 Check that the pump driveshaft rotates freely. If removed, fit the two dowels in the underside of the pump (see illustration). Install the oil pump in the crankcase, engaging the tab on the end of the shaft with the slot in the water pump shaft (see illustration 30.11b). Apply a drop of non-permanent thread locking compound to



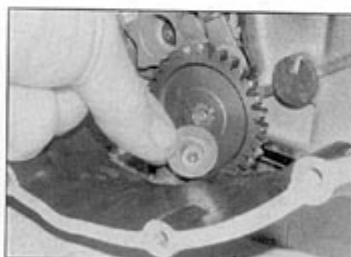
30.15b Measuring outer rotor-to-body clearance



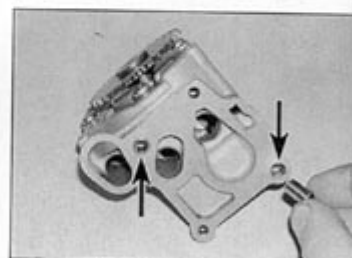
30.15c Measuring rotor end-float



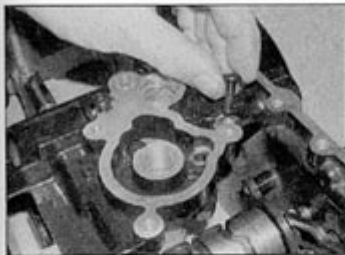
30.16 Look for scoring and wear, such as on this outer rotor



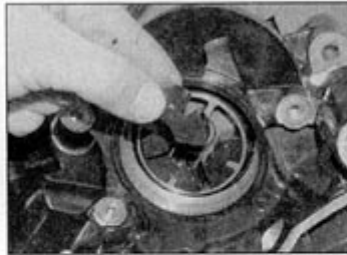
30.20 The dished side of the washer faces out so the screw head sits in it



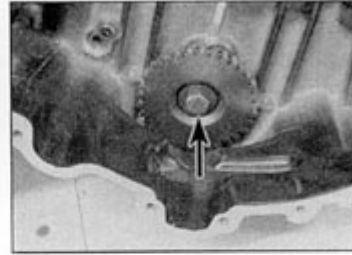
30.21a Fit the dowels into the pump if removed (arrowed)



30.21b Apply a threadlock to the pump screws



31.5 Remove the rubber dampers from the drive housing



31.6a Counter-hold the bolt (arrowed) . . .

the four retaining screws and tighten them to the specified torque setting (see illustration).

22 Install the selector forks and shaft (see Section 29, Step 27).

23 Reassemble the crankcase halves (see Section 21).

### 31 Starter clutch and alternator drive shaft – removal, inspection and installation

**Note:** While it is possible to remove the alternator drive shaft with the engine in the frame, it is a tricky operation that requires feeding a new shaft through the assembly at the same time as the old shaft is withdrawn. This is to prevent certain internal components from falling out of position and to prevent

others from dropping into the crankcase. It is possible for this to happen without you knowing it, and so it is not a procedure we advise. Besides which, it is very unlikely that you will ever have to renew the drive shaft. To remove the starter clutch, which is a much more likely necessity, the engine must be removed and the crankcases split.

#### Starter clutch check

- 1 If you suspect the starter clutch of being faulty, a simple check can be performed with the engine in the frame.
- 2 Remove the starter motor (see Chapter 8).
- 3 Using your finger inserted in the starter motor aperture, check that the starter idle/reduction gear turns freely anti-clockwise (as you look at it), and locks solid when turned clockwise. If not, remove the starter clutch for further investigation.

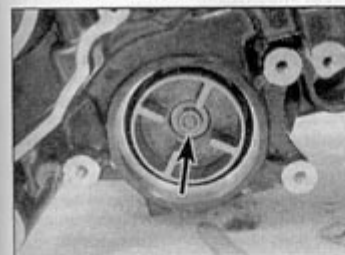
#### Removal

4 Remove the engine from the frame and separate the crankcase halves (see Sections 5 and 21). The alternator/starter clutch drive is housed in the upper crankcase half. Remove the transmission shafts (see Section 27).

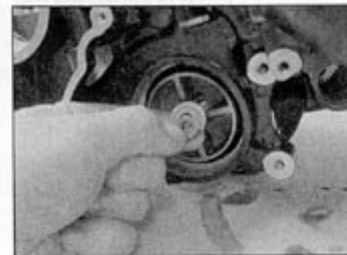
5 If not already done, remove the rubber dampers from the alternator drive housing (see illustration).

6 Counter-hold the drive shaft bolt (which also secures the alternator driven gear) and unscrew the drive housing nut (see illustrations). Remove the nut, washer and the housing (see illustrations). Withdraw the bolt and washer from the other side of the casing, the slide the driven gear off the shaft (see illustrations).

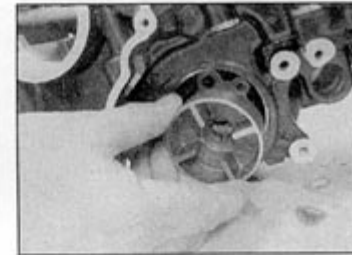
7 Unscrew the bolts and remove the ball bearing retaining washers from the alternator side (see illustration). Withdraw the



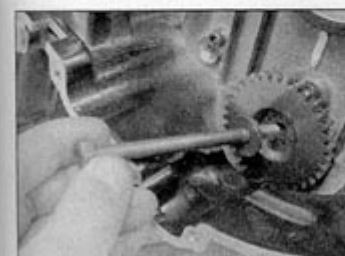
31.6b . . . and unscrew the nut (arrowed)



31.6c Remove the nut and washer . . .



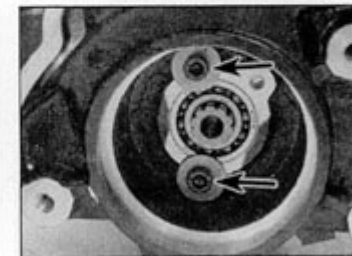
31.6d . . . and slide the housing off the shaft



31.6e Withdraw the bolt and remove the washer . . .



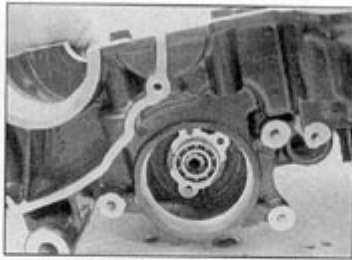
31.6f . . . and slide the gear off the shaft



31.7a Unscrew the bolts (arrowed) and remove the washers

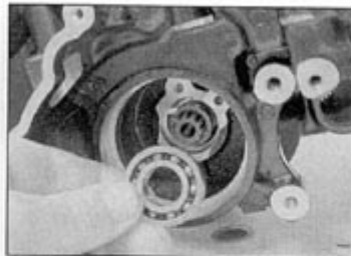


## 2•60 Engine, clutch and transmission



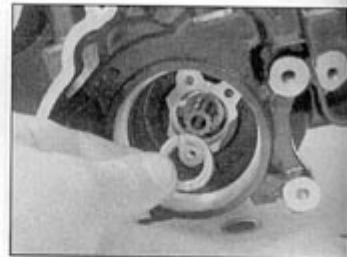
31.7b Angle the shaft down and push it in to dislodge the bearing ...

driveshaft a little way from the right-hand side, then tilt it down and push it back in to displace the ball bearing in the alternator side (see illustration). Remove the bearing and



31.7c ... then remove the bearing ...

the spacer, noting which way round it fits, then support the starter clutch and withdraw the shaft fully from the right-hand side (see illustrations). Lift the starter clutch out, then



31.7d ... and the spacer, noting which way round it fits

remove the splined spacer from the needle bearing if it didn't come out with the shaft (see illustration). Discard the drive shaft bolt and nut as Triumph specify new ones must be used.

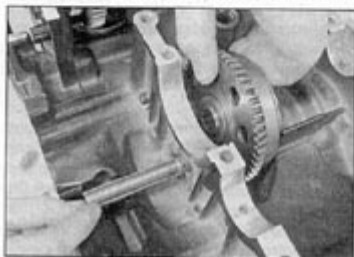
8 If required, unscrew the bolt and remove the washer securing the starter idle/reduction gear shaft (see illustration). Support the idle/reduction gear and withdraw the shaft from the crankcase, using a small screwdriver inserted in it and levered against it to help draw it out, then remove the gear, noting which way round it fits (see illustration).

### Inspection

9 Hold the starter clutch body with the driven gear facing up, and check that the gear turns freely anti-clockwise (as you look at it), and locks solid when turned clockwise. If not, disassemble the starter clutch as follows for further investigation.

10 Remove the circlip securing the driven gear to the starter clutch and remove the outer thrustwasher (see illustrations). Withdraw the gear from the clutch, rotating it anti-clockwise as you do so the sprags don't grip its hub (see illustration). Withdraw the needle roller bearing and inner thrustwasher from the boss (see illustrations).

11 Examine the bearing surface of the starter driven gear hub and the condition of the sprags inside the clutch body. If the hub and sprags show signs of excessive wear or are damaged (and if problems have been experienced in starting the engine), replace the starter clutch assembly with a new one – the sprag assembly



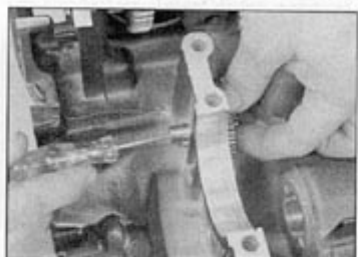
31.7e Withdraw the splined shaft and lift the starter clutch out



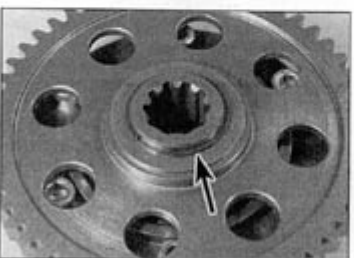
31.7f Remove the splined spacer from the needle bearing if it didn't come out with the shaft



31.8a Unscrew the bolt (arrowed) and remove the washer ...



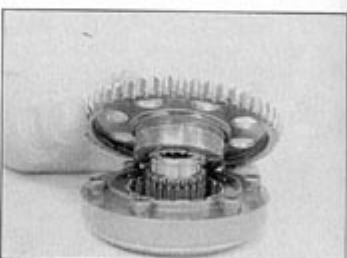
31.8b ... then withdraw the shaft and remove the idle/reduction gear



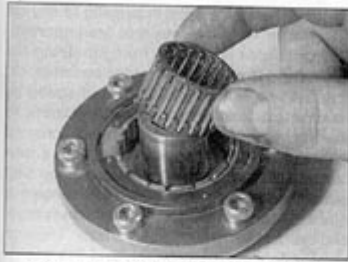
31.10a Remove the circlip (arrowed) ...



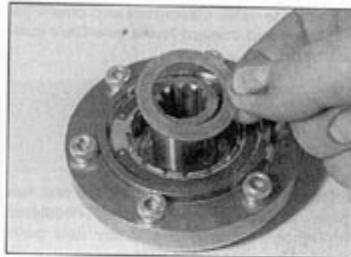
31.10b ... and the outer thrust washer



31.10c Withdraw the driven gear from the hub as described ...



31.10d ... then remove the needle bearing ...



31.10e ... and the thrust washer



31.11a Check that the bolts are tight

and driven gear are not available individually – the entire starter clutch must be renewed. Check that the six bolts securing the sprag assembly in the clutch body are all tight (see illustration). If any are loose, remove them all, then apply a suitable non-permanent thread locking compound to the threads and tighten them to the torque setting specified at the beginning of the Chapter (see illustration).

12 Fit the thrustwasher over the centre boss, followed by the needle roller bearing (see illustrations 31.10e and d). Insert the driven gear hub in the starter clutch, rotating it anti-clockwise as you do to spread the sprags and allow it to enter (see illustration 31.10c).

13 Check the teeth of the various gears and renew the gears if any damage or excessive wear is found.

14 Inspect the alternator cush drive rubbers. If compacted or deteriorated they should be renewed.

15 Check the condition of the driveshaft splines and the corresponding splines on the spacer, the starter driven gear and alternator drive housing. Renew any components that are worn or damaged. Also check the idle/reduction gear and its shaft for wear – fit the shaft into the gear and check for any freeplay between them.

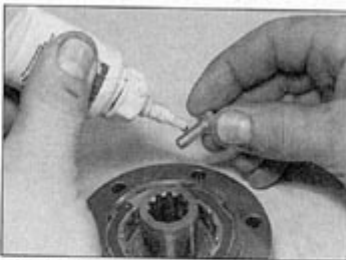
16 Check the condition of the ball and needle bearings for the driveshaft and replace them with new ones if necessary. Refer to *Tools and Workshop Tips* in the Reference Section for details of bearing checks. The needle bearing is secured by a screw and washer (see illustration). Apply a non-permanent

threadlock to the screw on installation and tighten it to the specified torque.

#### Installation

17 Lubricate the idle/reduction gear shaft with clean oil. Position the gear in the crankcase with its larger pinion against the side of the crankcase and slide the shaft fully into place from the outside of the crankcase (see illustration). Apply a drop of non-permanent thread locking compound to the threads of the shaft retainer bolt, then install it with its washer and tighten it to the torque setting specified at the beginning of the Chapter (see illustration 31.8a).

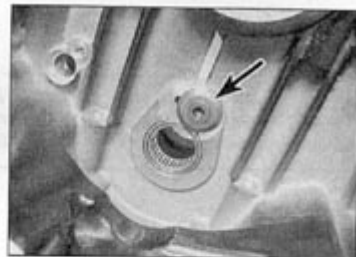
18 Fit the splined spacer into the needle bearing (see illustration 31.7f). Position the starter clutch in the crankcase as shown and locate it against the spacer to prevent it being pushed out, then slide the driveshaft through (see illustration 31.7e).



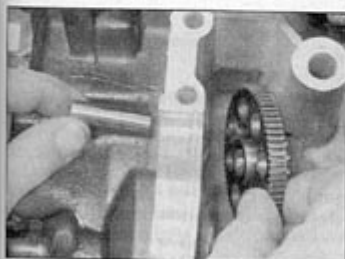
31.11b If any are loose, remove them all and apply a thread-lock

19 Fit the spacer onto the alternator end of the shaft with its notched side facing out (see illustration 31.7d). Fit the ball bearing into its housing (see illustration 31.7c), holding the other end of the shaft to prevent it being pushed out (see illustration). Apply a suitable non-permanent threadlocking compound to the bearing retainer bolt threads, then install the bolts with their washers and tighten them to the specified torque (see illustration 31.7a).

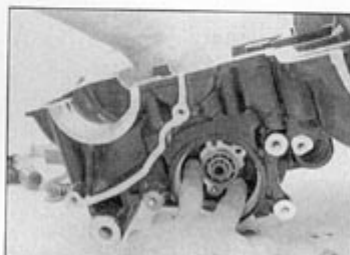
20 Slide the alternator driven gear onto the right-hand end of the shaft (see illustration 31.6f). Slide the alternator drive housing onto the left-hand end of the shaft (see illustration 31.6d). Fit the washer onto the new long bolt, then slide the bolt through the driveshaft (see illustration 31.6e). Fit the washer and a new nut onto the end of the bolt (see illustration 31.6c), then counter-hold the bolt and tighten the nut to the specified torque setting (see illustration).



31.16 Undo the screw and remove the washer to free the needle bearing



31.17 Position the gear in the crankcase and slide the shaft through



31.19 Hold the other end of the shaft as you insert the bearing



31.20 Counter-hold the bolt and tighten the nut to the specified torque

## 2•62 Engine, clutch and transmission

21 Install the transmission shafts (see Section 27) and reassemble the crankcase halves (see Section 21). When installing the alternator, do not forget to fit the rubber dampers (see illustration 31.5).

## 32 Initial start-up after overhaul

- 1 Make sure the engine oil and coolant levels are correct (see *Daily (pre-ride) checks*).
- 2 Make sure there is fuel in the tank.
- 3 Start the engine and let it run at a moderately fast idle until it reaches normal operating temperature.



**Warning:** If the oil pressure warning light doesn't go off, or it comes on while the engine is running, stop the engine immediately.

- 4 Check carefully that there are no oil leaks and make sure the transmission and controls, especially the brakes, function properly before road testing the machine. Refer to Section 33 for the recommended running-in procedure.
- 5 Upon completion of the road test, and after the engine has cooled down completely,

recheck the valve clearances and check the engine oil and coolant levels (see *Daily (pre-ride) checks*).

## 33 Recommended running-in procedure

- 1 Treat the machine gently for the first few miles to make sure oil has circulated throughout the engine and any new parts installed have started to seat.
- 2 Even greater care is necessary if new pistons and liners or a new crankshaft has been installed. In the case of new pistons and liners, the bike will have to be run in as if when new. This means greater use of the transmission and a restraining hand on the

throttle. There's no point in keeping to any set speed limit – it's the revs that are important. The main idea is to keep from labouring the engine and to gradually increase performance. It is best to vary engine and road speed as much as possible within the specified limits, so use the gearbox. These recommendations can be lessened to an extent when only a new crankshaft is installed. Experience is the best guide, since it's easy to tell when an engine is running freely. The table shows maximum engine speed limitations, which Triumph provide for new motorcycles, and this can be used as a guide. Full throttle should not be used until after the running-in period.

- 3 If a lubrication failure is suspected, stop the engine immediately and try to find the cause. If an engine is run without oil, even for a short period of time, severe damage will occur.

|                                     |              |
|-------------------------------------|--------------|
| Up to 100 miles (160 km)            | 3500 rpm max |
| 100 to 300 miles (160 to 500 km)    | 5000 rpm max |
| 300 to 600 miles (500 to 1000 km)   | 6000 rpm max |
| 600 to 800 miles (1000 to 1300 km)  | 7000 rpm max |
| 800 to 1000 miles (1300 to 1600 km) | 8000 rpm max |

## Chapter 3

### Cooling system

#### Contents

|                                                                      |                                    |                                                                               |               |
|----------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------|---------------|
| Coolant hoses, pipes and unions – removal and installation . . . . . | 8                                  | General information . . . . .                                                 | 1             |
| Coolant level check . . . . .                                        | see <i>Daily (pre-ride) checks</i> | Oil cooler – removal and installation . . . . .                               | see Chapter 2 |
| Coolant reservoir – removal and installation . . . . .               | 3                                  | Radiator pressure cap – check . . . . .                                       | 2             |
| Coolant temperature gauge – check and renewal . . . . .              | see Chapter 8                      | Radiator – removal and installation . . . . .                                 | 6             |
| Coolant temperature sensor – check and renewal . . . . .             | see Chapter 4                      | Thermostat and thermostat housing – removal, check and installation . . . . . | 5             |
| Cooling fan and relay – check and renewal . . . . .                  | 4                                  | Water pump – check, removal and installation . . . . .                        | 7             |
| Cooling system checks . . . . .                                      | see Chapter 1                      |                                                                               |               |
| Cooling system draining, flushing and refilling . . . . .            | see Chapter 1                      |                                                                               |               |

#### Degrees of difficulty

|                                                        |                                                                                     |                                                               |                                                                                     |                                                             |                                                                                     |                                                        |                                                                                       |                                                               |                                                                                       |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Easy, suitable for<br>novice with little<br>experience |  | Fairly easy, suitable<br>for beginner with<br>some experience |  | Fairly difficult,<br>suitable for competent<br>DIY mechanic |  | Difficult, suitable for<br>experienced DIY<br>mechanic |  | Very difficult,<br>suitable for expert DIY<br>or professional |  |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------|

#### Specifications

|                                          |                    |
|------------------------------------------|--------------------|
| <b>Coolant</b>                           |                    |
| Mixture type and capacity . . . . .      | see Chapter 1      |
| <b>Radiator</b>                          |                    |
| Cap valve opening pressure . . . . .     | 16.0 psi (1.1 Bar) |
| <b>Cooling fan</b>                       |                    |
| Cooling fan cut-in temperature . . . . . | 95°C               |
| <b>Thermostat</b>                        |                    |
| Opening temperature . . . . .            | 85°C               |
| <b>Torque wrench settings</b>            |                    |
| Thermostat cover bolts . . . . .         | 7 Nm               |
| Radiator mounting bolts . . . . .        | 9 Nm               |
| Water pump bolts . . . . .               | 10 Nm              |
| Coolant inlet union bolts . . . . .      | 12 Nm              |
| Coolant outlet union bolts . . . . .     | 9 Nm               |



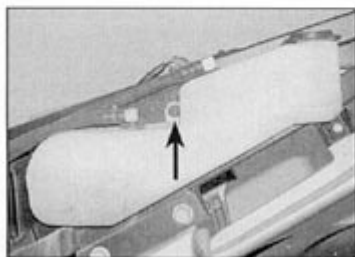
## 3•2 Cooling system

## 1 General information

The cooling system uses a water/antifreeze coolant to carry away excess energy in the form of heat. The cylinders are surrounded by a water jacket from which the heated coolant is circulated by thermo-syphonic action in conjunction with a water pump. The water pump is driven by the oil pump. The hot 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 sensor, mounted in the thermostat housing on Daytona, Speed Triple and Tiger models, and in the outlet union on Sprint models, transmits information to the engine management system. This information is used to help optimise the fuelling of the engine at all temperatures. The engine management system also controls the temperature gauge and the cooling fan, via a relay. Because the control side of these cooling system functions is integral with the engine management system, they are dealt with in Chapter 4. The function side of the cooling fan and relay are in this Chapter, while the function of the temperature gauge is in Chapter 8.

The complete cooling system is partially sealed and pressurised, the pressure being controlled by a valve contained in the spring-loaded radiator cap. By pressurising the coolant the boiling point is raised, preventing premature boiling in adverse conditions. The overflow pipe from the system is connected to a reservoir into which excess coolant is expelled under pressure. The discharged coolant automatically returns to the radiator when the engine cools.



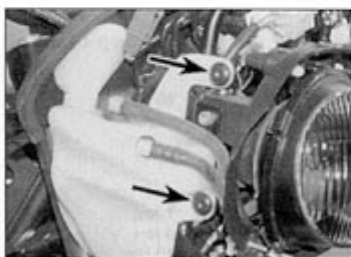
3.2a Reservoir mounting bolt (arrowed) – Sprint models



**Warning:** Do not remove the pressure cap from the radiator when the engine is hot. Scalding hot coolant and steam may be blown out under pressure, which could cause serious injury. When the engine has cooled, place a thick rag, like a towel over the pressure cap; slowly rotate the cap anti-clockwise to the first stop. This procedure allows any residual pressure to escape. When the steam has stopped escaping, press down on the cap while turning it anti-clockwise and remove it. Do not allow antifreeze to come into contact with your skin or painted surfaces of the motorcycle. Rinse off any spills immediately with plenty of water. Antifreeze is highly toxic if ingested. Never leave antifreeze 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 antifreeze. Many communities will have collection centres which will see that antifreeze is disposed of safely.

**Caution:** At all times use the specified type of antifreeze, and always mix it with distilled water in the correct proportion. The antifreeze 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 as opposed to tap water to avoid a build-up of scale which would also block the passages.

Many of the bolts used on Triumph motorcycles are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to obtain a set. Make sure you get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be useful in addition to the bits.



3.2b Reservoir mounting bolts (arrowed) – Tiger models

## 2 Radiator pressure cap – check

1 If problems such as overheating or loss of coolant occur, check the entire system as described in Chapter 1. The radiator cap opening pressure should be checked by a Triumph dealer with the special tester required for the job. If the cap is defective, replace it with a new one.

## 3 Coolant reservoir – removal and installation

## Removal

1 On Daytona and Speed Triple models, remove the seat (see Chapter 7). On Sprint models, remove the seat cowling (see Chapter 7). On Tiger models, remove the fairing (see Chapter 7).

2 Release the clamps securing the hoses to the unions on the reservoir and detach them, noting which fits where. Remove the reservoir – on Daytona and Speed Triple models, draw it out from under the frame cross-member; on Sprint models, remove the single bolt securing it to the frame (see illustration); on Tiger models, remove the two bolts securing it to the fairing stay (see illustration). Remove the filler cap and tip the contents into a suitable container.

## Installation

3 Installation is the reverse of removal. Make sure the hoses are correctly installed and secured with their clamps. On completion refill the reservoir (see *Daily (pre-ride) checks*).

## 4 Cooling fan and relay – check and renewal

## Cooling fan

## Check

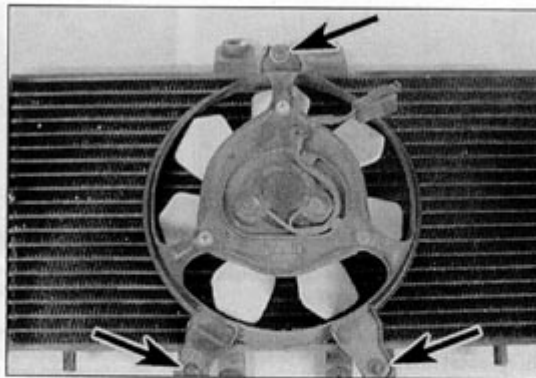
1 If the engine is overheating and the cooling fan isn't coming on, first check the fan fuse (see Chapter 8). On Daytona, Speed Triple, Sprint ST and Tiger models to VIN 89736, also check the fan relay as described below.

2 If the fuse and relay (where fitted) are good and the fan still does not come on, the fault could lie in either the cooling fan motor itself, or the relevant wiring and connectors. Test all the wiring and connections as described in Chapter 8, referring to the Wiring Diagram for your model.

3 To test the cooling fan motor, on Daytona and Sprint models, remove the fairing side panels (see Chapter 7). On Tiger models, remove the fuel tank (see Chapter 4). On all



4.3 Cooling fan wiring connector – Daytona shown



4.5 Fan motor screws (arrowed)

models, trace the wiring from the fan motor and disconnect it at the connector (see illustration). Using a 12 volt battery and two jumper wires, connect the positive (+ve) battery lead to the blue/white or brown/pink wire terminal (depending on model) on the fan wiring connector and the negative (-ve) lead to the black, black/yellow or black/green wire terminal (depending on model). Once connected the fan should operate. If it does not, and the wiring is all good, then the fan motor is faulty. Replace the fan assembly with a new one – individual components are not available. If all tests so far have shown no problems, test the coolant temperature sensor and engine management system (see Chapter 4).

#### Renewal



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

- 4 Remove the radiator (see Section 6).
- 5 Undo the three screws securing the fan assembly to the radiator and remove it (see illustration).
- 6 Installation is the reverse of removal.

#### Cooling fan relay – Daytona, Speed Triple, Sprint ST and Tiger models to VIN 89736

##### Check

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

8 If the fuse is good, on Daytona, Speed Triple and Tiger models, remove the seats, and on Sprint ST models remove the seat cowling (see Chapter 7). Disconnect the relevant relay from its connector block (see illustrations) – on Sprint ST models, Triumph advise that the exact location of each relay is subject to change, so it is impracticable to

specify its exact position in the relay pack – identify the relay by the blue coloured tag around the wiring going into it. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the *Wiring Diagrams* at the end of the Chapter.

9 Set a multimeter to the ohms x 1 scale and its probes between the blue/black (No. 1) and blue/white (No. 8) wire terminals on the relay. Using a fully-charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the black/yellow (No. 4) wire terminal on the relay, and the negative (-ve) terminal to the brown/pink (No. 6) wire terminal on the relay. At this point the relay should be heard to click and the multimeter read 0 ohms (continuity). If this is the case the relay is proved good. If the relay does not click when battery voltage is applied and indicates no continuity (infinite resistance) across its terminals, it is faulty and must be replaced with a new one. If the relay is good, test the fan motor (see Step 3).

#### Renewal

10 Carefully disconnect the relevant relay from its connector block (see illustration 4.8a, b or c).

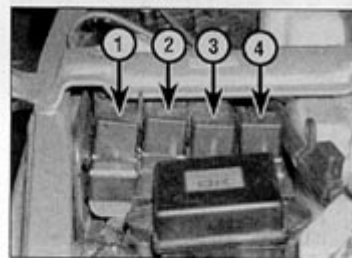
11 Plug the new relay into its connector.



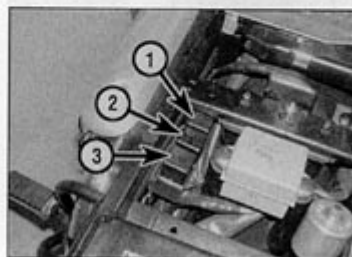
4.8b Relay pack – Sprint ST models. Identify the correct relay from the coloured identity tags (arrowed) – the cooling fan relay has a blue tag

#### 5 Thermostat housing and thermostat – removal, check and installation

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.

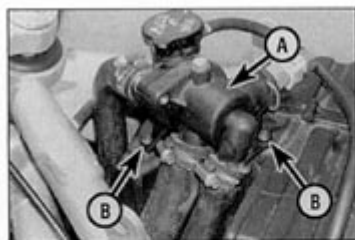


4.8a Cooling fan relay (2) – Daytona and Speed Triple models

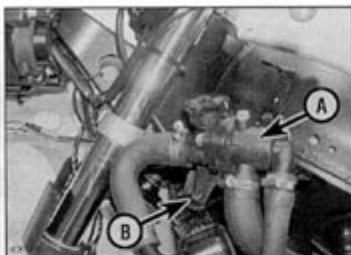


4.8c Cooling fan relay (1) – Tiger models

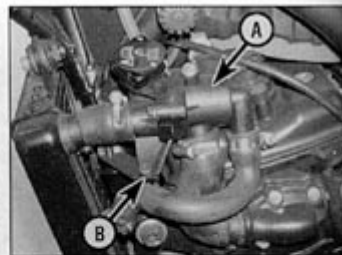
## 3•4 Cooling system



5.5a Thermostat housing (A) and mounting screws (B) – Daytona and Speed Triple models



5.5b Thermostat housing (A) and mounting screw (B) – Sprint models



5.5c Thermostat housing (A) and mounting screw (B) – Tiger models

**Removal****Thermostat housing**

2 On Daytona, Speed Triple and Tiger models, remove the fuel tank (see Chapter 4). On Sprint models, remove the left-hand fairing side panel (see Chapter 7).

3 Drain the cooling system (see Chapter 1).

4 On Daytona, Speed Triple and Tiger models, either disconnect the coolant temperature sensor wiring connector, or remove the sensor from the housing (see Chapter 4).

5 Slacken the clamps securing the hoses to the thermostat housing and detach the hoses, noting which fits where (see illustrations). Undo the screw(s) securing the housing and remove it, noting how it fits.

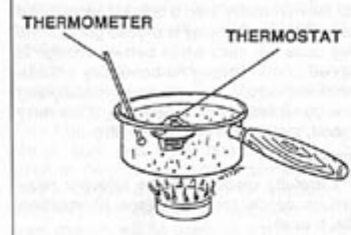
**Thermostat**

6 Drain the cooling system (see Chapter 1).

7 Remove the thermostat housing if required



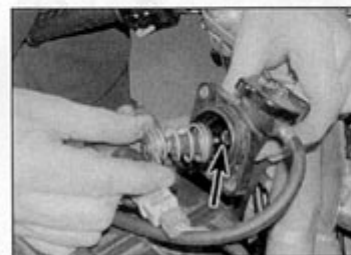
5.8 Thermostat cover bolts (arrowed) – Daytona shown



5.10 Thermostat testing set-up



5.14a Fit a new O-ring into the groove



5.14b Locate the point in the socket (arrowed) . . .



5.14c . . . then join the housing, locating the thermostat tabs in the slots

(see above), but note that it is possible to remove the thermostat with the housing in situ, or only displaced and with some or all hoses still attached, depending on your model. If you are working on a Daytona or Speed Triple model, then you need only remove the fuel tank cover (see Chapter 4), though removing the fuel tank as well provides better access.

8 Unscrew the bolts joining the thermostat housing and cover and separate them (see illustration and 5.13c). Withdraw the thermostat, noting how it fits (see illustration 5.13b). Discard the O-ring as a new one must be used (see illustration 5.13a).

**Check**

9 Examine the thermostat visually before carrying out the test. If it remains in the open position at room temperature, it should be replaced with a new one.

10 Suspend the thermostat by a piece of wire

in a container of cold water. Place a thermometer 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 specified opening temperature given at the beginning of the Chapter. If the thermostat opens at a different temperature, does not open at all, or is permanently open, it is faulty and must be replaced with a new one.

11 In the event of thermostat failure, 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****Thermostat housing**

12 Installation is the reverse of removal. Make sure the hoses are pushed fully on to their unions and are secured by the clamps (see illustrations 5.5a, b or c).

13 Refill the cooling system (see Chapter 1 and Daily (pre-ride) checks).

**Thermostat**

14 Fit a new O-ring into the groove in the housing (see illustration). Fit the thermostat into the cover, locating the point of the thermostat in the socket in the cover (see illustration). Join the housing and the cover, aligning the tabs on the thermostat with the slots in the housing, then install the bolts and tighten them to the torque setting specified at the beginning of the Chapter (see illustration).



6.4a Radiator hose clamps (arrowed) - Daytona and Speed Triple models



6.4b Radiator hose clamps (arrowed) - Sprint models



6.4c Radiator hose clamps (arrowed) - Tiger models

15 Install the housing (see above) and all other components, according to your model, referring to the relevant Chapter(s).

## 6 Radiator - removal and installation

### Removal

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

- 1 On Daytona and Sprint models, remove the fairing side panels and belly-pan (see Chapter 7). On Tiger models, remove the fuel tank (see Chapter 4). Trace the wiring from the fan motor and disconnect it at the connector (see illustration 4.3). On Sprint models, remove the screw securing the thermostat housing to the radiator (see illustration 5.5b).
- 2 Drain the cooling system (see Chapter 1).
- 3 Displace the oil cooler from its mountings and support it clear of the radiator (see Chapter 2) - there is no need to detach the hoses from the cooler.
- 4 Slacken the clamps securing all the radiator hoses and detach them from the radiator, noting which fits where (see illustrations).
- 5 Unscrew the two bolts securing the radiator, noting the arrangement of the collars and rubber grommets, then lift the radiator so the bottom mounting lugs clear their sockets and remove it (see illustrations).
- 6 If necessary, separate the cooling fan from the radiator (see Section 4).

7 Check the radiator for signs of damage and clear any dirt or debris that might obstruct air flow and inhibit cooling. If the radiator fins are badly damaged or broken the radiator must be renewed. Also check the rubber mounting grommets, and replace them with new ones if necessary.

### Installation

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

- a) Make sure the collars and grommets are correctly installed with the mounting bolts (see illustration 6.5d). Tighten the bolts to the torque setting specified at the beginning of the Chapter.
- b) Make sure that the wiring connector is correctly connected (see illustration 4.3).
- c) Ensure the coolant hoses are in good condition (see Chapter 1), and are

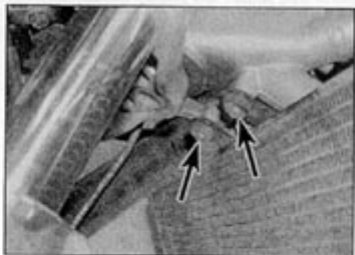
securely retained by their clamps, using new ones if necessary.

- d) On Sprint ST models, do not forget to secure the thermostat housing to the radiator (see illustration 5.5b).
- e) On completion refill the cooling system as described in Chapter 1 and 'Daily (pre-ride) checks'.

## 7 Water pump - check, removal and installation

### Check

- 1 The water pump is located on the left-hand side of the engine.
- 2 To prevent leakage of water from the cooling system to the lubrication system and



6.5a Radiator mounting bolts (arrowed) - Daytona and Speed Triple models



6.5b Radiator mounting bolt (arrowed) - there is one on each side - Sprint models



6.5c Radiator mounting bolts (arrowed) - Tiger models



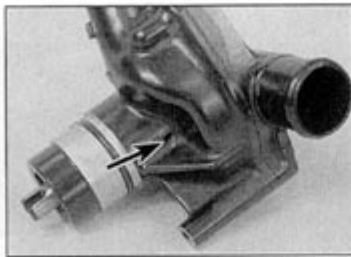
6.5d Note any collars, washers and grommets



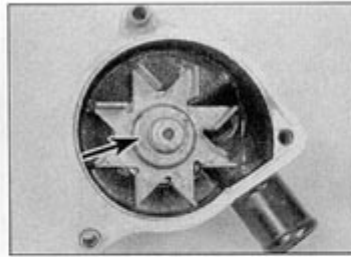
6.5e Lift the radiator so that the bottom lugs clear their sockets (arrowed)



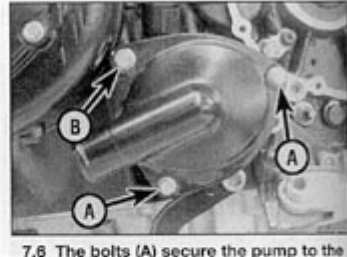
## 3•6 Cooling system



7.2 Water pump drain hole (arrowed)



7.3 Check the impeller (arrowed) as described



7.6 The bolts (A) secure the pump to the engine as well as the cover, the bolt (B) just secures the cover

vice versa, two seals are fitted on the pump shaft. The seal on the water pump side is of the mechanical type which bears on the rear face of the impeller. The second seal, which is mounted behind the mechanical seal is of the normal feathered lip type. On the bottom of the pump there is a drain hole (see illustration). If either seal fails, the drain allows the coolant or oil to escape and prevents them mixing. However, neither seal is available as a separate item as the pump is sold as an assembly. Therefore, if on inspection the drainage hole shows signs of leakage, the pump must be removed and replaced with a new one.

3 Remove the pump cover (see Step 6 below), noting that the cooling system must first be drained. Wiggle the water pump impeller back-and-forth and in-and-out, and spin it by hand (see illustration). If there is excessive

movement, or the pump is noisy or rough when turned, remove the pump (see below) and check it, particularly the bearing, visually and mechanically. If any wear or damage is found, replace the pump with a new one – individual components are not available.

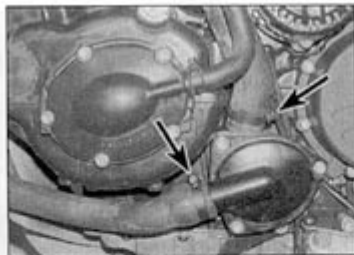
4 Check the pump housing and cover, and the impeller and shaft for cracks, deformation and any other damage. Check that the shaft is straight – if it is bent, replace the pump with a new one. Also check for corrosion or a build-up of scale in the pump body and clean or renew the pump as necessary.

**Removal**

5 Drain the cooling system (see Chapter 1).

6 If you just want to remove the cover to inspect the pump, unscrew the three bolts and remove the cover (the hose can stay attached) (see illustration).

7 To remove the pump, slacken the clamps securing the coolant hoses to it and detach them, noting which fits where (see illustration). Unscrew the lower and rear bolts (see illustration 7.6) and draw the pump out of the engine (see illustration). Discard the O-ring as a new one must be used (see illustration). If you now wish to remove the cover unscrew the remaining bolt (see illustration). It is possible that the dowels locating the cover have corroded, in which case the cover could be difficult to remove. Tap it with a soft-faced hammer to dislodge it – do not try to lever it off as the mating surfaces could be damaged, or the cover could crack. Try spraying some penetrating oil around the joint. Note the position of the shorter bolt. Remove the dowels if they are loose (see illustration). Discard the cover O-ring as a new one must be used (see illustration).



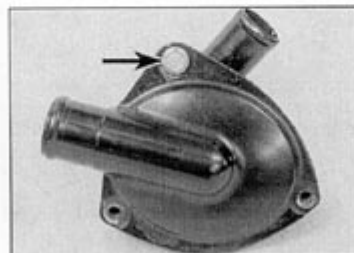
7.7a Slacken the clamps (arrowed) and detach the hoses



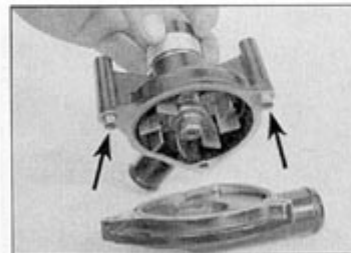
7.7b Draw the pump out of the engine



7.7c Discard the O-ring



7.7d Unscrew the remaining cover bolt...



7.7e ... and remove it, noting the dowels (arrowed)



7.7f Discard the cover O-ring

**Installation**

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

- Fit new O-rings into the grooves in the cover and pump body (see illustrations 7.7f and c).
- Fit the dowels into the cover if removed (see illustration 7.7e). Clean the dowels and smear them with grease if they were corroded.
- Make sure the coolant hoses are pushed fully onto their unions and are secured by their clamps (see illustration 7.7a).
- Refill the cooling system (see Chapter 1 and 'Daily (pre-ride) checks').

## 8 Coolant hoses, pipes and unions – removal and installation

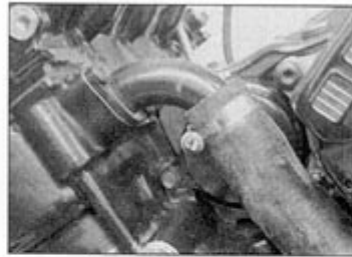
**Removal**

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

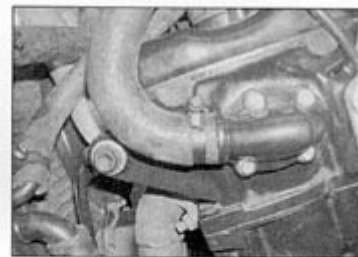
2 Use a screwdriver to slacken the larger-bore hose clamps, then slide them back along the hose and clear of the union spigot. The smaller-bore hoses are secured by spring clamps which can be expanded by squeezing their ears together with pliers.

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

3 If a hose proves stubborn, release it by rotating it on its union before working it off. If all else fails, cut the hose with a sharp knife then slit it at each union so that it can be



8.4a Coolant inlet union



8.4b Coolant outlet union

peeled off in two pieces. Whilst this means renewing the hose, it is preferable to buying a new radiator.

4 Remove the coolant pipes and the unions on the engine by detaching the hoses (see above), then unscrewing the retaining bolts (see illustrations). Discard the gaskets as new ones must be used.

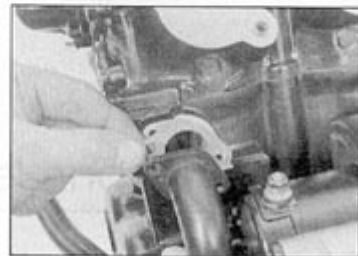
**Installation**

5 Slide the clamp onto the hose and then work it on to its respective union.



**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.

6 Rotate the hose on its union to settle it in position before sliding the clamp into place and tightening it securely.



8.7 Always use a new gasket

7 If the water pipes or unions on the engine have been removed, fit new gaskets, then install them and tighten their mounting bolts to the torque setting specified at the beginning of the Chapter (see illustration).

## Chapter 4

# Engine management system (fuel and ignition)

## Contents

|                                                                                       |               |                                                                        |               |
|---------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------|---------------|
| Air filter – renewal .....                                                            | see Chapter 1 | Fuel tank – cleaning and repair .....                                  | 3             |
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## Degrees of difficulty

Easy, suitable for  
novice with little  
experience



Fairly easy, suitable  
for beginner with  
some experience



Fairly difficult,  
suitable for competent  
DIY mechanic



Difficult, suitable for  
experienced DIY  
mechanic



Very difficult,  
suitable for expert DIY  
or professional



## Specifications

### Fuel

#### Grade

UK and Europe .....

US .....

Unleaded, minimum 95 RON (Research Octane Number)

Unleaded, minimum 89 (R+M)/2 (CLC or AKI Octane rating)

#### Fuel tank capacity (including reserve)

Daytona and Speed Triple models .....

Sprint models .....

Tiger models .....

18 litres

21 litres

23 litres

#### Fuel quantity remaining when level warning light comes on

Daytona and Speed Triple models .....

Sprint models .....

Tiger models .....

3.5 litres

3.0 litres

3.5 litres

## 4•2 Engine management system (fuel and ignition)

### Fuel injection system

|                                                       |                                             |
|-------------------------------------------------------|---------------------------------------------|
| Operating pressure .....                              | 40.0 to 47.0 psi (2.75 to 3.25 Bar) nominal |
| Idle speed .....                                      | 1200 rpm                                    |
| Idle air control valve stepper motor resistance ..... | 47 to 59 ohms                               |
| Fuel injector resistance .....                        | 15.5 to 16.3 ohms                           |
| Purge valve resistance .....                          | 26.0 ohms                                   |

### Engine management system

|                                                                                                     |                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                |                                                                                                                                                                 |
| Daytona, Speed Triple, Sprint ST and Tiger models to VIN 89736 ..                                   | MC 2000 ECM                                                                                                                                                     |
| Daytona, Speed Triple, Sprint ST and Tiger models<br>from VIN 89737, and all Sprint RS models ..... | MC 1000 ECM                                                                                                                                                     |
| Control sensors .....                                                                               | Road speed and camshaft position (T509 and T595 only), intake air pressure, intake air temperature, coolant temperature, crankshaft position, throttle position |
| Sensor input voltage .....                                                                          | 4.5 to 5.5 V                                                                                                                                                    |
| Coolant temperature gauge in-line resistor .....                                                    | 9.0 to 11.0 ohms                                                                                                                                                |
| Tachometer in-line resistor .....                                                                   | 1.1 to 1.3 K-ohms                                                                                                                                               |
| Fuel gauge in-line resistor (Sprint ST and Tiger) .....                                             | 9.0 to 11.0 ohms                                                                                                                                                |
| Lambda sensor heater resistance .....                                                               | 4.0 to 8.0 ohms                                                                                                                                                 |

### Ignition system

|                                                            |                               |
|------------------------------------------------------------|-------------------------------|
| Type .....                                                 | Digital inductive             |
| Firing order .....                                         | 1 - 2 - 3                     |
| Cylinder identification .....                              | 1 - 2 - 3, from left to right |
| Spark plugs .....                                          | see Chapter 1                 |
| Ignition rev limiter                                       |                               |
| Daytona models .....                                       | 10,800 rpm                    |
| Speed Triple models .....                                  | 9,700 rpm                     |
| Sprint models .....                                        | 9,600 rpm                     |
| Tiger models .....                                         | 8,750 rpm                     |
| Ignition coil/cap resistance .....                         | 0.7 to 0.9 ohms               |
| Crankshaft position sensor (pick-up coil) resistance ..... | 1.3 K-ohms $\pm$ 10% @ 20°C   |
| Crankshaft position sensor (pick-up coil) air gap .....    | 0.8 to 1.2 mm                 |

### Torque settings

|                                                                                   |       |
|-----------------------------------------------------------------------------------|-------|
| Fuel tank mountings                                                               |       |
| Daytona and Speed Triple models .....                                             | 12 Nm |
| Sprint models                                                                     |       |
| Front .....                                                                       | 8 Nm  |
| Rear .....                                                                        | 5 Nm  |
| Tiger models                                                                      |       |
| Front .....                                                                       | 8 Nm  |
| Rear .....                                                                        | 9 Nm  |
| Fuel pump mounting plate bolts .....                                              | 6 Nm  |
| Fuel level sensor bolts .....                                                     | 5 Nm  |
| Throttle body screws .....                                                        | 12 Nm |
| Fuel rail bolts .....                                                             | 5 Nm  |
| Fuel hose banjo bolts (Daytona to VIN 71698 and 885 cc Speed Triple models) ..... | 20 Nm |
| Fuel delivery hose union bolts (all other models) .....                           | 5 Nm  |
| Silencer mounting bolt                                                            |       |
| Daytona and Speed Triple models .....                                             | 18 Nm |
| Sprint models .....                                                               | 15 Nm |
| Tiger models .....                                                                | 15 Nm |
| Downpipe assembly nuts (all models)                                               |       |
| Initial setting .....                                                             | 8 Nm  |
| Final setting .....                                                               | 12 Nm |
| Silencer clamp bolt (Sprint) .....                                                | 22 Nm |
| Downpipe assembly rear mounting bolt (Sprint) .....                               | 15 Nm |
| Silencer and downpipe clamp bolts (Tiger) .....                                   | 22 Nm |
| Collector box mounting bolts (Tiger) .....                                        | 3 Nm  |
| Camshaft position sensor screw .....                                              | 10 Nm |
| Speed sensor screw .....                                                          | 9 Nm  |
| Throttle position sensor screws .....                                             | 2 Nm  |
| Idle air control valve mounting screws .....                                      | 12 Nm |



## 1 General information and precautions

### General information

All models are fitted with an electronic engine management system which controls both the fuel and ignition system functions. The system is controlled by an electronic control module, or ECM. The ECM receives information from various sensors around the motorcycle, which it uses to determine the optimum fuel requirements for the fuel injection system and the optimum timing for the ignition system for all engine speeds and loads. Two different systems have been used on the model range, though overall their function is very similar. Early Daytona, Speed Triple, Sprint ST and Tiger models have the MC 2000 ECM, while the later versions of those models and all Sprint RS models have the MC 1000 ECM. They are distinguishable by their different size and by their connectors – the MC 1000 ECM is smaller and has two connectors into it.

The sensors used are for road speed and camshaft position (T509 and T595 only), intake air pressure, intake air temperature, coolant temperature, crankshaft position, and throttle position. In certain markets a Lambda sensor in the exhaust system provides information on the oxygen content of the exhaust gases. More information on the function of these sensors can be found later in this chapter.

The fuel system consists of the fuel tank, the fuel pump, the pressure regulator, the fuel hoses and control cable, the fuel injectors and throttle bodies, and the air intake system. The fuel pump is housed inside the tank. There is an injector for each cylinder, housed in the throttle body. The low fuel warning circuit is operated by a level sensor inside the tank. Cold starting is controlled by the ECM which reacts to the information sent by the intake air temperature and pressure sensors, and the coolant temperature sensor, and adjusts the fuel requirements accordingly – there is no manual method (i.e. a choke) for assisting cold starting. Many of the fuel system service procedures are considered routine maintenance items and for that reason are included in Chapter 1.

The ignition system type is digital inductive, which due to its lack of mechanical parts is totally maintenance free. On all models, the coil for each spark plug is incorporated in the spark plug cap. The system incorporates an electronic advance system controlled by the ECM, which reacts to the information sent to it from the various sensors to provide the spark at the optimum time. A rev limiter prevents the engine exceeding its maximum rpm. The system incorporates a safety interlock circuit which will cut the ignition if the sidestand is put down whilst the engine is running and in

gear, or if a gear is selected whilst the engine is running and the sidestand is down. Note that there is no provision for checking or adjusting the ignition timing on these models.

The engine management system has in-built diagnostic functions which record and store all data should a fault occur. Recorded faults can then be checked using Triumph's diagnostic tool, which reads the data and lists a code to indicate the exact fault. Should a fault occur, the malfunction indicator lamp (MIL) in the instrument cluster illuminates. If this happens, the management system switches itself into 'limp home' mode, so that in theory you should not be left stranded. Depending on the problem, it is possible that you will notice no difference in the running of the motorcycle.

Because of their nature, the individual system components can be checked but not repaired. If system troubles occur, and the faulty component can be isolated, the only cure for the problem is to replace the part with a new one. Keep in mind that most electrical parts, once purchased, cannot be returned. To avoid unnecessary expense, make very sure the faulty component has been positively identified before buying a new part.

Many of the bolts used on Triumph motorcycles are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to obtain a set. Make sure you get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be useful in addition to the bits.

### Precautions



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

Always perform fuel-related 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 (gasoline) 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 (gasoline) 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 (gasoline), and clearly marked as such; the containers themselves should be kept in a safe place. Note that this last point applies equally to the fuel tank if it is removed from the machine; also remember to keep its filler cap closed at all times.

Read the Safety first! section of this manual carefully before starting work.

Owners of machines used in the US, particularly California, should note that their machines must comply at all times with Federal or State legislation governing the permissible levels of noise and of pollutants such as unburnt hydrocarbons, carbon monoxide etc. that can be emitted by those machines. All vehicles offered for sale must comply with legislation in force at the date of manufacture and must not subsequently be altered in any way which will affect their emission of noise or of pollutants.

In practice, this means that adjustments may not be made to any part of the fuel, ignition or exhaust systems by anyone who is not authorised or mechanically qualified to do so, or who does not have the tools, equipment and data necessary to properly carry out the task. Also if any part of these systems is to be replaced it must be replaced with only genuine Triumph components or by components which are approved under the relevant legislation. The machine must never be used with any part of these systems removed, modified or damaged.

## 2 Fuel tank – removal and installation



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

### Removal

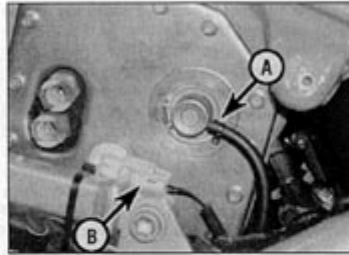
#### Daytona and Speed Triple models

- 1 Make sure the fuel cap is secure.
- 2 Remove the seats, the seat cowl and the fuel tank cover (see Chapter 7).
- 3 Mark or tag each fuel hose with the location of its socket on the tank to prevent confusion on installation – the hoses must be fitted the same way round. The feed and return hose unions and the outlets from the tank are self-sealing, so there is no need to worry about

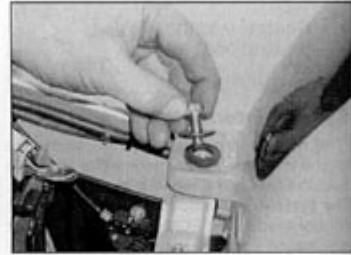
## 4•4 Engine management system (fuel and ignition)



2.3 Press the retaining clip in to release the fuel hose



2.4 Fuel pressure regulator hose (A), fuel pump wiring connector (B)



2.5a Unscrew the bolt at the rear ...

fuel spillage when releasing them. Hold each hose union in turn and press the retaining clip in – the hose will spring out of its socket (see illustration).

4 Release the clamp securing the hose to the fuel pressure regulator and detach the hose (see illustration).

5 Unscrew the bolt securing the rear of the tank (see illustration). Unscrew the bolt securing each tank support rubber at the front and remove them, noting how they fit (see illustration). If required, raise the tank at the rear using a block of wood.

6 Mark or tag the drain and breather hoses on the left-hand side of the tank so they can be installed on the correct union (see illustration). Detach the hoses from the unions.

7 Disconnect the fuel pump wiring connector (see illustration 2.4). Trace the wiring from the fuel level sensor on the underside of the tank and disconnect it at the connector.

8 Carefully lift the tank off the bike and remove it (see illustration).

9 Discard the O-ring on each fuel hose union as new ones must be used (see illustration). Inspect the tank support rubbers for signs of damage or deterioration and replace them with new ones if necessary, noting the collared sleeve that fits inside.

## Sprint models

10 Make sure the fuel cap is secure.

11 Remove the seats and the seat cowlings (see Chapter 7).

12 Mark or tag the drain and breather hoses on the right-hand side of the tank so they can be installed on the correct union (see illustration). Detach the hoses from the unions.

13 Mark or tag each fuel hose with the location of its socket on the tank to prevent confusion on installation – the hoses must be fitted the same way round (see illustration 2.12). The feed and return hoses unions and the outlets from the tank are self-sealing, so there is no need to worry about fuel spillage when releasing them. Hold each hose union in turn and press the retaining clip in – the hose will spring out of its socket. Release the feed hose from the socket that is on the short hose extension from the lower union on the tank – do not separate the short hose from the tank itself.

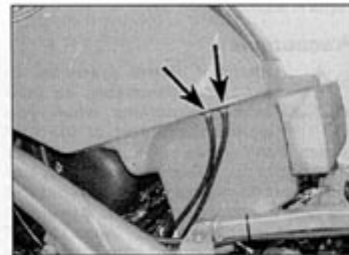
14 Release the clamp securing the hose to the fuel pressure regulator and detach the hose (see illustration 2.12).

15 Disconnect the fuel pump wiring connector (see illustration 2.12). Trace the wiring from the fuel level sensor on the underside of the tank and disconnect it at the connector.

16 Undo the screw securing the front of the tank, noting the arrangement of the washers, sleeve and rubber grommet (see



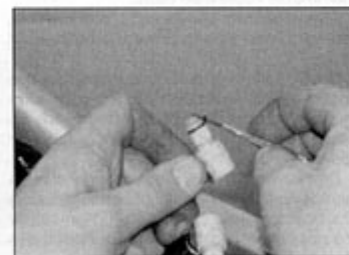
2.5b ... and the bolt on each side at the front, noting how the rubber supports fit



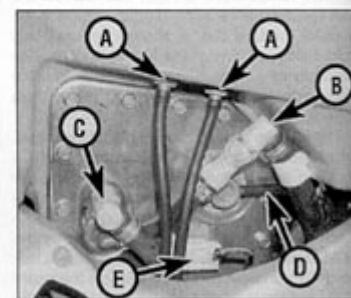
2.6 Detach the drain and breather hoses (arrowed), noting which fits where



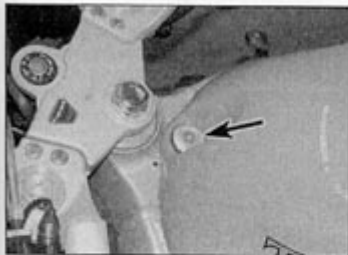
2.8 Carefully lift the tank off the frame and remove it



2.9 Replace the fuel hose O-rings with new ones



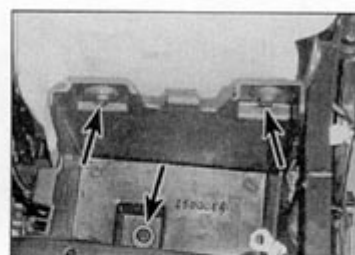
2.12 Drain and breather hoses (A), fuel feed hose (B) and return hose (C), fuel pressure regulator hose (D), fuel pump wiring connector (E)



2.16a Front mounting screw (arrowed)



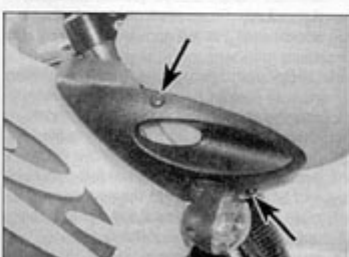
2.16b Rear mounting screws (arrowed)



2.21a Remove the screws (arrowed) and lift out the box ...



2.21b ... releasing the main fuse from its housing



2.22a Undo the screws (arrowed) ...



2.22b ... and release the panel

illustration). Undo the screw securing each tank support rubber at the rear and remove them, noting how they fit (see illustration).

17 Carefully lift the tank off the bike and remove it.

18 Discard the O-ring on each fuel hose union as new ones must be used. Inspect the tank support rubbers for signs of damage or deterioration and replace them with new ones if necessary.

#### Tiger models

19 Make sure the fuel cap is secure.

20 Remove the seat and the side panels (see

Chapter 7), then remove the battery (see Chapter 8).

21 Undo the three screws securing the battery box and lift it out of the frame, releasing the main fuse holder from its housing on the left-hand end of the box as you do so (see illustrations).

22 Remove the two screws securing each turn signal panel to the fairing, then draw the panel away and disconnect the wiring connectors (see illustrations).

23 Mark or tag the drain and breather hoses on the left-hand side of the tank so they can be installed on the correct union (see illustration). Detach the hoses from the unions.

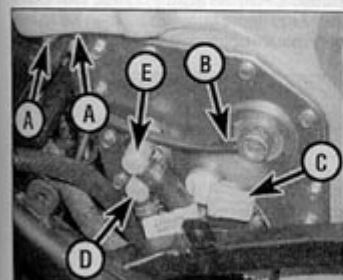
24 Release the clamp securing the hose to the fuel pressure regulator and detach the

hose (see illustration 2.23).

25 Disconnect the fuel pump wiring connector (see illustration 2.23). Trace the wiring from the fuel level sensor on the underside of the tank and disconnect it at the connector (see illustration).

26 Mark or tag each fuel hose with the location of its socket on the tank to prevent confusion on installation – the hoses must be fitted the same way round (see illustration 2.23). The feed and return hose unions and the outlets from the tank are self-sealing, so there is no need to worry about fuel spillage when releasing them. Hold each hose union in turn and press the retaining clip in – the hose will spring out of its socket.

27 Undo the screw securing the front of the tank, noting the arrangement of the washers,



2.23 Drain and breather hoses (A), fuel pressure regulator hose (B), fuel pump wiring connector (C), fuel feed hose (D) and return hose (E)

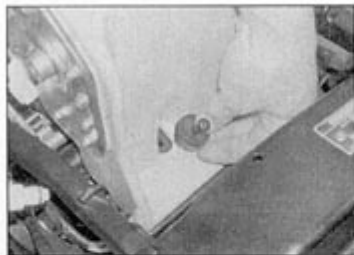


2.25 Disconnect the fuel level sensor wiring connector (arrowed)



2.27a Remove the front mounting screw ...

## 4•6 Engine management system (fuel and ignition)



2.27b ... and the rear mounting screw ...

sleeve and rubber grommet (see illustration). Undo the screw securing the tank at the rear, again noting the arrangement (see illustration).

28 Make sure the handlebars are straight. Carefully lift the tank off the bike and remove it, noting how it locates onto the front support rubbers on each side of the frame (see illustration).

29 Discard the O-ring on each fuel hose union as new ones must be used. Inspect the tank support rubbers for signs of damage or deterioration and replace them with new ones if necessary.

**Installation**

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

- Check the condition of all the rubber grommets and supports and replace them with new ones if they are damaged, deformed or deteriorated.
- Fit a new O-ring onto each fuel hose union (see illustration 2.9).
- On Tiger models, make sure the handlebars are straight when installing the tank, and make sure the front support rubbers are in place, that they do not get knocked off, and locate correctly into the cut-outs in the tank.
- On Daytona, Speed Triple and Tiger models, fit the feed hose (which goes to the right-hand end of the fuel rail) into the bottom socket in the fuel pump mounting plate, and fit the return hose (which comes from the left-hand end of the fuel



2.28 ... then carefully lift the tank off the frame and remove it

rail) into the top socket (see illustration 2.3 or 2.23). Press each union into its socket until it is felt and heard to click into place.

- On Sprint models, fit the feed hose (which goes to the right-hand end of the fuel rail) into the socket on the end of the short hose extension from the union on the fuel pump mounting plate, and fit the return hose (which comes from the left-hand end of the fuel rail) into the socket on the plate (see illustration 2.12). Press each union into its socket until it is felt and heard to click into place.
- Tighten the fuel tank mounting bolts and/or screws to the torque settings specified at the beginning of the Chapter.
- Make sure the electrical connectors are secure.
- Before installing the body panels, switch the ignition ON and check that there are no leaks around the hose unions as the pump pressurises.

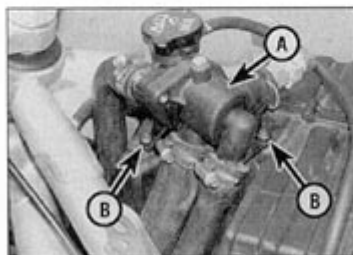
**3 Fuel tank – cleaning and repair**

1 All repairs to the fuel tank should be carried out by a professional who has experience in this critical and potentially dangerous work. Even after cleaning and flushing of the fuel system, explosive fumes can remain and ignite during repair of the tank.

2 If the fuel tank is removed from the bike, it should not be placed in an area where sparks or open flames could ignite the fumes coming out of the tank. Be especially careful inside garages where a natural gas-type appliance is located, because the pilot light could cause an explosion.

**4 Airbox – removal and installation****Removal**

- Remove the fuel tank (see Section 2).
- On Daytona and Speed Triple models, undo the screws securing the thermostat housing to the airbox and displace it – there is no need to drain the cooling system or detach any hoses or the wiring connector (see illustration). Detach the intake ducts in the fairing from the ducts into the airbox. On models up to VIN 71698, unscrew the bolt securing the front of the airbox.
- Disconnect the intake air temperature sensor wiring connector (see illustration). On all models from VIN 89736, either disconnect the intake air pressure sensor wiring connector, or carefully pull the sensor out of the airbox (see illustration). On models from VIN 89737, pull the air tube to the sensor (which is actually housed in the ECM), out of the airbox.
- Working around the airbox, disconnect the various drain and breather hoses from their unions on the airbox, noting which fits where – mark or tag the hoses if required. If any are inaccessible with the airbox in situ, disconnect them as you lift the box off the throttle bodies.
- On Daytona and Speed Triple models up to VIN 71698, slacken the clamp screws securing the housing to the throttle bodies. On all other models, spring clamps are used which are self releasing. Undo the screws securing the back of the airbox to the bracket (see illustration). Lift up the rear of the box to release it from the throttle bodies, then draw it back and remove it, on all models except Daytona and Speed Triple up to VIN 71698,



4.2 Thermostat housing (A) and its mounting screws (B)

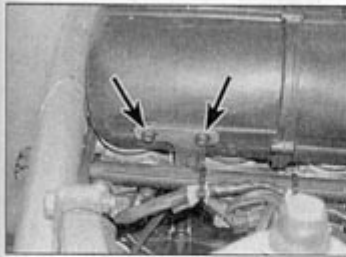


4.3a Intake air temperature sensor (arrowed)

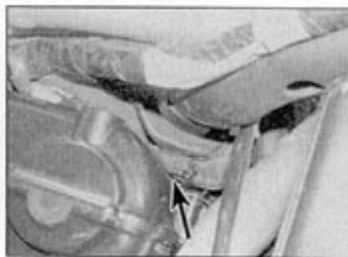


4.3b Intake air pressure sensor (arrowed) – models to VIN 89736





4.5a Undo the screws (arrowed)



4.5b Note how the hook (arrowed) locates ...



4.5c ... then remove the airbox

noting how the hook on the front of the box locates (see illustrations). On Daytona models, you will have to manoeuvre the intake ducts on the front of the airbox or they catch on the frame. Block the throttle bodies with clean rag to prevent anything falling in.

#### Installation

6 Installation is the reverse of removal. Do not forget to remove the rag from the throttle bodies. On Daytona and Speed Triple models up to VIN 71698, make sure the clamp screws are positioned so they will be accessible for tightening. Make sure the airbox locates correctly onto the throttle bodies, and that the self gripping spring clamps seat correctly. On all models except Daytona and Speed Triple up to VIN 71698, make sure the hook on the front of the box locates correctly (see illustration 4.5b). Make sure all hoses and wiring connectors are correctly and securely attached.

#### 5 Fuel pump and relay – check, removal and installation



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

#### Check

1 The fuel pump is located inside the fuel tank. The relay is fitted to Daytona, Speed Triple, Sprint ST and Tiger models up to VIN

89736, and is not fitted to Sprint RS models. 2 The fuel pump runs for a few seconds when the ignition is switched ON, then cuts out when the system is up to operating pressure, until the engine is started. If you can't hear anything, first check the fuse (see Chapter 8), then check the wiring and wiring connectors in the fuel pump and relay circuit, referring to the Wiring Diagrams at the end of Chapter 8. Next, check the relay (see Step 4). If they are all good, remove the pump (see below) and check the internal connections.

3 If the pump still does not work, using a fully charged 12 volt battery and two insulated jumper wires, briefly touch the jumper wires to the pump wiring connector terminals. The pump should operate. If the pump does not operate, replace it with a new one. The pump is controlled by the ECM, so if the pump, relay (where fitted) and wiring are all good, it is possible the ECM is faulty. Refer to Section 13 for further information.

4 To check the relay, remove the seats on Daytona and Speed Triple models, the seat cowl on Sprint ST models, and the seat on Tiger models (see Chapter 7). Disconnect the relevant relay from its connector block (see illustrations) – on Sprint ST models Triumph advise that the exact location of each relay is subject to change, so it is impracticable to specify its exact position in the relay pack – identify the relay by its white coloured tag around the wiring going into it. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the Wiring Diagrams at the end of the Chapter.

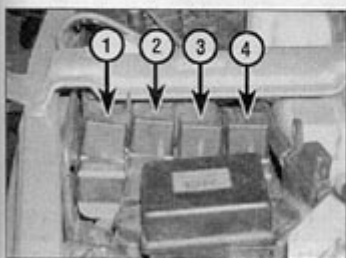
5 Set a multimeter to the ohms x 1 scale and connect its probes between the purple (or purple/green) (terminal No. 1) and purple/white (No. 8) wire terminals on the relay. Using a fully-charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the green/red (No. 6) wire terminal on the relay, and the negative (-ve) terminal to the black/purple (No. 4) wire terminal on the relay. At this point the relay should be heard to click and the multimeter read 0 ohms (continuity). If this is the case the relay is proved good. If the relay does not click when battery voltage is applied and indicates no continuity (infinite resistance) across its terminals, it is faulty and must be replaced with a new one.

6 If the pump operates but is thought to be delivering an insufficient amount of fuel, first check that the fuel tank breather hose is unobstructed, that all fuel hoses are in good condition and not pinched or trapped. Remove the pump (see below) and check that the fuel strainer and filter are not blocked. Also check the fuel rail and injectors for blockages. If all is good, check the fuel pressure and the pressure regulator (see Section 6).

#### Removal

7 Make sure the ignition is switched OFF. Remove the fuel tank and drain it (see Section 2).

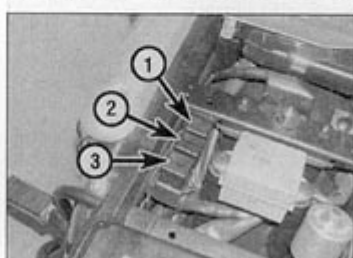
8 Unscrew the bolts securing the fuel pump mounting plate to the tank, then withdraw the



5.4a Fuel pump relay (3) – Daytona and Speed Triple



5.4b Relay identification tags (arrowed) – Sprint ST



5.4c Fuel pump relay (2) – Tiger



#### 4•8 Engine management system (fuel and ignition)

pump assembly (see illustrations). Discard the gasket as a new one must be used (see illustration).

9 If a new fuel pump is being installed, release the fuel pipe link piece from its clamp (where fitted), then release the clamp securing the hose to the pump and detach it (see illustration). Disconnect the wiring connector from the pump. Release the fuel pump clamp and remove the pump, taking care not to damage the strainer, and noting how it fits.

##### Installation

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

- Check the condition of the strainer and/or filter on the fuel pump and clean or renew as required (see Chapter 1).
- Make sure the wires are correctly and securely fitted to the pump.
- Install the pump assembly using a new gasket and tighten the mounting plate bolts evenly and a little at a time in a criss-cross pattern to the torque setting specified at the beginning of the Chapter (see illustrations 5.7c, b and a).
- On completion, start the engine and check carefully that there is no leakage from around the pump mounting plate and from the hose connections.

#### 6 Fuel pressure and pressure regulator – check, removal and installation

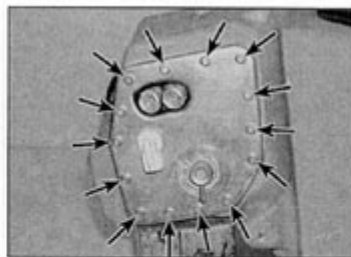


**Warning:** Refer to the precautions given in Section 1 before starting work.

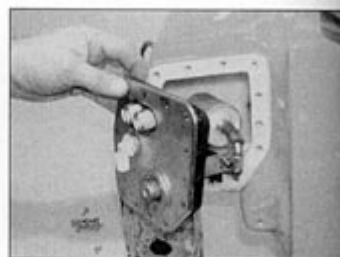
##### Fuel pressure check

1 To check the fuel pressure, the Triumph gauge (Pt. No. T3880048) is needed. The gauge comes fitted with the special unions required to fit into the fuel hose sockets in the fuel tank. A commercial pressure gauge will not be any use.

2 Make sure the ignition switch is in the OFF position. On Daytona, Speed Triple and Sprint models, remove the seat cowl, and on



5.8a Unscrew the bolts (arrowed) ...



5.8b ... and remove the pump assembly

Tiger models remove the left-hand side panel (see Chapter 7).

3 Detach the fuel feed hose from the bottom socket on the fuel pump mounting plate on Daytona, Speed Triple and Tiger models, and from the short hose extension coming from the bottom union on Sprint models – to release the hose, hold the union and press the retaining clip in – the hose will spring out of its socket (see illustrations 2.3 and 2.12 or 2.23).

4 Fit the union on the end of the hose coming from the gauge into the socket on the tank (or on the end of the extension on Sprint models), then fit the fuel feed hose union into the socket on the gauge. Press each union into its socket until it is felt and heard to click into place.

5 Turn the ignition switch ON and check the pressure reading on the gauge. The pressure should be as specified at the beginning of the Chapter.

6 Turn the ignition OFF and remove the gauge, then fit the fuel feed hose back into its socket.

7 If the pressure is too low, either the pressure regulator is stuck open, the fuel pump is faulty, the strainer or filter is blocked, or there is a leak in the system, probably from a hose joint.

8 If the pressure is too high, either the feed or return hose is pinched or clogged, the regulator is stuck closed or the fuel pump check valve is faulty.

9 Refer to the relevant Sections of this Chapter and Chapter 1 and check the possible problems according to whether the

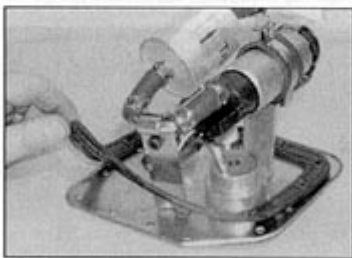
pressure was too low or too high. Triumph provide no test procedure for the pressure regulator. However, if it is stuck open, it will be possible to blow through it with a low pressure air source. If it is stuck closed, then a high pressure air source with a gauge can be used to check the pressure at which it does open, if at all. Alternatively, substitute the suspect one with a known good one and repeat the fuel pressure check.

##### Pressure regulator – check and renewal

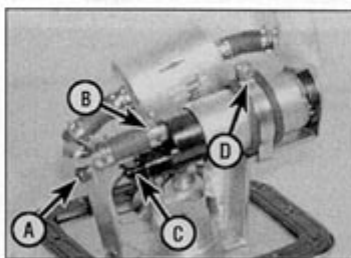
10 Make sure the ignition is switched OFF. Remove the fuel tank and drain it (see Section 2).

11 Remove the large circlip holding the regulator in the fuel pump mounting plate and draw it out (see illustration). Discard the O-rings and circlip as new ones must be used.

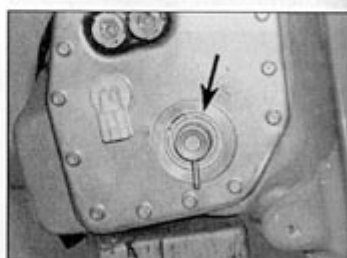
12 Triumph provide no test data or procedure for checking the operation of the regulator, but it is safe to assume that if you apply more than the maximum operating pressure specified to the inlet on the regulator, and it doesn't open and allow a flow out of the outlet, then it is faulty. Similarly, if it opens and allows a flow out before the minimum operating pressure is reached, then it is faulty. You will have to devise a method of applying the pressure in a controlled and measurable way to the inlet – using air pressure is probably easier than using a fluid. If a known good regulator is available, it is probably best to substitute that for the suspect one and see if the fault is cured.



5.8c Discard the old gasket as a new one must be used



5.9 Link pipe clamp bolt (A), hose clamp (B), wiring connector (C), pump clamp screw (D)



6.11 Fuel pressure regulator (arrowed)

13 Fit new O-rings onto the regulator and smear them with petroleum jelly (e.g. Vaseline), then press the regulator into its socket and secure it with a new circlip. Install the fuel tank (see Section 2).

#### 7 Fuel level sensor – check, removal and installation



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

#### Check

1 If the low fuel level warning light fails to come on, first check the bulb in the instrument cluster (see Chapter 8), then check the wiring and connectors between the sensor and the instrument cluster for continuity, referring to the wiring diagrams at the end of Chapter 8.

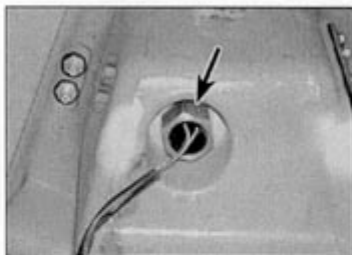
2 On Sprint ST and Tiger models, if the fuel level gauge fails to work, first check the fuse (see Chapter 8), then check the wiring and connectors between the sensor and the instrument cluster for continuity, referring to the wiring diagrams at the end of Chapter 8. If they are good, check that the resistance value of the in-line resistor(s) going into the fuel gauge are as specified on the wiring diagrams at the end of Chapter 8, using the diagrams to determine the correct connections.

3 Triumph provide no test data or procedure for checking the operation of the sensor, but it is safe to assume that if you connect an ohmmeter to the sensor wiring connector, then as the float in the sensor moves up and down the resistance will change – in the case of Sprint ST and Tiger models with a fuel gauge, the resistance should change gradually as the float moves, while in the case of other models with only a warning light, there should be infinite resistance when the float is at the top of the sensor, and little or no resistance when it is at the bottom. To perform this test you will have to start with an empty fuel tank, then gradually fill it while watching the reading on the ohmmeter. Remove the seat cowl on Daytona, Speed Triple and Sprint models, or the right-hand side panel on Tiger models, to access the sensor (see Chapter 7). If the sensor does not behave as described, or if you are in any doubt, take it to Triumph dealer for further assessment.

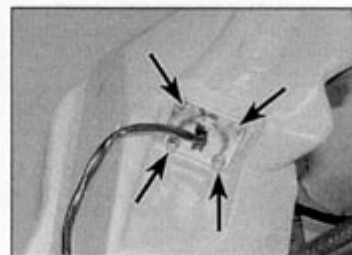
#### Removal

4 Make sure the ignition is switched OFF. Remove the fuel tank and drain it (see Section 2). Turn the tank upside down and rest it on some clean rag.

5 Unscrew the sensor itself, or the bolts securing it to the tank, according to your model, and withdraw the sensor from the tank (see illustrations). Discard the sealing washer or gasket as a new one must be used.



7.5a Fuel level sensor (arrowed) – Daytona and Speed Triple models



7.5b Fuel level sensor mounting bolts (arrowed) – Sprint and Tiger models

#### Installation

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

- Install the sensor using a new sealing washer or gasket. Where the sensor is secured by four bolts, tighten them to the torque setting specified at the beginning of the Chapter. Where the sensor itself threads into the tank, tighten it securely, but do not overtighten it as the threads could be damaged (see illustration 7.5a or b).
- On completion, start the engine and check carefully that there is no leakage from around the pump mounting plate and from the hose connections.

#### 8 Throttle bodies – removal, cleaning, inspection and installation



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

#### Removal

**Note:** A gasket is fitted between the throttle bodies and the cylinder head – a new one must be used on installation so it is wise to obtain it in advance. Note that the gasket design differs between 885 and 995 cc engines, so be sure to obtain the correct one for your machine. The gasket on 955 cc engines is identifiable by the small hole in the portion of gasket that protrudes from the left-hand side

of the No. 1 cylinder throttle body (see illustration 8.12a).

1 The throttle bodies can be removed with the fuel rail and injectors attached if required, or you can remove them beforehand or afterwards (see Section 9). If you are going to separate the assembly at any stage, first disconnect the fuel pump wiring connector (see Section 5), then turn the engine over on the starter for a few seconds – this reduces the pressure in the fuel rail and so prevents the fuel from being sprayed everywhere when the rail is removed or the hoses are detached.

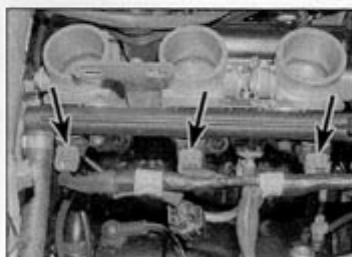
2 Remove the fuel tank (see Section 2) and the air filter housing (see Section 4).

3 On Daytona and Speed Triple models to VIN 71843, mark or tag the idle air control valve hoses with the identity of the throttle body they attach to, then detach them from their unions. On all other models the valve is removed with the throttle bodies. If you want to remove it first, or afterwards, refer to Section 16 for details.

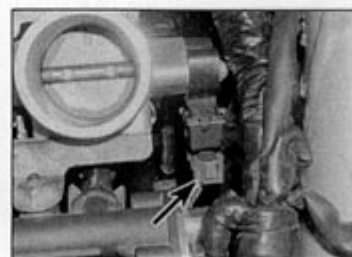
4 Disconnect the wiring connector on each fuel injector, then release the wiring from any clips or ties on the fuel rail, noting where they fit and which wires are held (see illustration). Disconnect the throttle position sensor wiring connector (see illustration).

5 Detach the throttle cable from the throttle bodies (see Section 10).

6 Using a socket extension, undo the screws securing the throttle body assembly to the cylinder head, on Daytona and Speed Triple models to VIN 71843 noting how the idle air control valve bracket is secured by one of the

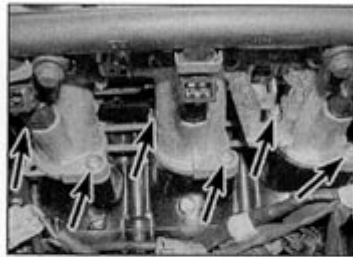


8.4a Disconnect the injector wiring connectors (arrowed) . . .

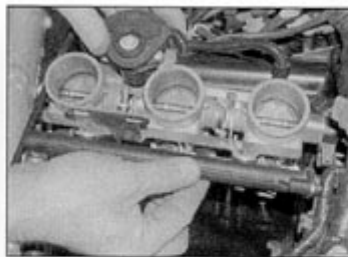


8.4b . . . and the throttle position sensor wiring connector (arrowed)

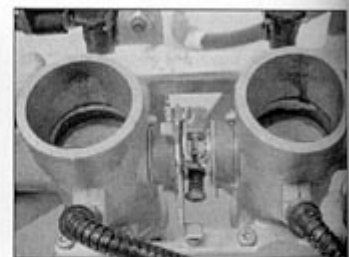
## 4•10 Engine management system (fuel and ignition)



8.6a Undo the screws (arrowed) ...



8.6b ... and remove the throttle body assembly



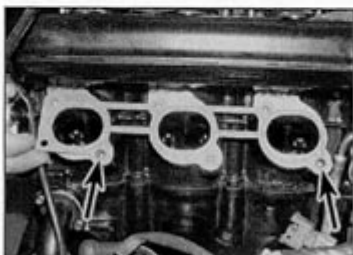
8.7 Make sure the throttle linkage and springs are clean and operate smoothly

screws (see illustration). Lift the throttle body assembly off the engine, and on Daytona and Speed Triple models from VIN 71844-on, and on all other models, disconnect the idle air control valve wiring connector when it is accessible (see illustration). Discard the gasket as a new one must be used. Note the locating dowels and remove them for safekeeping if they are loose. Block the intake tracts with clean rag to prevent anything falling in. Clean all traces of old gasket material from the throttle bodies and cylinder head. Do not remove the throttle position sensor from the throttle bodies unless you know it is faulty and are replacing it with a new one, or unless you are replacing the throttle bodies with new ones. If you do remove it, it has to be set up using the Triumph diagnostic tool. There is no alternative, unless you want to run the risk of having the bike running incorrectly. Refer to the engine management section for further information.

**Cleaning**

**Caution:** Use only a dedicated spray cleaner (such as a carburettor and injector cleaner) for throttle body cleaning.

7 Spray the cleaner over the throttle bodies to remove any dirt and grime, paying particular attention to the throttle linkage assembly and springs in between each body (see illustration). Use a nylon brush if required, but be careful not to embed dirt particles into the springs as this could cause the throttles to stick.



8.12 Make sure the dowels (arrowed) are installed, and use a new gasket

**Inspection**

8 Check the throttle bodies for cracks or any other damage which may result in air getting in. Also check for any signs of fuel leakage from the joints between the injectors, the fuel rail and the throttle bodies (refer to Section 9 to remove them).

9 Check that the throttle butterflies move smoothly and freely in the bodies, and make sure that the inside of each body is completely clean.

10 Check that the throttle cable cam moves smoothly and freely, taking into account spring pressure. Clean any grit and dirt from around the cams. Check all the springs for signs of damage and distortion.

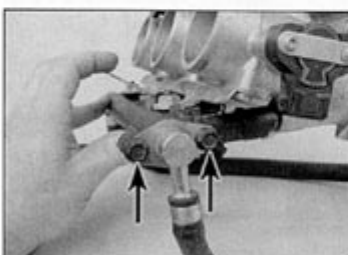
11 Do not attempt to separate the throttle bodies. If a body or the linkage assembly is damaged, the whole assembly must be renewed as individual components are not available.

**Installation**

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

a) Do not forget to remove the rag from the intake tracts. Install the throttle bodies using a new gasket, and make sure that the dowels are installed and the gasket and bodies locate correctly onto them (see illustration).

b) Tighten the throttle body screws to the torque setting specified at the beginning of the Chapter, not forgetting to secure the idle air control valve on Daytona and Speed Triple models to VIN 71843.



9.4 Fuel feed hose union bolts (arrowed)

c) Make sure all the wiring connectors are reconnected. Secure the wiring to the fuel rail in the same way as before.

d) On Daytona and Speed Triple models to VIN 71843, connect each idle air control valve hose to its union on the correct throttle body as noted on removal.

e) Check the operation of the throttle cable and adjust it as necessary (see Chapter 1).

f) Check throttle synchronisation and adjust as necessary (see Chapter 1).

**9 Fuel rail and injectors – removal and installation**

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

**Removal**

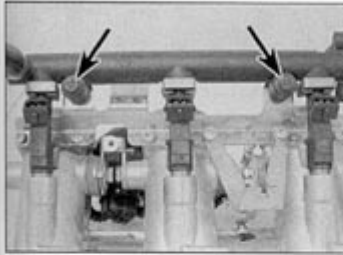
1 Before removing the fuel rail and injectors disconnect the fuel pump wiring connector (see Section 5), then turn the engine over on the starter for a few seconds – this reduces the pressure in the fuel rail and so prevents the fuel from being sprayed everywhere when the rail is removed or the hoses are detached. If the throttle bodies have already been removed, ignore any steps which do not apply.

2 Remove the fuel tank (see Section 2) and the airbox (see Section 4). If required, remove the throttle bodies (see Section 8), but note that the rail and injectors can be separated from them, leaving them in situ.

3 Disconnect the wiring connector on each fuel injector, then release the wiring from any clips or ties on the fuel rail, noting where the fit and which wires are held (see illustration 8.4a).

4 If required, disconnect the fuel hoses from the fuel rail. On Daytona models to VIN 71699 and 885 cc Speed Triple models, the hoses are secured by banjo fittings which use a sealing washer on each side of the union. All other models have the feed hose secured by two bolts and sealed by an O-ring, while the return hose slips over a union and is held by a clamp (see illustration).

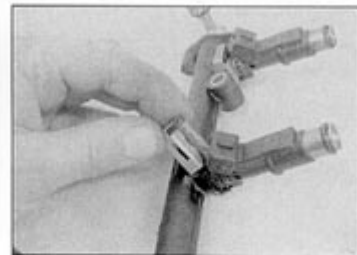
5 Unscrew the bolts securing the fuel rail to



9.5a Unscrew the bolts (arrowed) ...



9.5b ... and carefully remove the fuel rail with the injectors attached (later model type rail shown)



9.6a Release the clip ...

the bracket and lift the rail off the throttle bodies, bringing the injectors with the rail (see illustrations).

6 To separate the injectors from the fuel rail, release the clip under the injector wiring connector (see illustration). Carefully pull the injector out of the fuel rail (see illustration). Discard the injector O-rings as new ones must be used.

7 Modern fuels contain detergents which should keep the rail injectors clean and free of gum or varnish from residue fuel. Clean the rail in a dedicated cleaner and blow it through with compressed air. If the injector is suspected of being blocked, flush it through with injector cleaner. If the injector is clean but its performance is suspect, take it to a Triumph dealer for assessment.

### Installation

8 Fit new O-rings onto each injector (see illustration). Push the injector into the fuel rail, making sure you do not turn it whilst doing so, and that it is properly seated (see illustration 9.6b). Secure the injector with its clip (see illustration 9.6a).

9 Fit the fuel rail and injectors onto the throttle bodies, making sure each injector seats correctly (see illustration 9.5b). Install the fuel rail bolts and tighten them to the specified torque setting (see illustration 9.5a).

10 If removed, install the fuel hoses, using new sealing washers and O-rings where fitted, and tighten the banjo bolts or union bolts to the torque setting specified at the beginning

of the Chapter (see illustration 9.4). Use a new clamp on the return hose on later models.

11 If removed, install the throttle bodies (see Section 8).

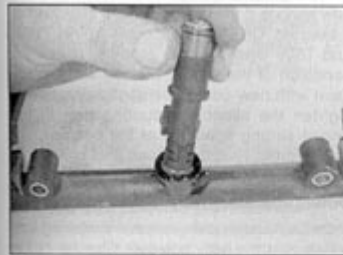
12 Connect the injector wiring connectors and secure the wiring on the rail as noted on removal (see illustration 8.4a).

13 Install the airbox (see Section 4).

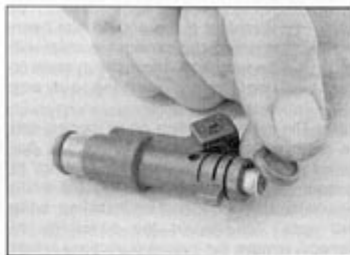
### 10 Throttle cable – removal and installation



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



9.6b ... and carefully pull the injector out of the rail



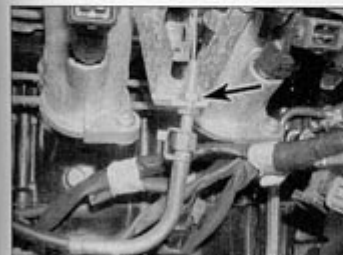
9.8 Fit a new O-ring onto each end of the injector

### Removal

1 Remove the fuel tank and airbox (see Sections 2 and 4).

2 Slacken the top locknut securing the cable in its bracket on the throttle bodies and thread it off the top (see illustration). Rotate the throttle cam to the fully open position using your fingers and hold it there, then draw the outer cable out of its bracket and detach the inner cable from the throttle cam (see illustrations).

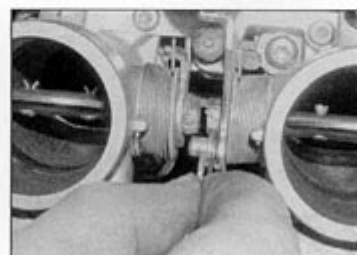
3 On Daytona, Speed Triple and Sprint RS models, pull the rubber boot off the throttle



10.2a Thread the top nut (arrowed) off the cable ...



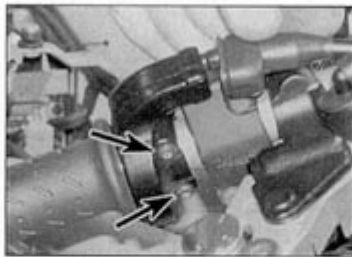
10.2b ... then free the outer cable from the bracket ...



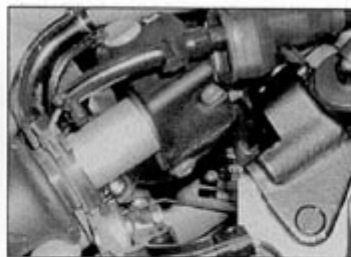
10.2c ... and detach the inner cable end from the cam



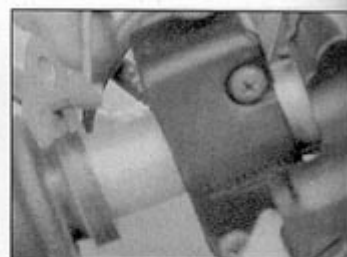
## 4•12 Engine management system (fuel and ignition)



10.3a Pull back the rubber boot, then undo the screws (arrowed)



10.3b Separate the housing halves and detach the cable elbow...



10.3c ... then free the cable end from the pulley

pulley housing on the handlebars (see illustration). Remove the housing screws and separate the halves. Free the cable elbow from the housing and detach the inner cable end from the pulley, noting how it all fits (see illustrations).

4 On Sprint ST and Tiger models, remove the right-hand switch housing screws on the handlebar and separate the halves. Free the cable elbow from the housing and detach the inner cable end from the pulley, noting how it all fits.

5 Remove the cable from the machine noting its correct routing.

**Installation**

6 Installation is the reverse of removal. If necessary, lubricate the cable (see Chapter 1). Make sure the cable is correctly routed – it

must not interfere with any other component and should not be kinked or bent sharply. Lubricate the end of each inner cable with multi-purpose grease.

7 Adjust the cable as described in Chapter 1. Turn the handlebars back and forth to make sure the cable doesn't cause the steering to bind.

8 Install the airbox and fuel tank (see Sections 4 and 2).

9 Start the engine and check that the engine speed does not rise as the handlebars are turned. If it does, correct the problem before riding the motorcycle.

**Daytona and Speed Triple models****Silencer**

1 On Daytona models, remove the belly pan (see Chapter 7).

2 Carefully release the springs holding the silencer in the downpipe assembly (see illustration).

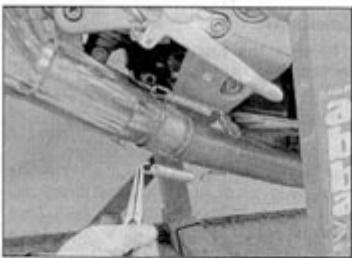
3 Unscrew and remove the nut on the inside of the footrest bracket, then support the silencer and withdraw the bolt, noting the washer and the arrangement of the collars (see illustration). Draw the silencer out of the downpipe assembly (see illustration). Remove the collars, and on Daytona models to VIN 71698 and T509 Speed Triple models the rubber bushes for safekeeping if required (see illustration).

4 Installation is the reverse of removal. Use new springs if the old ones have stretched or weakened. On Daytona models to VIN 71698 and T509 Speed Triple models, check the condition of the rubber bushes and replace them with new ones if hardened or cracked. Tighten the silencer mounting bolt to the torque setting specified at the beginning of the Chapter. Run the engine and check that there are no leaks.

**Downpipe assembly**

5 On Daytona models, remove the fairing side panels and the belly pan (see Chapter 7). On all models, remove the silencer (see above).

6 Drain the cooling system (see Chapter 1), then remove the radiator (see Chapter 3).

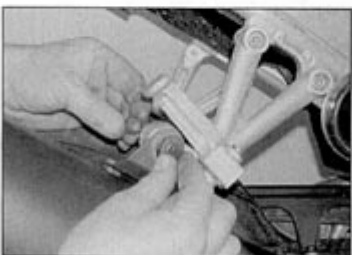


11.2 Carefully unhook the springs

**11 Exhaust system – removal and installation**

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

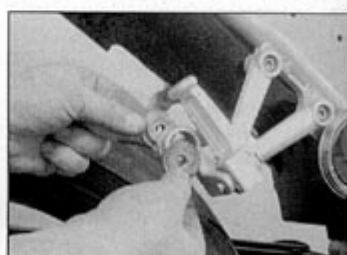
**Note:** The exhaust system on all models can be removed as one piece if required, but unless you have an assistant it is awkward to manoeuvre and support the system while simultaneously removing or installing bolts and nuts. To prevent the possibility of damage, remove the individual sections in turn as described. If you have help, follow the relevant Steps in each Section and remove the system in one piece.



11.3a Unscrew the nut and withdraw the bolt...

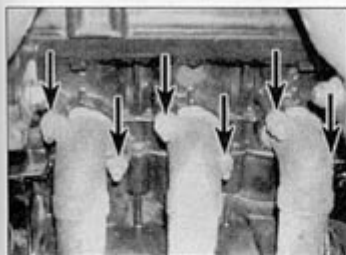


11.3b ... and remove the silencer



11.3c Remove the collars for safekeeping if loose





11.7a Unscrew the nuts (arrowed) ...

7 Unscrew the six downpipe assembly nuts from the cylinder head (see illustration). Draw the downpipes out of the cylinder head and remove them (see illustration).

8 Remove the gasket from each port in the cylinder head and discard them as new ones must be fitted (see illustration 11.9).

9 Apply a smear of grease to the new gaskets to keep them in place and fit one into each of the cylinder head ports (see illustration).

10 Manoeuvre the assembly into position so that the head of each downpipe is located in its port in the cylinder head, then fit the downpipe nuts and tighten them first to the initial torque setting specified at the beginning of the Chapter, then to the final torque setting (see illustrations 11.7b and a).

11 Install the silencer (see above).

12 Install the radiator (see Chapter 3) and fill the cooling system (see Chapter 1 and Daily (pre-ride) checks).

13 Run the engine and check that there are no leaks from the exhaust system. On Daytona models install the body panels.

#### Sprint models

##### Silencer

14 On ST models, remove the belly pan (see Chapter 7).

15 Slacken the clamp bolt securing the silencer in the downpipe assembly (see illustration).

16 Unscrew and remove the nut on the inside of the footrest bracket, then support the silencer and withdraw the bolt, noting the arrangement of the collars (see illustration 11.15). Draw the silencer out of the downpipe



11.7b ... and remove the downpipe assembly

assembly. Remove the collars and the rubber bushes for safekeeping if required.

17 Installation is the reverse of removal. Check the condition of the rubber bushes and replace them with new ones if hardened or cracked. Tighten the silencer mounting bolt to the torque setting specified at the beginning of the Chapter, then tighten the clamp bolt to the specified torque. Run the engine and check that there are no leaks from the exhaust system.

#### Downpipe assembly

**Note:** The downpipe assembly on German and US California market models incorporates a catalytic converter at the 4-into-1 joint. Take care when handling the downpipe assembly, not to strike or drop it because the delicate catalytic converter element could be damaged.

18 Remove the fairing side panels and on ST models the belly pan (see Chapter 7). Remove the silencer (see above).

19 Drain the cooling system (see Chapter 1), then remove the radiator (see Chapter 3). On German market models, disconnect the Lambda (oxygen) sensor wiring connector.

20 Unscrew the bolt securing the rear of the downpipe assembly to the frame, noting the arrangement of the collars and rubber bushes (see illustration 11.15).

21 Unscrew the six downpipe assembly nuts from the cylinder head (see illustration 11.7a). Draw the downpipes out of the cylinder head and remove them (see illustration 11.7b).

22 Remove the gasket from each port in the cylinder head and discard them as new ones must be fitted (see illustration 11.9). Remove the collars and bushes from the rear mounting



11.9 Smear the gaskets with grease to stop them falling out

for safekeeping if required. Check the condition of the rubber bushes and replace them with new ones if hardened or cracked.

23 Apply a smear of grease to the new gaskets to keep them in place and fit one into each of the cylinder head ports (see illustration 11.9). If removed, fit the bushes and collars into the rear mounting.

24 Manoeuvre the assembly into position so that the head of each downpipe is located in its port in the cylinder head, then install the rear mounting bolt, but do not yet tighten it (see illustration 11.15). Fit the downpipe nuts and tighten them first to the initial torque setting specified at the beginning of the Chapter, then to the final torque setting (see illustrations 11.7b and a). Now tighten the rear mounting bolt to the specified torque. On German market models, do not forget to connect the Lambda sensor wiring connector.

25 Install the silencer (see above).

26 Install the radiator (see Chapter 3) and fill the cooling system (see Chapter 1 and Daily (pre-ride) checks).

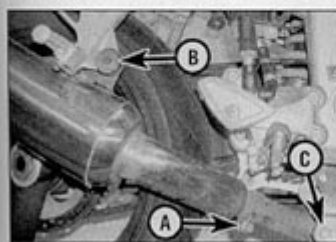
27 Run the engine and check that there are no leaks from the exhaust system before installing the body panels.

#### Tiger models

##### Silencer

28 Slacken the clamp bolt securing the silencer in the collector box (see illustration).

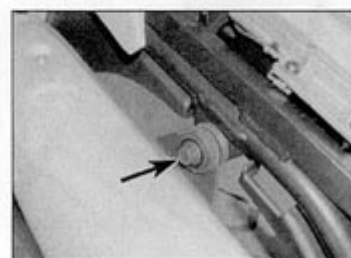
29 Unscrew and remove the nut on the inside of the footrest bracket, then support the silencer and withdraw the bolt, noting the arrangement of the washers, collar and bush (see illustration).



11.15 Silencer clamp bolt (A), silencer mounting bolt (B), downpipe assembly rear mounting bolt (C) - ST shown

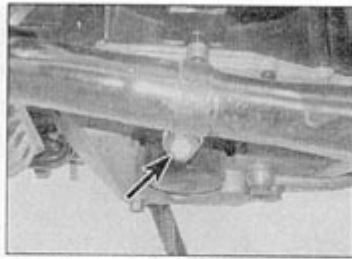


11.26 Slacken the clamp bolt (arrowed) ...

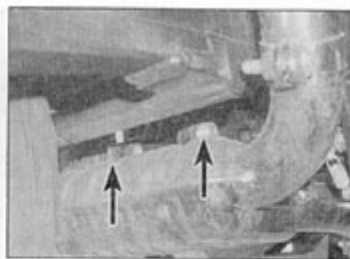


11.29 ... then unscrew the mounting bolt (arrowed) and remove the silencer

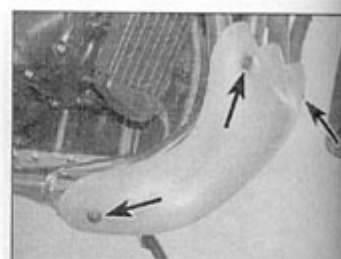
#### 4•14 Engine management system (fuel and ignition)



11.32 Slacken the clamp bolt (arrowed) ...



11.33 ... then unscrew the mounting bolts (arrowed) and remove the collector box



11.37 Undo the screws (arrowed) and remove the guard if required

Draw the silencer out of the collector box. Remove the collar and the rubber bush for safekeeping if required.

30 Installation is the reverse of removal. Check the condition of the rubber washer and bush and replace them with new ones if hardened or cracked. Tighten the silencer mounting bolt to the torque setting specified at the beginning of the Chapter, then tighten the clamp bolt to the specified torque. Run the engine and check the system for leaks.

##### Collector box

**Note:** The collector box on German and US California market models incorporates a catalytic converter. Take care when handling the collector box, not to strike or drop it because the delicate catalytic converter element could be damaged.

31 Remove the silencer (see above). Disconnect the Lambda (oxygen) sensor wiring connector – German market models.

32 Slacken the clamp bolt securing the collector box to the downpipe assembly (see illustration).

33 Unscrew the collector box mounting bolts, then draw the box off the downpipe assembly (see illustration). Remove the rubber bushes for safekeeping if required.

34 Installation is the reverse of removal. Check the condition of the rubber bushes and replace them with new ones if hardened or cracked. Tighten the mounting bolts to the torque setting specified at the beginning of the Chapter, then tighten the clamp bolt to the specified torque. On German market models do not forget to

connect the Lambda sensor wiring connector. Run the engine and check that there are no leaks from the exhaust system.

##### Downpipe assembly

35 Remove the silencer and the collector box (see above).

36 Drain the cooling system (see Chapter 1), then remove the radiator (see Chapter 3).

37 If required, undo the screws securing the exhaust guard and remove it (see illustration).

38 Unscrew the six downpipe assembly nuts from the cylinder head (see illustration 11.7a). Draw the downpipes out of the cylinder head and remove them (see illustration 11.7b).

39 Remove the gasket from each port in the cylinder head and discard them as new ones must be fitted (see illustration 11.9). Remove the collars and bushes from the rear mounting for safekeeping if required. Check the condition of the rubber bushes and replace them with new ones if hardened or cracked.

40 Apply a smear of grease to the new gaskets to keep them in place and fit one into each of the cylinder head ports (see illustration 11.9). If removed, fit the bushes and collars into the rear mounting.

41 Manoeuvre the assembly into position so that the head of each downpipe is located in its port in the cylinder head, then fit the downpipe nuts and tighten them first to the initial torque setting specified at the beginning of the Chapter, then to the final torque setting (see illustrations 11.7b and a).

42 Install the collector box and silencer (see

above). If removed, fit the exhaust guard (see illustration 11.37).

43 Install the radiator (see Chapter 3) and fill the cooling system (see Chapter 1 and Daily (pre-ride) checks).

44 Run the engine and check that there are no leaks from the exhaust system.

#### 12 Ignition coils/caps – check



**Warning:** The energy levels in electronic systems can be very high. On no account should the ignition be switched on whilst the plugs or plug caps are being held. Shocks from the HT circuit can be most unpleasant. Secondly, it is vital that the engine is not turned over or run with any of the plug caps removed, and that the plugs are soundly earthed (grounded) when the system is checked for sparking. The ignition system components can be seriously damaged if the HT circuit becomes isolated.

1 Before testing the coils, check that the spark plugs are in good condition and that the electrode gap is correct (see Chapter 1).

2 If not already done, remove the fuel tank and airbox (see Sections 2 and 4). Working on one coil/cap at a time, disconnect the wiring connector (see illustration). Undo the Torx screw securing the coil/cap to the valve cover and pull it off the spark plug (see illustrations).



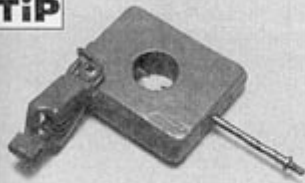
12.2a Disconnect the wiring connector ...



12.2b ... then undo the screws ...



12.2c ... and pull the coil/cap off the spark plug

**TOOL  
Tip**

A simple spark gap testing tool can be made from a block of wood, a large alligator clip and two nails, one of which is fashioned so that the spark plug cap can be connected to its end. Make sure the gap between the two nail ends is the same as specified.

Reconnect the wiring connector. Connect the cap to a new spark plug and lay the plug on the engine with the threads contacting the engine. If necessary, hold the spark plug with an insulated tool. Do not hold the plug against an engine cover that is magnesium coated as the coating could be damaged.

**Warning:** Do not remove any of the spark plugs from the engine to perform this check – atomised fuel being pumped out of the open spark plug hole could ignite, causing severe injury!

3 Check that the kill switch is in the RUN position and the transmission is in neutral, then turn the ignition switch ON and turn the engine over on the starter motor. If the system is in good condition a regular, fat blue spark should be evident at the plug electrodes. If the spark appears thin or yellowish, or is non-existent, further investigation will be necessary. Turn the ignition OFF. Repeat the check for the other coils/caps.

4 The ignition system must be able to produce a spark which is capable of jumping a particular size gap. Triumph provide no specification, but a healthy system should produce a spark capable of jumping at least 6 mm. A simple testing tool can be made to



12.5 Connect the tester as shown – when the engine is cranked sparks should jump the gap between the nails

test the minimum gap across which the spark will jump (see **Tool Tip**) or alternatively it is possible to buy an ignition spark gap tester tool and some of these tools are adjustable to alter the spark gap.

5 Connect the coil/cap to the protruding electrode on the test tool, and clip the tool to a good earth (ground) on the engine or frame (see illustration). Check that the kill switch is in the RUN position, turn the ignition switch ON and turn the engine over on the starter motor. If the system is in good condition a regular, fat blue spark should be seen to jump the gap between the nail ends. Repeat the test for the other coil/caps. If the test results are good the entire ignition system can be considered good. If the spark appears thin or yellowish, or is non-existent, further investigation is necessary.

6 Using an ohmmeter set to the ohms x 1 scale, measure the resistance between the terminals on the coil/cap (see illustration). The resistance should be as specified at the beginning of the Chapter. If not, the coil is faulty and must be replaced with a new one; the coil is a sealed unit and cannot therefore be repaired.

7 If the coils/caps and spark plugs are good, then there is a fault elsewhere in the system. The likely faults are listed below, starting with the most probable source of failure. Work through the list systematically, referring to the subsequent sections for full details of the necessary checks and tests. **Note:** Before checking the following items ensure that the battery is fully charged and that all fuses are in good condition.

- a) Loose, corroded or damaged wiring connections, broken or shorted wiring between any of the component parts of the ignition system (see Chapter 8).
- b) Faulty spark plug, dirty, worn or corroded plug electrodes, or incorrect gap between electrodes.
- c) Faulty ignition (main) switch or engine kill switch (see Chapter 8).
- d) Faulty clutch, neutral or sidestand switch (see Chapter 8).
- e) Faulty crankshaft position sensor, incorrect air gap, or damaged rotor.
- f) Faulty ECM.



12.6 To test the coil resistance, connect the meter as shown

8 If the above checks don't reveal the cause of the problem, have the engine management system tested by a Triumph dealer. Triumph produce a diagnostic tool which can perform a complete analysis of the engine management system. Refer to Sections 1 and 13 for more information.

### 13 Engine management system and ECM – fault finding



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

1 For a general description of the system, see Section 1.

#### Diagnostic tool and fault codes

2 To diagnose the exact cause of a failure in the system, the Triumph diagnostic tool, specifically designed for this system, is essential. Hence if a problem occurs, the motorcycle should be taken to a Triumph dealer.

3 The engine management system has in-built diagnostic functions which record and store all data should a fault occur. Recorded faults can then be checked using Triumph's diagnostic tool, which reads the data and lists a code to indicate the exact fault. Should a fault occur, the malfunction indicator lamp (MIL) in the instrument cluster illuminates. If this happens, the management system switches itself into 'limp home' mode, so that in theory you should not be left stranded. Depending on the problem, it is possible that you will notice no difference in the running of the motorcycle.

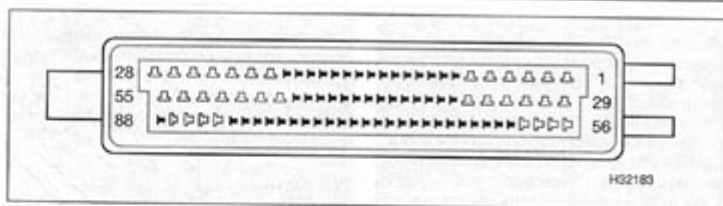
4 In order to diagnose the problem and to turn the MIL off, the diagnostic tool is essential. Take your machine to a Triumph dealer and have them check the system – it should not take them long. Note that this task is impracticable for the DIY mechanic, not only because the diagnostic tool would be prohibitively expensive, but because an authorisation code is required to operate it and the codes are only available to Triumph dealers. For information, the diagnostic tool plugs into a main wiring harness at a connection point under the rider's seat on the right-hand side of the frame.

5 It is possible to perform certain tests and checks to identify a particular fault, but the difficulty is knowing in which part of the system the fault has occurred, and therefore where to start checking. Further details on the functions of and checks that can be made to the individual sensors and components and the wiring between them are detailed below and in the following Sections.

#### Fault tracing

6 If a fault is indicated, first check the wiring and connectors to and from the ECM (electronic control module) and the various

## 4•16 Engine management system (fuel and ignition)



13.6a MC 2000 ECM wiring connector pin identification

sensors and all their related components. It may be that a connector is dirty or corroded or has come loose – a dirty or corroded terminal or connector will affect the resistance in that circuit, which will upset the information going to the ECM, and therefore affect the decisions it makes in controlling the system. A wire could be pinched and is shorting out – a continuity test of all wires from connector to connector will locate this. Albeit a fiddly and laborious task, the only way to determine any wiring faults is to systematically work through the Wiring Diagrams at the end of Chapter 8 and test each individual wire and connector for continuity – all wires are colour coded. The Wiring Diagrams show the terminal number for each wire on the ECM – match these to the terminals on the ECM connector(s) when making the tests (see illustrations).

7 Two different systems have been used on the model range, though overall their function is very similar. Early Daytona, Speed Triple, Sprint ST and Tiger models have the MC 2000

ECM, while the later versions of those models and all Sprint RS models have the MC 1000 ECM. They are distinguishable by their different size and by their connectors – the MC 1000 ECM is smaller and has two connectors into it. When making continuity checks, isolate the wire being tested by disconnecting the wiring connectors at each end. To release the MC 2000 ECM wiring connector, pull the retaining clip up (see illustration). To release the MC 1000 ECM wiring connectors, press in the locking tab and rotate the clamping ring until a click is felt (see illustration). Note that when identifying a terminal on the MC 1000 ECM, the first number given on the wiring diagram indicates the relevant connector – number 1 is the black connector, number 2 is the grey connector. The letter and number given afterwards are like grid references for the terminals – in the illustration 13.6b, the highlighted terminal is 1/E3.

8 Some of the circuits in the system have in-line resistors, which are also shown with their resistance value in the Wiring Diagrams. If you are testing a circuit with an in-line resistor, set the meter to the appropriate range, and make sure the reading obtained is correct for the value of the resistor.

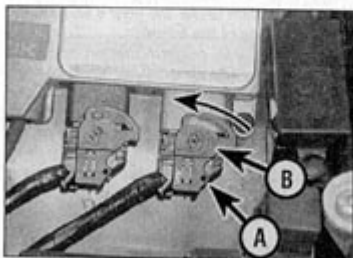
#### 14 Electronic Control Module (ECM) power relay – location and check

**Note:** Before disconnecting the relay, make sure the ignition is switched OFF, then remove the seat(s) (see Chapter 7) and disconnect the battery (see Chapter 8).

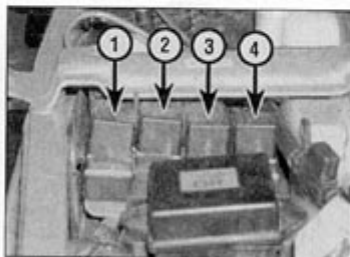
1 The ECM has its own power relay which is



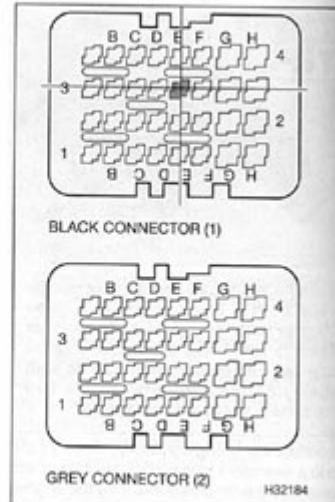
13.7a Releasing the connector on MC 2000 ECM



13.7b To release MC 1000 ECM connectors, press in the tab (A), then turn the locking ring (B) as shown until it is free



14.2a ECM power relay (4) – Daytona and Speed Triple



13.6b MC 1000 ECM wiring connector pin identification

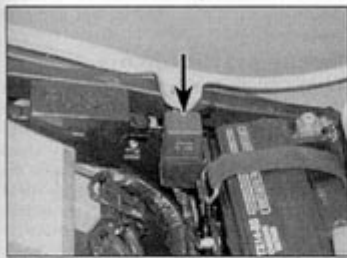
designed to provide a steady voltage supply to the ECM. The ECM holds the relay open after the ignition is switched off to enable it perform various power-down functions, such as writing data to the memory, referencing the position of the idle air control valve, and if necessary, running the cooling fan.

2 To check the relay, remove the seats on Daytona and Speed Triple models, the seat cowling on Sprint ST models to VIN 89735, the seat on all other Sprint ST models and RS models, and the seat on Tiger models (see Chapter 7). Disconnect the relay from its connector block (see illustrations) – on Sprint ST models to VIN 89736 Triumph advise that the exact location of each relay is subject to change, so it is impracticable to specify its exact position in the relay pack – identify the relay by the red coloured tag around the wiring going into it. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the Wiring Diagrams at the end of the Chapter. Test according to the applicable procedure:



14.2b Relay identification tags (arrowed) – Sprint ST to VIN 89736





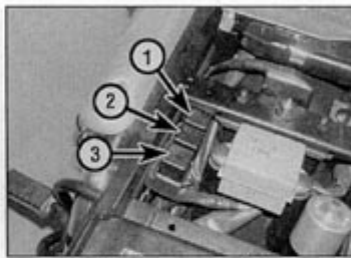
14.2c ECM power relay (arrowed) - Sprint ST (VIN 89737-on) and Sprint RS

### Daytona, Speed Triple and Tiger up to VIN 89736

3 Set a multimeter to the ohms x 1 scale and connect its probes between the purple (terminal No. 1) and brown/pink (No. 8) wire terminals on the relay. Using a fully-charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the purple (No. 6) wire terminal on the relay, and the negative (-ve) terminal to the yellow/brown (No. 4) wire terminal on the relay. At this point the relay should be heard to click and the multimeter read 0 ohms (continuity). If this is the case the relay is proved good. If the relay does not click when battery voltage is applied and indicates no continuity (infinite resistance) across its terminals, it is faulty and must be replaced with a new one.

### Daytona, Speed Triple and Tiger from VIN 89737, all Sprint models

4 Set a multimeter to the ohms x 1 scale and connect its probes between the brown (terminal No. 1) and brown/pink (No. 8) wire terminals on the relay. Using a fully-charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the brown (No. 6) wire terminal on the relay, and the negative (-ve) terminal to the yellow/brown (No. 4) wire terminal on the relay. At this point the relay should be heard to click and the multimeter read 0 ohms (continuity). If this is the case the relay is proved good. If the relay does not click when



14.2d ECM power relay (3) - Tiger

battery voltage is applied and indicates no continuity (infinite resistance) across its terminals, it is faulty and must be replaced with a new one.

### 15 Sensors - function, removal and installation

**Note:** Before disconnecting the wiring connector from any sensor, make sure the ignition is switched OFF, then remove the seat(s) (see Chapter 7) and disconnect the battery (see Chapter 8).

### Camshaft position sensor (Daytona and Speed Triple models to VIN 67207 only)

#### Function

1 The camshaft position sensor is located in the valve cover. The sensor reads the position of the camshaft and how fast it is turning. This information is used by the ECM to determine which cylinder is on its ignition stroke and when it should fire.

#### Removal and installation

2 The camshaft position sensor is located in the valve cover. Make sure the ignition is switched OFF. Remove the airbox (see Section 4). Disconnect the sensor wiring connector, then undo the screw and remove the sensor. Check the condition of the seal in the valve cover and replace it with a new one

if it is damaged or deteriorated. On installation, tighten the sensor screw to the torque setting specified at the beginning of the Chapter.

### Speed sensor (Daytona and Speed Triple models to VIN 67207 only)

#### Function

3 The speed sensor is located by the rear wheel. The sensor reads the rotational speed of the rear wheel. This information is used by the ECM in conjunction with engine speed information to determine which gear the bike is in, and controls fuelling and ignition accordingly. The information also helps to determine the idle air control valve setting.

#### Removal and installation

4 The speed sensor is located by the rear wheel. Make sure the ignition is switched OFF. Disconnect the sensor wiring connector, then undo the screw and remove the sensor. On installation, tighten the sensor screw to the torque setting specified at the beginning of the Chapter.

### Crankshaft position sensor

#### Function

5 The crankshaft position sensor is located on the right-hand end of the crankshaft. The sensor reads the position of the crankshaft and how fast it is turning. This information is used by the ECM to determine which cylinder is on its ignition stroke and when it should fire, and reads engine speed, and combines with information from other sensors to determine fuelling and ignition requirements.

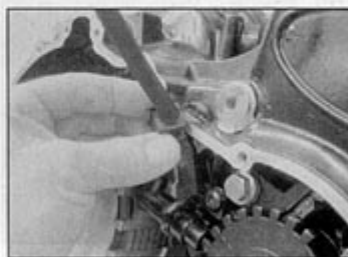
#### Removal and installation

6 The crankshaft position sensor is located on the right-hand end of the crankshaft. Remove the clutch cover to access it (see Chapter 2). Trace the wiring from the sensor and disconnect it at the connector, then free the wiring grommet from its cut-out (see illustrations). Undo the screws and remove the sensor (see illustration).

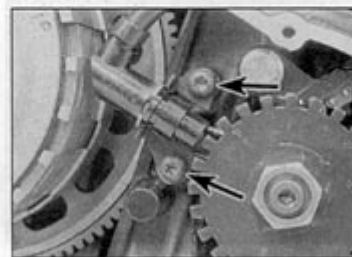
7 Install the sensor and secure it with the screws, but do not fully tighten them yet - leave them loose enough to allow positional



15.6a Disconnect the wiring connector ...



15.6b ... then free the wiring grommet



15.6c Undo the screws (arrowed) and remove the sensor

## 4•18 Engine management system (fuel and ignition)



15.7a Install the sensor . . .

adjustment of the sensor (see illustration). Turn the crankshaft using a spanner or socket on the large hex on the timing rotor so that one of the triggers on the rotor is directly aligned with the sensor pick-up. Using a feeler gauge blade, set the air gap between the sensor pick-up and trigger to 1 mm, then tighten the screws, making sure the sensor does not move (see illustration).

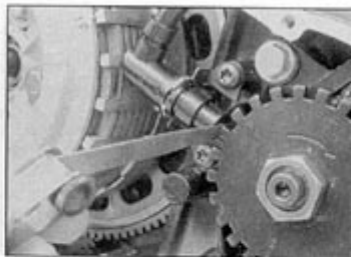
8 Fit the wiring grommet into its cut-out and reconnect the wiring connector (see illustrations 15.6b and a), then install the clutch cover (see Chapter 2).

**Intake air pressure sensor****Function**

9 On models to VIN 89736, the sensor is located in the right-hand side of the airbox at the back. On all later models, the sensor is housed within the ECM itself and is connected to the airbox via a tube. The sensor reads the pressure of the air in the airbox and from this calculates atmospheric (barometric) pressure (i.e. air density). The ECM combines this with other information to determine engine load and adjusts fuelling requirements accordingly.

**Removal and installation**

10 On models to VIN 89736, the sensor is located in the right-hand side of the airbox at the back (see illustration 4.3b). On all later models, the sensor is housed within the ECM itself and is connected to the airbox via a tube, and therefore cannot itself be removed. On models to VIN 89736, make sure the



15.7b . . . and set the air gap correctly

ignition is switched OFF. Remove the fuel tank (see Section 2). Disconnect the wiring connector from the sensor and carefully pull it out of the airbox. Installation is the reverse of removal.

**Intake air temperature sensor****Function**

11 The sensor is located in the right-hand side of the airbox at the front. The sensor reads the temperature of the air in the airbox. As changes in temperature affect air density, the ECM uses the information to determine fuelling requirements.

**Removal and installation**

12 The sensor is located in the right-hand side of the airbox at the front (see illustration 4.3a). Make sure the ignition is switched OFF. Remove the fuel tank (see Section 2). Disconnect the wiring connector from the sensor, then unscrew the sensor and draw it out of the airbox. Installation is the reverse of removal.

**Engine coolant temperature sensor****Function**

13 The sensor is located in the thermostat housing on Daytona, Speed Triple and Tiger models, and in the coolant union on the left-hand side of the cylinder head on Sprint models. The sensor reads the temperature of the engine coolant, and the ECM uses the information to determine fuelling

requirements, particularly for hot and cold starting.

**Removal and installation**

14 The sensor is located in the thermostat housing on Daytona, Speed Triple and Tiger models, and in the coolant union on the left-hand side of the cylinder head on Sprint models (see illustrations). Make sure the ignition is switched OFF. On Daytona, Speed Triple and Tiger models, remove the fuel tank (see Section 2). On Sprint models, remove the left-hand fairing side panel (see Chapter 7). Drain the cooling system (see Chapter 1). Disconnect the wiring connector from the sensor.

15 On Daytona, Speed Triple and Tiger models, pull out the sensor retaining clip and withdraw the sensor. Discard the O-ring as a new one must be used.

16 On Sprint models, unscrew the sensor from the union. Discard the sealing washer as a new one must be used.

17 On Daytona, Speed Triple and Tiger models, fit a new O-ring onto the sensor, then push it into the thermostat housing until it is seated and secure it with the retaining clip, making sure it locates correctly around the sensor. Reconnect the wiring connector, then fill the cooling system (see Chapter 1). Install the fuel tank.

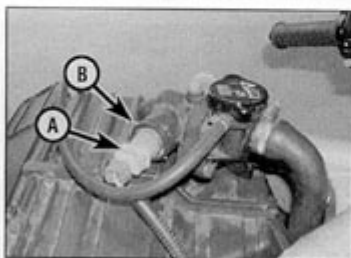
18 On Sprint models, fit a new sealing washer onto the sensor, then thread it into the coolant union and tighten it securely. Reconnect the wiring connector, then fill the cooling system (see Chapter 1). Install the fairing side panel.

**Throttle position sensor****Function**

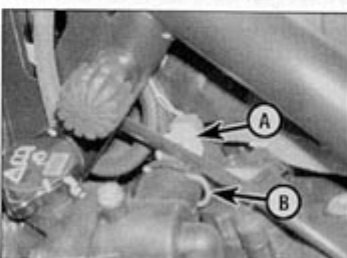
19 The sensor is located on the right-hand end of the throttle bodies. The sensor reads the amount of throttle being used, and the ECM uses this in conjunction with the information from other sensors to determine fuelling and ignition requirements.

**Removal and installation**

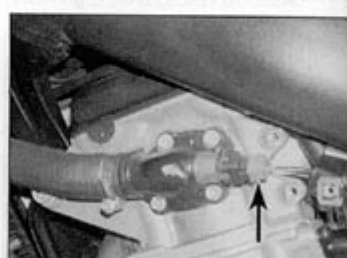
20 The sensor is located on the right-hand end of the throttle bodies. Do not remove the throttle position sensor unless you know it is



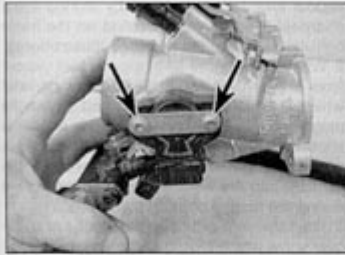
15.14a Coolant temperature sensor (A) and its retaining clip (B) – Daytona and Speed Triple



15.14b Coolant temperature sensor (A) and its retaining clip (B) – Tiger



15.14c Coolant temperature sensor (arrowed) – Sprint



15.21 Throttle position sensor screws (arrowed)

faulty and are replacing it with a new one, or unless you are replacing the throttle bodies with new ones. If you do remove it, it has to be set up using the Triumph diagnostic tool. There is no alternative, unless you want to run the risk of having the bike running incorrectly.

21 Remove the throttle bodies (see Section 8). Undo the screws securing the sensor and remove the retaining plate, then draw the sensor off the end of the throttle shaft (see illustration).

22 Locate the sensor onto the end of the throttle shaft, aligning it so the D-shaped end of the shaft fits into the sensor. Fit the retaining plate and tighten the screws to the torque setting specified at the beginning of the Chapter.

23 Install the throttle bodies (see Section 8). The sensor must now be set up correctly using the Triumph diagnostic tool.

#### Lambda (oxygen) sensor – German Sprint and Tiger models

##### Function

24 The sensor measures oxygen left in the unburnt exhaust gases and generates a signal voltage which is fed back to the ECM. In this way the ECM can correct the mixture supplied to the engine to ensure that the oxygen content of the exhaust gases remains within a narrow range and suitable for the operation of the catalytic converter. This type of system is called closed-loop control.

##### Removal and installation

25 On Sprint models, the sensor is located at the 4-into-1 junction in the exhaust downpipes, at the point where the catalytic converter is housed; on ST models remove the belly pan for access (see Chapter 7). On Tiger models, the sensor is located on the top surface of the exhaust collector box.

26 Disconnect the sensor's wiring connector and carefully unscrew it from the exhaust system – the sensor and catalytic converter are fragile so care must be taken not to apply undue force. If the sensor is difficult to unscrew or the area is badly corroded, apply a penetrating fluid. When refitting, check the condition of the sealing washer between the sensor and exhaust and renew it if it is damaged or distorted – it is essential to have an air-tight joint at this point.



16.6 Idle air control valve screws (arrowed) – later type shown

#### 16 Idle air control valve – check and renewal

**Note:** Before disconnecting the valve, make sure the ignition is switched OFF, then remove the seat(s) (see Chapter 7) and disconnect the battery (see Chapter 8).

##### Check

1 The idle air control valve is actuated by the ECM and set according to information received by the ECM from the various sensors. The valve is used to control the

engine idle speed, to adjust the air supply on engine overrun, to correct for altitude, and for cold starting. The idle speed cannot be adjusted manually.

2 The ECM actuates a stepper motor which moves a plunger in and out of the valve to vary the amount it is open. The operation of the valve can only be checked using the Triumph diagnostic tool. However, if a fault in the valve is suspected it is worth checking the wiring connector for loose, corroded or damaged terminals, and the wiring between the valve and the ECM for continuity, referring to the wiring diagrams at the end of Chapter 8 for details.

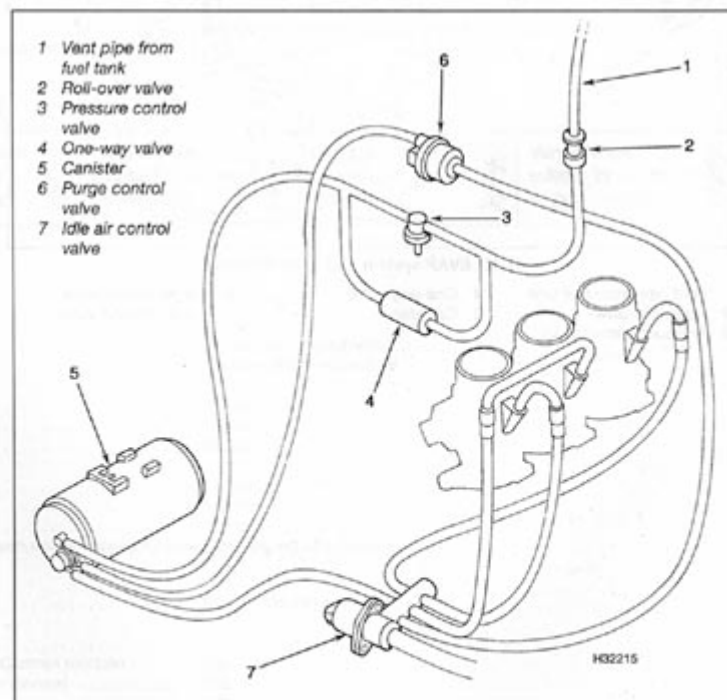
##### Renewal

3 Remove the fuel tank and the airbox (see Sections 2 and 4).

4 Disconnect the idle air control valve hoses from their unions on the valve – mark each hose according to the union it attaches to so that it can be correctly installed later. Also disconnect the valve wiring connector.

5 On Daytona and Speed Triple models to VIN 71843, unscrew the throttle body bolt that secures the idle air control valve bracket, then remove the valve.

6 On all other models, undo the two screws securing the valve to the throttle bodies and remove the valve (see illustration).



17.1a EVAP system – Daytona and Speed Triple models to VIN 71843

## 4•20 Engine management system (fuel and ignition)

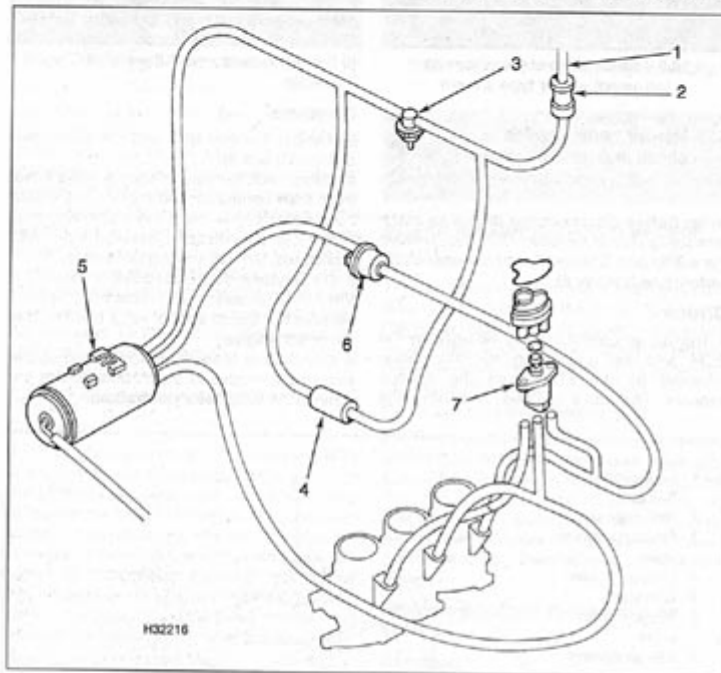
7 If required, undo the screws securing the stepper motor to the valve body and separate them. Check the condition of the O-ring and replace it with a new one if necessary.

8 Installation is the reverse of removal. Make sure the hoses and wiring connector are securely attached. Tighten the mounting screws to the torque setting specified at the beginning of the Chapter.

## 17 EVAP system and catalytic converter – general

## Evaporative emission control system – US California market models

1 This system prevents the escape of fuel



17.1b EVAP system – all other models

- |                            |                 |                          |
|----------------------------|-----------------|--------------------------|
| 1 Vent pipe from fuel tank | 4 One-way valve | 6 Purge control valve    |
| 2 Roll-over valve          | 5 Canister      | 7 Idle air control valve |
| 3 Pressure control valve   |                 |                          |

vapour into the atmosphere by storing it in a charcoal-filled canister located on the frame right-hand side at the rear (see illustrations).

2 When the engine is stopped, fuel vapour from the tank is directed into the canister where it is absorbed and stored whilst the motorcycle is standing. When the engine is started, the purge control valve opens, thus drawing vapours which are stored in the canister into the throttle bodies to be burned during the normal combustion process.

3 The tank vent pipe also incorporates a roll-over valve which closes and prevents any fuel from escaping through it in the event of the bike falling over. The tank filler cap has a one-way valve which allows air into the tank as the volume of fuel decreases, but prevents any fuel vapour from escaping.

4 The system is not adjustable and can be properly tested only by a Triumph dealer, as the diagnostic tool is required. However the owner can check that all the hoses are in good condition and are securely connected at each end. Renew any hoses that are cracked, split or generally deteriorated.

## Catalytic converter – German and US California market Sprint and Tiger models

5 On Sprint models the catalytic converter is housed in the exhaust downpipe assembly at the 4-into-1 joint. On Tiger models the catalytic converter is housed in the exhaust collector box. It operates under closed-loop control with a Lambda (oxygen) sensor on German market models, and without the sensor (open-loop) on California market models.

6 The catalytic converter requires no maintenance, but the following points should be noted:

- Always use unleaded fuel – the use of leaded fuel will destroy the catalytic converter.
- Do not use oil or fuel additives.
- Handle the assembly containing the catalytic converter carefully when working removing and refitting the exhaust system.



## Chapter 6

### Brakes, wheels and tyres

#### Contents

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#### Degrees of difficulty

|                                                  |                                                                                     |                                                         |                                                                                     |                                                       |                                                                                     |                                                  |                                                                                       |                                                         |                                                                                       |
|--------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------|
| Easy, suitable for novice with little experience |  | Fairly easy, suitable for beginner with some experience |  | Fairly difficult, suitable for competent DIY mechanic |  | Difficult, suitable for experienced DIY mechanic |  | Very difficult, suitable for expert DIY or professional |  |
|--------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------|

#### Specifications

##### Brakes – Daytona, Speed Triple and Sprint models

|                                     |          |
|-------------------------------------|----------|
| Brake fluid type .....              | DOT 4    |
| Brake pad minimum thickness .....   | 1.5 mm   |
| Front caliper piston OD             |          |
| Large bore .....                    | 33.96 mm |
| Small bore .....                    | 30.23 mm |
| Front disc thickness                |          |
| Standard .....                      | 4.0 mm   |
| Service limit .....                 | 3.5 mm   |
| Front disc maximum runout .....     | 0.3 mm   |
| Front master cylinder bore ID ..... | 14.0 mm  |
| Rear caliper piston OD .....        | 27.0 mm  |
| Rear disc thickness                 |          |
| Standard .....                      | 5.0 mm   |
| Service limit .....                 | 4.5 mm   |
| Rear disc maximum runout .....      | 0.3 mm   |
| Rear master cylinder bore ID .....  | 14.0 mm  |

## 6•2 Brakes, wheels and tyres

**Brakes – Tiger models**

|                                     |         |
|-------------------------------------|---------|
| Brake fluid type .....              | DOT 4   |
| Brake pad minimum thickness .....   | 1.5 mm  |
| Front caliper piston OD .....       | 27.0 mm |
| Front disc thickness                |         |
| Standard .....                      | 5.0 mm  |
| Service limit .....                 | 4.5 mm  |
| Front disc maximum runout .....     | 0.3 mm  |
| Front master cylinder bore ID ..... | 12.7 mm |
| Rear caliper piston OD .....        | 27.0 mm |
| Rear disc thickness                 |         |
| Standard .....                      | 6.0 mm  |
| Service limit .....                 | 5.5 mm  |
| Rear disc maximum runout .....      | 0.3 mm  |
| Rear master cylinder bore ID .....  | 14.0 mm |

**Wheels**

Runout (max) – axial (side-to-side) and radial (out-of round)

|                                               |        |
|-----------------------------------------------|--------|
| Daytona, Speed Triple and Sprint models ..... | 0.5 mm |
| Tiger models .....                            | 1.0 mm |

**Tyres**Tyre pressures ..... see *Daily (pre-ride) checks*

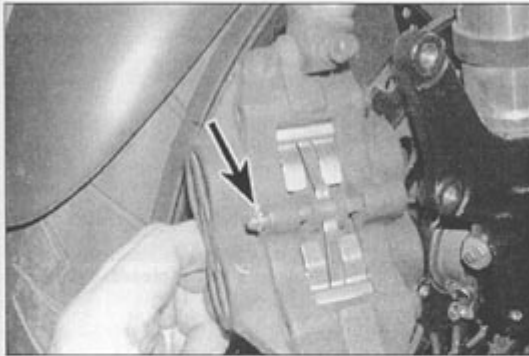
## Tyre sizes\*

|                                 |           |
|---------------------------------|-----------|
| Daytona and Speed Triple models |           |
| Front .....                     | 120/70/17 |
| Rear .....                      | 190/50/17 |
| Sprint models                   |           |
| Front .....                     | 120/70/17 |
| Rear .....                      | 180/55/17 |
| Tiger models                    |           |
| Front .....                     | 110/80/19 |
| Rear .....                      | 150/70/17 |

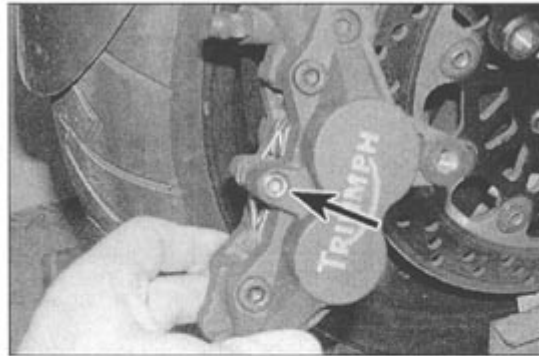
\*Refer to the owners handbook, the tyre information label on the swingarm, or your Triumph dealer or a tyre specialist for approved tyre brands and ratings.

**Torque wrench settings**

|                                                                          |        |
|--------------------------------------------------------------------------|--------|
| Brake pad retaining pins                                                 |        |
| Daytona and Speed Triple models                                          |        |
| Front .....                                                              | 25 Nm  |
| Rear .....                                                               | 20 Nm  |
| Sprint models                                                            |        |
| Front and rear .....                                                     | 20 Nm  |
| Tiger models                                                             |        |
| Front .....                                                              | 18 Nm  |
| Rear .....                                                               | 28 Nm  |
| Front brake caliper mounting bolts                                       |        |
| Daytona, Speed Triple and Sprint models .....                            | 40 Nm  |
| Tiger models .....                                                       | 28 Nm  |
| Brake hose banjo bolts .....                                             | 25 Nm  |
| Front brake disc bolts .....                                             | 22 Nm  |
| Front brake master cylinder clamp bolts .....                            | 15 Nm  |
| Rear brake disc bolts .....                                              | 22 Nm  |
| Rear brake caliper mounting bolts                                        |        |
| Daytona, Speed Triple and Sprint models .....                            | 40 Nm  |
| Tiger models .....                                                       | 28 Nm  |
| Sprocket coupling nut – Daytona, Speed Triple and Sprint ST models ..... | 146 Nm |
| Rear brake master cylinder mounting bolts                                |        |
| Daytona and Speed Triple models .....                                    | 30 Nm  |
| Sprint and Tiger models .....                                            | 27 Nm  |
| Rear brake light switch – Sprint and Tiger models .....                  | 25 Nm  |
| Bleed valves .....                                                       | 7 Nm   |
| Front wheel axle bolt – Daytona and Speed Triple models .....            | 60 Nm  |
| Front wheel axle – Sprint models .....                                   | 61 Nm  |
| Front wheel axle nut – Tiger models .....                                | 60 Nm  |
| Front axle clamp bolts – Daytona, Speed Triple and Sprint models .....   | 20 Nm  |
| Rear axle nut                                                            |        |
| Daytona, Speed Triple and Sprint ST models .....                         | 146 Nm |
| Sprint RS models .....                                                   | 110 Nm |
| Rear axle bolt – Tiger models .....                                      | 85 Nm  |



2.2a Remove the split pin (arrowed) ...



2.2b ... then unscrew the pad pin (arrowed)

## 1 General information

Daytona, Speed Triple and Sprint models are fitted with cast alloy wheels designed for tubeless tyres only. The Tiger model has wire spoked wheels which require the use of tubed tyres.

Both front and rear brakes are hydraulically operated disc brakes. On Daytona, Speed Triple and Sprint models, the front brakes are twin opposed-piston calipers. The rear brake is a twin piston sliding caliper. On Tiger models, both front and rear brakes are twin piston sliding calipers.

**Caution:** Disc brake components rarely require disassembly. Do not disassemble components unless absolutely necessary. If a hydraulic brake line is loosened, the system must be thoroughly bled. Do not use solvents on internal brake components. Solvents will cause the seals to swell and distort. Use only clean brake

fluid or denatured alcohol for cleaning. Use care when working with brake fluid as it can injure your eyes and it will damage painted surfaces and plastic parts.

Many of the bolts used on Triumph motorcycles are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to obtain a set. Make sure you get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be useful in addition to the bits.

## 2 Brake pads – renewal



**Warning:** The dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes.

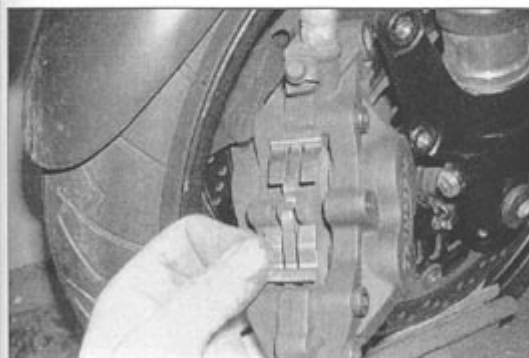
### Daytona, Speed Triple and Sprint models

#### Front

1 If new pads are being installed, displace the calipers from the discs (see Section 3) – this makes it easier to push the pistons back into the caliper to allow for the extra thickness of new pads. If you do this, slacken the pad retaining pin before displacing the caliper, but only by a very small amount (just to break the seal) as there is a split pin in the end of it (see illustration 2.2b). Otherwise, the pads can be removed with the caliper in situ.

2 Remove the split pin from the inner end of the pad retaining pin (see illustration). Unscrew and withdraw the pad pin, noting how it fits through the pad spring (see illustration). Remove the pad spring, noting how it fits (see illustrations). Withdraw the pads from the caliper, noting how they fit (see illustration).

3 Inspect the surface of each pad for contamination and check that the friction material has not worn beyond its service limit

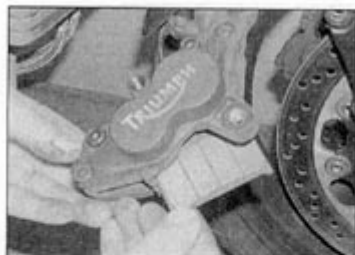


2.2c Remove the pad spring ...



2.2d ... and remove the pads from the caliper

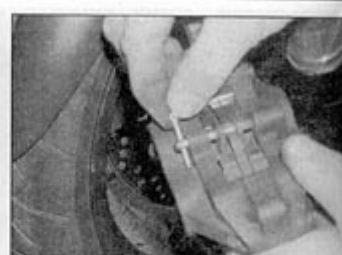
## 6•4 Brakes, wheels and tyres



2.9a Install the pads



2.9b Press down on the spring and insert the pad pin



2.9c Secure the pad pin with a new split pin

(see Chapter 1, Section 9). If either pad is worn down to or beyond the service limit wear indicator, is fouled with oil or grease, or is heavily scored or damaged by dirt and debris, both pads in each caliper must be renewed. Note that it is not possible to degrease the friction material; if the pads are contaminated in any way new ones must be fitted.

4 If the pads are in good condition clean them carefully, using a fine wire brush which is completely free of oil and grease, to remove all traces of road dirt and corrosion. Using a pointed instrument, clean out the groove in the friction material and dig out any embedded particles of foreign matter. Remove any areas of glazing using emery cloth. Spray with a dedicated brake cleaner to remove any dust.

5 Check the condition of the brake disc (see Section 4).

6 Remove all traces of corrosion from the pad pin. Check it for signs of damage and renew it if necessary.

7 If new pads are being installed, push the pistons as far back into the caliper as possible using hand pressure or a piece of wood as leverage. This will displace brake fluid back into the reservoir, so it may be necessary to remove the fluid reservoir cap, plate and diaphragm and siphon out some fluid (depending on how much fluid was in there in the first place and how far the pistons have to be pushed in). If the pistons are difficult to

push back, attach a length of clear hose to the bleed valve and place the open end in a suitable container, then open the valve and try again. Take great care not to draw any air into the system. If in doubt, bleed the brakes afterwards (see Section 10).

8 Lightly smear the backs of the pads and the shank of the pad pin with copper-based grease, making sure that none gets on the front or sides of the pads.

9 Insert the pads into the caliper so that the friction material on each pad faces the other (see illustration). Fit the pad spring onto the pads, making sure it is the correct way up (see illustration 2.2c). Slide the pad retaining pin through the hole in the outer pad, then press down on the pad spring and slide the pin over the spring and through the hole in the inner pad (see illustration). Tighten the pin to the torque setting specified at the beginning of the Chapter. Fit a new split pin into the end of the retaining pin and bend its ends round to secure it (see illustration).

10 If displaced, install the calipers (see Section 3). Top up the master cylinder reservoir if necessary (see *Daily (pre-ride)* checks), and refit the diaphragm, plate and reservoir cap.

11 Operate the brake lever several times to bring the pads into contact with the disc. Check the operation of the brake before riding the motorcycle.

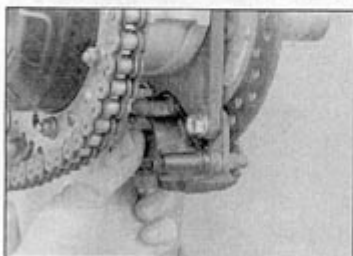
## Rear

12 On Daytona, Speed Triple and Sprint ST models, remove the rear wheel (see Section 14). **Note:** Although the caliper can be displaced and the pads removed with the wheel in situ, access to the caliper mounting bolts is restricted, and there is little clearance between the wheel and the caliper when removing it – it is too easy to scratch the wheel, so it is best to remove it. On Sprint RS models, remove the exhaust silencer for best access to the pad retaining pins and caliper mounting bolts, if required (see Chapter 4).

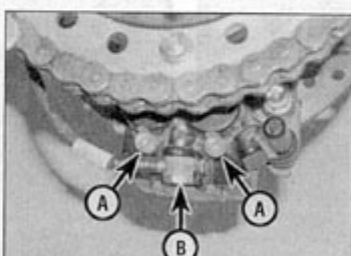
13 If new pads are being fitted, to allow for the increased friction material thickness of new pads, push the brake caliper against the disc so that the pistons are forced back into the caliper (see illustration). This will displace brake fluid back into the reservoir, so it may be necessary to remove the master cylinder reservoir cover and diaphragm and siphon out some fluid. If the pistons are difficult to push back, attach a length of clear hose to the bleed valve and place the open end in a suitable container, then open the valve and try again. Take great care not to draw any air into the system. If in doubt, bleed the brakes afterwards (see Section 10).

14 Slacken the pad retaining pins, but do not yet remove them (see illustrations). Displace the caliper from the disc (see Section 6).

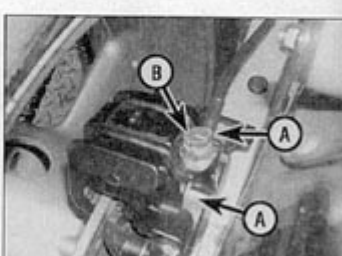
15 Press down on the bottom of the pads



2.13 Push the caliper against the disc so the pistons are pressed back into the caliper

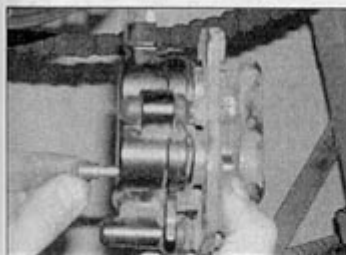


2.14a Pad retaining pins (A), brake hose banjo bolt (B) – Daytona, Speed Triple and Sprint ST

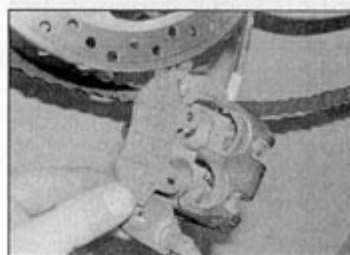


2.14b Pad retaining pins (A), brake hose banjo bolt (B) – Sprint RS





2.15a Withdraw the pad pins ...

2.15b ... then remove the outer pad,  
noting how it locates ...

2.15c ... and the inner pad

and withdraw the retaining pins (see illustration). Remove the outer pad, noting how it hooks against the pin on the caliper bracket, then remove the inner pad, noting how it fits in the bracket (see illustrations). Note how the pad spring is fitted and remove it if required (see illustration).

16 Refer to Steps 3, 4, 5, and 6 above.

17 Check that the caliper body is able to slide freely on the slider pins on the bracket. Separate the bracket from the caliper by sliding them apart (see illustration). Clean off all traces of corrosion and hardened grease. Check the rubber boots in the caliper. If they are damaged or deteriorated, they should be replaced with new ones (but check with a Triumph dealer as they do not list them as being available separately). Apply a smear of copper or silicone based grease to the slider pins. Slide the bracket back onto the caliper.

18 If removed, fit the pad spring into the caliper (see illustration 2.15d), making sure it is correctly located (see illustration).

19 Fit the inner pad into the caliper (see illustration 2.15c) and locate its ends against the bracket (see illustration). Fit the outer pad, locating the cutout around the pin on the bracket (see illustration 2.15b). Press the pads against the spring and slide the pad retaining pins through (see illustration). Make sure the pins pass through the holes in each pad. Tighten the pad retaining pins to the torque setting specified at the beginning of

the Chapter (this can be done after installing the caliper if required).

20 Install the caliper (see Section 6). If not done earlier, now tighten the retaining pins to the torque setting specified at the beginning of the Chapter (see illustration 2.14). Install the rear wheel (see Section 14).

21 Top up the master cylinder reservoir if necessary (see *Daily (pre-ride) checks*).

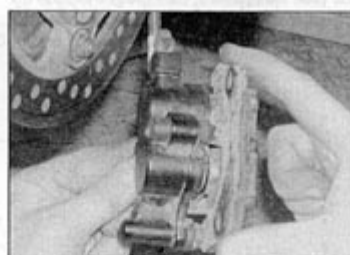
22 Operate the brake pedal several times to bring the pads into contact with the disc. Check the operation of the brake before riding the motorcycle.

#### Tiger models

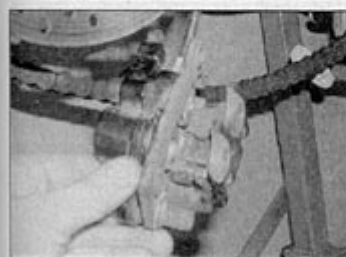
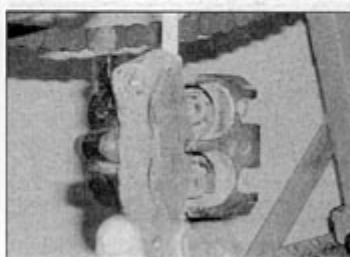
23 If new pads are being fitted, to allow for

the increased friction material thickness of new pads, push the brake caliper against the disc so that the pistons are forced back into the caliper. This will displace brake fluid back into the reservoir, so it may be necessary to remove the master cylinder reservoir cover and diaphragm and siphon out some fluid. If the pistons are difficult to push back, attach a length of clear hose to the bleed valve and place the open end in a suitable container, then open the valve and try again. Take great care not to draw any air into the system. If in doubt, bleed the brakes afterwards (see Section 10).

24 Unscrew the pad retaining pin plug and the pad retaining pin, then remove the pads

2.15d Remove the pad spring if required,  
noting how it fits

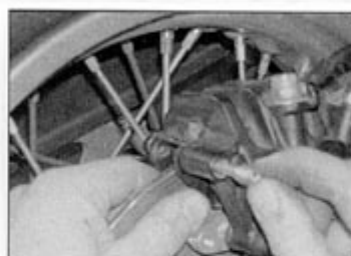
2.17 Slide the bracket out of the caliper

2.18 Make sure the spring locates  
correctly in the caliper2.19a Make sure the inner pad locates  
correctly2.19b Press down on the pads and insert  
the pins

## 6•6 Brakes, wheels and tyres



2.24a Unscrew the plug ...



2.24b ... then unscrew and withdraw the pin ...



2.24c ... and remove the pads

(see illustrations). Note how the pad spring is fitted.

25 Refer to Steps 3, 4, 5, and 6 above.

26 Check that the caliper body is able to slide freely on the slider pins on the bracket. If it doesn't, displace the caliper (see Section 6). Separate the bracket from the caliper by sliding them apart (see illustration). Clean off all traces of corrosion and hardened grease. Check the rubber boots in the caliper. If they are damaged or deteriorated, they should be replaced with new ones (but check with a Triumph dealer as they do not list them as being available separately). Apply a smear of copper or silicone based grease to the slider pins. Slide the bracket back onto the caliper.

27 Make sure the pad spring is correctly positioned in the caliper. Insert the pads into the caliper so that the friction material faces the disc (see illustration), then press the pads up against the spring and slide the pad retaining

pin through (see illustration 2.24b). Make sure the pin passes through the hole in each pad, and the pad ends locate correctly. Tighten the pad retaining pin to the torque setting specified at the beginning of the Chapter. Install the pad pin plug (see illustration 2.24a).

27 Top up the master cylinder reservoir if necessary (see Daily (pre-ride) checks).

28 Operate the brake lever or pedal several times to bring the pads into contact with the disc. Check the operation of the brake before riding the motorcycle.

### 3 Front brake calipers – removal, overhaul and installation



**Warning:** If a caliper indicates the need for an overhaul (usually due to leaking fluid or sticky operation), all old brake fluid should be flushed from the system. Also, the dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use the specified clean brake fluid, dedicated brake cleaner or denatured alcohol only, as described.

1 If the caliper is leaking fluid, or the brake pads are wearing unevenly due to a sticky or

seized piston (first check that this is not due to misalignment of the caliper on the disc), or if the brake lever produces a firm feel when the brake is applied but the brakes are no good, and the hydraulic hoses and the master cylinder are all in good condition, then the caliper must be overhauled.

2 Before disassembling the caliper, read through the entire procedure and make sure that you have a new seal kit. Also, you will need some new DOT 4 brake fluid and some clean rags. **Note:** To prevent damage to the paintwork from spilled brake fluid, always cover the fuel tank when working on the master cylinder.

**Caution:** Disassembly, overhaul and reassembly of the caliper must be done in a spotlessly clean work area to avoid contamination and possible failure of the brake hydraulic system components.

#### Removal

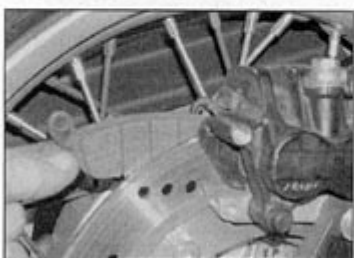
3 If the calipers are being overhauled, remove the brake pads (see Section 2). If the calipers are just being displaced or removed, the pads can be left in place.

4 On Tiger models, unscrew the bolt securing the brake hose guide to the front fork and displace it (see illustration).

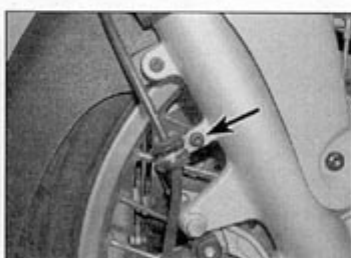
5 If the calipers are just being displaced and not completely removed or overhauled, do not disconnect the brake hose(s). If the calipers are being completely removed or overhauled, remove the brake hose banjo bolt and detach the hose(s), noting the alignment with the caliper (see illustrations). Plug the hose



2.25 Slide the bracket out of the caliper



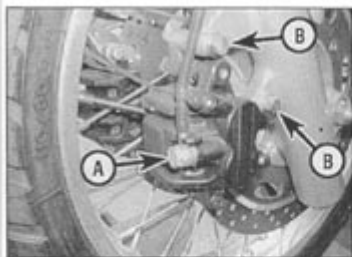
2.27 Slide the pads into the caliper



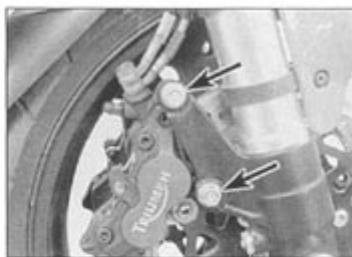
3.4 Unscrew the bolt (arrowed) and displace the hose guide



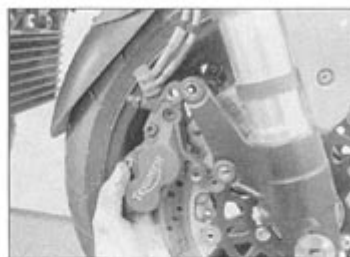
3.5a Brake hose banjo bolt (arrowed) – note the two hoses on the right-hand caliper



3.5b Brake hose banjo bolt (A), caliper mounting bolts (B) – Tiger models



3.6a Unscrew the bolts (arrowed) ...



3.6b ... and slide the caliper off the disc

end(s) or wrap a plastic bag tightly around to minimise fluid loss and prevent dirt entering the system. Discard the sealing washers as new ones must be used on installation. **Note:** If you are planning to overhaul the caliper and don't have a source of compressed air to blow out the pistons, just loosen the banjo bolt at this stage and retighten it lightly. The bike's hydraulic system can then be used to force the pistons out of the body once the pads have been removed. Disconnect the hose once the pistons have been sufficiently displaced.

6 Unscrew the caliper mounting bolts and slide the caliper off the disc (see illustrations or 3.5b).

#### Overhaul

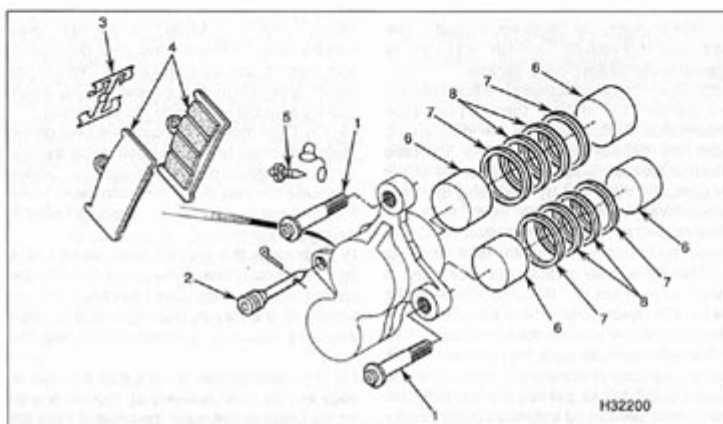
7 Clean the exterior of the caliper with denatured alcohol or brake system cleaner (see illustrations).

8 On Daytona, Speed Triple and Sprint models, using a flat piece of wood, block the pistons on one side of the caliper in their bores and displace the opposite pistons either by pumping them out by operating the front brake lever, or by forcing them out using compressed air. Remove the seals (see Steps 10 and 11) from the bore of the displaced pistons, then reinstall the pistons and block them using the wood. Now displace the pistons from the other side using the same method. Remove the wood and all the pistons. Mark each piston head and caliper body with a felt marker to ensure that the pistons can be matched to their original bores on reassembly. If the compressed air method is used, direct the air into the fluid inlet to force the pistons out of the body. Use only low pressure to ease the pistons out and make sure both pistons on the side concerned are displaced at the same time. If the air pressure is too high and the pistons are forced out, the caliper and/or pistons may be damaged.



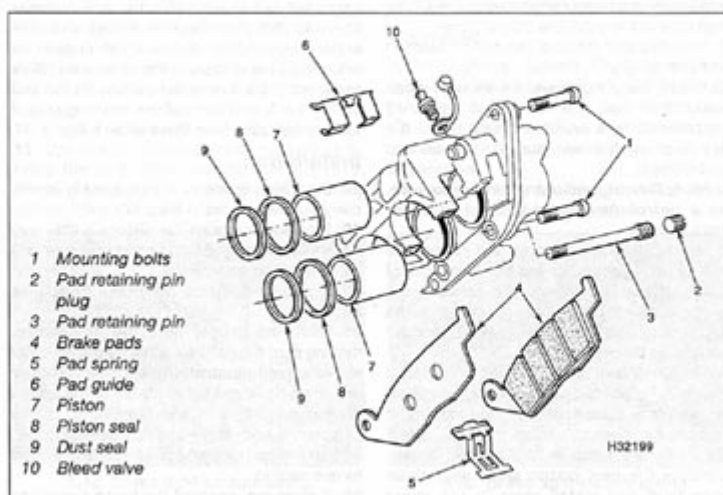
**Warning:** Never place your fingers in front of the pistons in an attempt to catch or protect them when applying compressed air, as serious injury could result.

**Caution:** Do not try to remove the pistons by levering them out, or by using pliers or



3.7a Front brake caliper components – Daytona, Speed Triple and Sprint models

- |                                   |               |               |
|-----------------------------------|---------------|---------------|
| 1 Mounting bolts                  | 3 Pad spring  | 6 Piston      |
| 2 Pad retaining pin and split pin | 4 Brake pads  | 7 Piston seal |
|                                   | 5 Bleed valve | 8 Dust seal   |



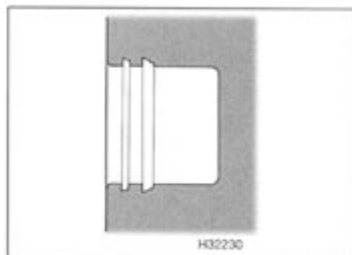
3.7b Front brake caliper components – Tiger models

- |                          |
|--------------------------|
| 1 Mounting bolts         |
| 2 Pad retaining pin plug |
| 3 Pad retaining pin      |
| 4 Brake pads             |
| 5 Pad spring             |
| 6 Pad guide              |
| 7 Piston                 |
| 8 Piston seal            |
| 9 Dust seal              |
| 10 Bleed valve           |

## 6•8 Brakes, wheels and tyres



3.10 Use a plastic or wooden tool (such as a pencil) to remove the seals



3.14 Caliper seal orientation – Daytona, Speed Triple and Sprint models



3.21 Slide the caliper onto the disc and install the mounting bolts

any other grips. On Daytona, Speed Triple and Sprint models, do not attempt to separate the caliper body halves.

9 On Tiger models, separate the bracket from the caliper by sliding them apart (see illustration 2.26). Remove the pad spring from the caliper noting how it fits (see illustration 6.8). Displace the pistons either by pumping them out by operating the front brake lever, or by forcing them out using compressed air. Mark each piston head and caliper body with a felt marker to ensure that the pistons can be matched to their original bores on reassembly. If the compressed air method is used, direct the air into the fluid inlet to force the pistons out of the body. Use only low pressure to ease the pistons out and make sure both pistons are displaced at the same time. If the air pressure is too high and the pistons are forced out, the caliper and/or pistons may be damaged.

10 Using a wooden or plastic tool, remove the dust seals from the caliper bores, noting which way round they fit (see illustration). Discard them as new ones must be used on installation. If a metal tool is being used, take great care not to mark the caliper bores.

11 Remove and discard the piston seals in the same way.

12 Clean the pistons and bores with clean brake fluid of the specified type. If compressed air is available, use it to dry the parts thoroughly (make sure it's filtered and unlubricated).

**Caution:** Do not, under any circumstances, use a petroleum-based solvent to clean brake parts.

13 Inspect the caliper bores and pistons for signs of corrosion, nicks and burrs and loss of plating. If surface defects are present, the caliper assembly must be renewed. If the caliper is in bad shape the master cylinder should also be checked.

14 On Daytona, Speed Triple and Sprint models, note that two sizes of bore and piston are used (see Specifications), and care must therefore be taken to ensure that the correct size seals are fitted to the correct bores. Lubricate the new piston seals with clean brake fluid and install them in the lower grooves in the caliper bores, making sure their

wider side is fitted outermost (see illustration). Lubricate the new dust seals with clean brake fluid and install them in the upper grooves in the caliper bores, again making sure the wider side fits outermost.

15 On Tiger models lubricate the new piston seals with clean brake fluid and install them in the lower grooves in the caliper bores. Lubricate the new dust seals with clean brake fluid and install them in the upper grooves in the caliper bores.

16 Lubricate the pistons with clean brake fluid and install them closed-end first into the caliper bores. Using your thumbs, push the pistons all the way in, making sure they enter the bore squarely without dislodging the seals.

17 On Tiger models, check that the caliper body is able to slide freely on the slider pins on the bracket. Separate the bracket from the caliper by sliding them apart (see illustration 2.26). Clean off all traces of corrosion and hardened grease. Check the rubber boots in the caliper. If they are damaged or deteriorated, they should be replaced with new ones (but check with a Triumph dealer as they do not list them as being available separately). Apply a smear of copper or silicone based grease to the slider pins. Slide the bracket back onto the caliper. Fit the pad spring back into the caliper, making sure it locates correctly (see illustration 6.8).

#### Installation

18 On Tiger models, if not already done, carry out the checks in Step 17.

19 If necessary, push the pistons a little way back into the caliper using hand pressure or a piece of wood as leverage.

20 If removed, install the brake pads (see Section 2).

21 Slide the caliper onto the brake disc, making sure the pads sit squarely each side of the disc (see illustration). Install the caliper mounting bolts and tighten them to the torque setting specified at the beginning of the Chapter. If necessary and not already done, tighten the pad retaining pin(s) to the specified torque setting.

22 If removed, connect the brake hose(s) to the caliper, using new sealing washers on

each side of the union(s). Align the hose(s) as noted on removal (see illustration 3.5a or b). Tighten the banjo bolt to the torque setting specified at the beginning of the Chapter.

23 On Tiger models, fit the brake hose guide onto the front fork and tighten the bolt securely (see illustration 3.4).

24 Top up the master cylinder reservoir with DOT 4 brake fluid (see Daily (pre-ride) checks) and bleed the hydraulic system as described in Section 10. Check for leaks and thoroughly test the operation of the brake before riding the motorcycle.

#### 4 Front brake discs – inspection, removal and installation

##### Inspection

1 Visually inspect the surface of the disc for score marks and other damage. Light scratches are normal after use and won't affect brake operation, but deep grooves and heavy score marks will reduce braking efficiency and accelerate pad wear. If a disc is badly grooved it must be machined or a new one fitted.

2 To check disc runout, position the bike on an auxiliary stand and support it so that the front wheel is raised off the ground. Mount a dial gauge to a fork leg, with the plunger on the gauge touching the surface of the disc about 10 mm (1/2 in) from the outer edge (see illustration). Rotate the wheel and watch the



4.2 Set up a dial gauge with the probe contacting the brake disc, then rotate the wheel to check for runout





4.3 Using a micrometer to measure disc thickness

gauge needle, comparing the reading with the limit listed in the Specifications at the beginning of the Chapter. If the runout is greater than the service limit, check the wheel bearings for play (see Chapter 1). If the bearings are worn, install new ones (see Section 15) and repeat this check. If the disc runout is still excessive, a new one will have to be fitted, although machining by an engineer may be possible.

3 The disc must not be machined or allowed to wear down to a thickness less than the service limit as listed in this Chapter's Specifications. The thickness of the disc can be checked with a micrometer or any other measuring tool (see illustration). If the thickness of the disc is less than the service limit, a new one must be fitted.

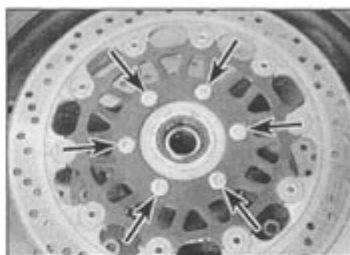
**Note:** Even if only one disc needs to be renewed, Triumph specify that they must be renewed as a pair. They also specify that the disc bolts should only be used once, so get new ones in advance.

#### Removal

4 Remove the wheel (see Section 13).

**Caution:** Do not lay the wheel down and allow it to rest on the disc – the disc could become warped. Set the wheel on wood blocks so the disc doesn't support the weight of the wheel.

5 Mark the relationship of the discs to the wheel, so they can be installed in the same position (unless you are fitting new discs). Also mark the discs according to their side – this is especially important on Daytona, Speed Triple and Sprint models as the discs



4.6 Unscrew the bolts (arrowed) and remove the disc

are different. If you are installing new discs, match them to the old ones so they can be installed correctly.

6 Unscrew the disc retaining bolts, loosening them evenly and a little at a time in a criss-cross pattern to avoid distorting the disc, then remove the disc from the wheel (see illustration). Discard the bolts as Triumph specify that new ones should be used.

#### Installation

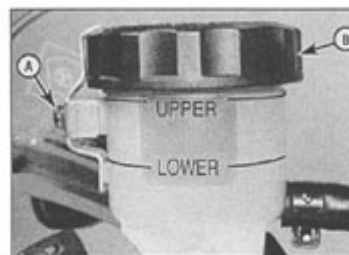
7 Before installing the disc, make sure there is no dirt or corrosion where the disc seats on the hub, particularly right in the angle of the seat, as this will not allow the disc to sit flat when it is bolted down and it will appear to be warped when checked or when using the front brake.

8 Mount the disc on the wheel making sure it is the correct way round, and on Daytona, Speed Triple and Sprint models, on the correct side (see Step 5). Align the previously applied matchmarks (if you're reinstalling the original disc).

9 Install new bolts and tighten them evenly and a little at a time in a criss-cross pattern to the torque setting specified at the beginning of the Chapter (see illustration 4.6). Clean off all grease from the brake disc using acetone or brake system cleaner. If a new brake disc has been installed, remove any protective coating from its working surfaces.

10 Install the front wheel (see Section 13).

11 Operate the brake lever several times to bring the pads into contact with the disc. Check the operation of the brakes carefully before riding the bike.



5.3a Undo the screw (A) and remove the cap, then slacken the cap (B)

#### 5 Front brake master cylinder – removal, overhaul and installation

1 If the master cylinder is leaking fluid, or if the lever does not produce a firm feel when the brake is applied, and bleeding the brakes does not help (see Section 10), and the hydraulic hoses and the brake calipers are all in good condition, then master cylinder overhaul is recommended.

2 Before disassembling the master cylinder, read through the entire procedure and make sure that you have the correct rebuild kit. Also, you will need some new DOT 4 brake fluid, some clean rags and internal circlip pliers. **Note:** To prevent damage to the paintwork from spilled brake fluid, always cover the fuel tank and surrounding areas when working on the master cylinder.

**Caution:** Disassembly, overhaul and reassembly of the brake master cylinder must be done in a spotlessly clean work area to avoid contamination and possible failure of the brake hydraulic system components.

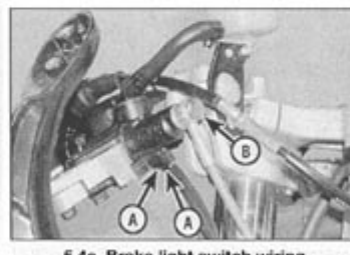
#### Removal

3 On Daytona, Speed Triple and Sprint models, remove the reservoir cap clamp and partially unscrew the cap (see illustration). On Tiger models, slacken the reservoir cover screws, but do not yet remove them (see illustration).

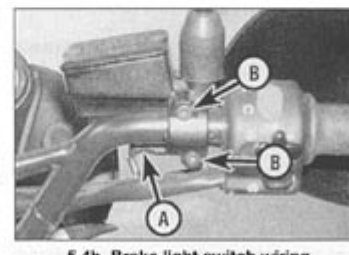
4 Disconnect the brake light switch wiring connectors (see illustrations).



5.3b Slacken the reservoir cover screws



5.4a Brake light switch wiring connectors (A), brake hose banjo bolt (B) – Daytona shown



5.4b Brake light switch wiring connectors (A), master cylinder clamp bolts (B) – Tiger models



## 6•10 Brakes, wheels and tyres



5.6 Brake hose banjo bolt (arrowed) - Tiger models



5.7 Reservoir mounting bolt (arrowed) - Sprint shown



5.8 Front brake master cylinder clamp bolts (arrowed) - Daytona shown

5 If the master cylinder is being overhauled, remove the front brake lever (see Chapter 5). If it is just being displaced it can remain in situ.

6 If the master cylinder is being completely removed or overhauled, place some rags under and around it, then unscrew the brake hose banjo bolt and separate the hose from the master cylinder, noting its alignment (see

illustration or 5.4a). Discard the sealing washers as they must be replaced with new ones. Wrap the end of the hose in a clean rag and suspend it in an upright position or bend it down carefully and place the open end in a clean container. The objective is to prevent excessive loss of brake fluid, fluid spills and system contamination. Also wrap a rag

around the master cylinder fluid outlet. If the master cylinder is just being displaced and not completely removed or overhauled, do not disconnect the brake hose.

7 On Daytona, Speed Triple and Sprint models, unscrew the bolt securing the reservoir to its mounting bracket (see illustration). Temporarily support the reservoir upright.

8 Unscrew the master cylinder clamp bolts, then lift the master cylinder and reservoir away from the handlebar (see illustration or 5.4b).

9 On Daytona, Speed Triple and Sprint models, remove the reservoir cap, the diaphragm plate and the rubber diaphragm. On Tiger models, remove the reservoir cover and the rubber diaphragm. Drain the brake fluid from the reservoir into a suitable container. On Daytona, Speed Triple and Sprint models, release the clamp securing the reservoir hose to the union on the master cylinder, then detach the hose. Wipe any remaining fluid out of the reservoir with a clean rag.

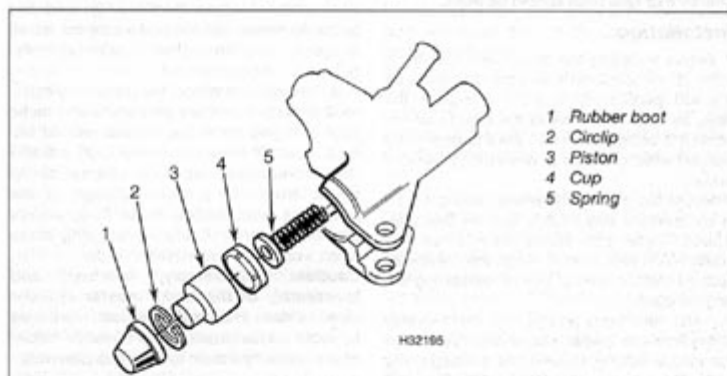
10 If required, remove the screw securing the brake light switch to the underside of the master cylinder and remove the switch.

**Caution:** Do not tip the master cylinder upside down or brake fluid will run out.

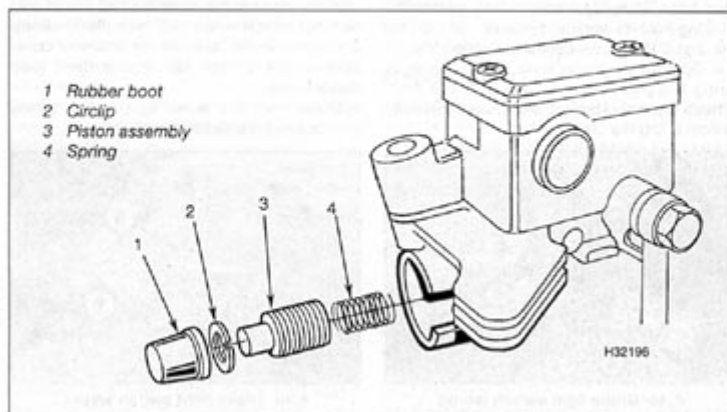
### Overhaul

11 Carefully remove the dust boot from the master cylinder, noting how it locates (see illustrations).

12 Using circlip pliers, remove the circlip and



5.11a Front master cylinder components - Daytona, Speed Triple and Sprint models



5.11b Front master cylinder components - Tiger models



5.11c Remove the rubber boot from the end of the master cylinder piston ...



5.12 ... then depress the piston and remove the circlip using a pair of internal circlip pliers

slide out the piston assembly and the spring, noting how they fit (see illustration). If they are difficult to remove, apply low pressure compressed air to the fluid outlet. Lay the parts out in the proper order to prevent confusion during reassembly.

13 Clean all parts with clean brake fluid. If compressed air is available, use it to dry the parts thoroughly (make sure it's filtered and unlubricated).

**Caution:** Do not, under any circumstances, use a petroleum-based solvent to clean brake parts.

14 Check the master cylinder bore for corrosion, scratches, nicks and score marks. If damage or wear is evident, the master cylinder must be replaced with a new one. If the master cylinder is in poor condition, then the calipers should be checked as well. Check that the fluid inlet and outlet ports in the master cylinder are clear.

15 The dust boot, circlip, piston assembly and spring are included in the rebuild kit. Use all of the new parts, regardless of the apparent condition of the old ones. Fit them according to the layout of the old piston assembly (see illustration 5.11a or b).

16 Fit the spring into the master cylinder.

17 Lubricate the piston assembly with clean brake fluid. Fit the assembly into the master cylinder, making sure it is the correct way round. Make sure the lips on the cup do not turn inside out when they are slipped into the bore. Depress the piston and install the new circlip, making sure that it locates in the groove (see illustration 5.12).



5.27a On Daytona, Speed Triple and Sprint models, fit the diaphragm, plate and cap and secure them with the clamp



5.21 Align the mating surfaces of the clamp with the punchmark (arrowed) on the handlebar

18 Install the rubber dust boot, making sure the lip is seated correctly in the groove (see illustration 5.11c).

19 Inspect the reservoir rubber diaphragm and renew it if it is damaged or deteriorated. On Daytona, Speed Triple and Sprint models, inspect the reservoir hose for cracks or splits and renew if necessary.

#### Installation

20 If removed, fit the brake light switch onto the underside of the master cylinder.

21 Attach the master cylinder to the handlebar and fit the clamp with its 'UP' mark facing up, aligning the top mating surfaces of the clamp with the punchmark on the handlebar (see illustration). Tighten the upper bolt first, then the lower bolt to the torque setting specified at the beginning of the Chapter.

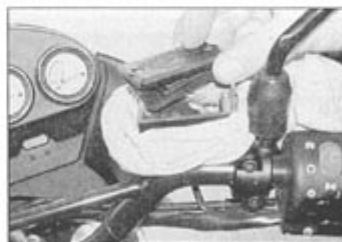
22 If detached, connect the brake hose to the master cylinder, using new sealing washers on each side of the union, and aligning the hose as noted on removal (see illustration 5.4a or 5.6). Tighten the banjo bolt to the torque setting specified at the beginning of the Chapter.

23 If removed, install the brake lever (see Chapter 5).

24 On Daytona, Speed Triple and Sprint models, mount the reservoir and tighten the bolt securely (see illustration 5.7). Connect the reservoir hose to the union on the master cylinder and secure it with the clamp.

25 Connect the brake light switch wiring connectors (see illustration 5.4a or b).

26 Fill the fluid reservoir with new DOT 4



5.27b On Tiger models, fit the diaphragm and cover and secure them with the screws

brake fluid as described in Daily (pre-ride) checks. Refer to Section 10 of this Chapter and bleed the air from the system.

27 Fit the rubber diaphragm, making sure it is correctly seated, the diaphragm plate (except Tiger models) and the cap or cover onto the master cylinder reservoir, then fit the cap clamp or tighten the cover screws, according to model (see illustrations).

28 Check the operation of the front brake before riding the motorcycle.

#### 6 Rear brake caliper – removal, overhaul and installation



**Warning:** If a caliper indicates the need for an overhaul (usually due to leaking fluid or sticky operation), all old brake fluid should be flushed from the system. Also, the dust created by the brake system may contain asbestos, which is harmful to your health. Never blow it out with compressed air and don't inhale any of it. An approved filtering mask should be worn when working on the brakes. Do not, under any circumstances, use petroleum-based solvents to clean brake parts. Use the specified clean brake fluid, dedicated brake cleaner or denatured alcohol only, as described.

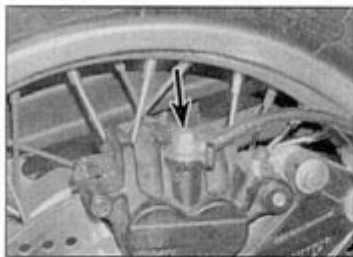
1 If the caliper is leaking fluid, or the brake pads are wearing unevenly due to a sticky or seized piston (first check that this is not due to misalignment of the caliper on the disc), or if the brake lever produces a firm feel when the brake is applied but the brakes are no good, and the hydraulic hoses and the master cylinder are all in good condition, then the caliper must be overhauled.

2 Before disassembling the caliper, read through the entire procedure and make sure that you have a new seal kit. Also, you will need some new DOT 4 brake fluid and some clean rags. **Note:** To prevent damage to the paint from spilled brake fluid, always cover the fuel tank when working on the master cylinder. **Caution:** Disassembly, overhaul and reassembly of the caliper must be done in a spotlessly clean work area to avoid contamination and possible failure of the brake hydraulic system components.

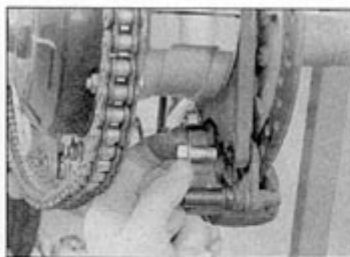
#### Removal

3 On Daytona, Speed Triple and Sprint ST models, remove the rear wheel (see Section 14). **Note:** Although the caliper can be displaced and the pads removed with the wheel in situ, access to the caliper mounting bolts is restricted, and there is little clearance between the wheel and the caliper when removing it – it is too easy to scratch the wheel, so it is best to remove it. On Sprint RS models, remove the exhaust silencer for best access to the pad retaining pins and caliper mounting bolts, if required (see Chapter 4).

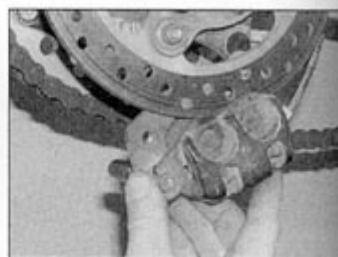
## 6•12 Brakes, wheels and tyres



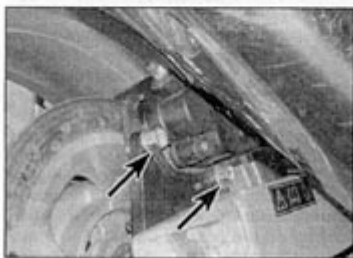
6.5 Brake hose banjo bolt (arrowed) - Tiger models



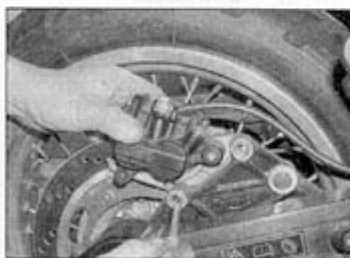
6.6a On Daytona, Speed Triple and Sprint ST, unscrew the mounting bolts ...



6.6b ... and slide the caliper off the disc



6.6c Caliper mounting bolts (arrowed) - Sprint RS models



6.6d Removing the caliper - Tiger models

4 If the calipers are being overhauled, remove the brake pads (see Section 2). If the calipers are just being displaced or removed, the pads can be left in place.

5 If the caliper is just being displaced and not completely removed or overhauled, do not disconnect the brake hose. If the caliper is being completely removed or overhauled, remove the brake hose banjo bolt and detach the hose, noting the alignment with the caliper (see illustration or 2.14a or b). Plug the hose end or wrap a plastic bag tightly around to minimise fluid loss and prevent dirt entering the system. Discard the sealing washers as new ones must be used on installation. **Note:** If you are planning to overhaul the caliper and don't have a source of compressed air to blow

out the pistons, just loosen the banjo bolt at this stage and retighten it lightly. The bike's hydraulic system can then be used to force the pistons out of the body once the pads have been removed. Disconnect the hose once the pistons have been sufficiently displaced.

6 Unscrew the caliper mounting bolts and slide the caliper off the disc (see illustrations).

### Overhaul

7 Clean the exterior of the caliper with denatured alcohol or brake system cleaner (see illustration).

8 Separate the bracket from the caliper by sliding them apart (see illustration 2.17 or 2.26). On Tiger models, and if not already done on all other models, remove the pad spring from the caliper, noting how it fits (see illustration or 2.15d). Displace the pistons either by pumping them out by operating the brake pedal, or by forcing them out using compressed air. Mark each piston head and

caliper body with a felt marker to ensure that the pistons can be matched to their original bores on reassembly. If the compressed air method is used, direct the air into the fluid inlet to force the pistons out of the body. Use only low pressure to ease the pistons out and make sure both pistons are displaced at the same time. If the air pressure is too high and the pistons are forced out, the caliper and/or pistons may be damaged.



**Warning:** Never place your fingers in front of the pistons in an attempt to catch or protect them when applying compressed air, as serious injury could result.

**Caution:** Do not try to remove the pistons by levering them out, or by using pliers or any other grips.

9 Using a wooden or plastic tool, remove the dust seals from the caliper bores, noting which way round they fit (see illustration 3.10). Discard them as new ones must be used on installation. If a metal tool is being used, take great care not to mark the caliper bores.

10 Remove and discard the piston seals in the same way.

11 Clean the pistons and bores with clean brake fluid of the specified type. If compressed air is available, use it to dry the parts thoroughly (make sure it's filtered and unlubricated).

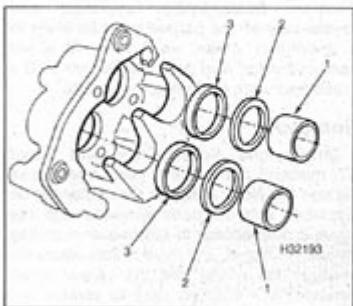
**Caution:** Do not, under any circumstances, use a petroleum-based solvent to clean brake parts.

12 Inspect the caliper bores and pistons for signs of corrosion, nicks and burrs and loss of plating. If surface defects are present, the caliper assembly must be renewed. If the caliper is in bad shape the master cylinder should also be checked.

13 Lubricate the new piston seals with clean brake fluid and install them in the lower grooves in the caliper bores.

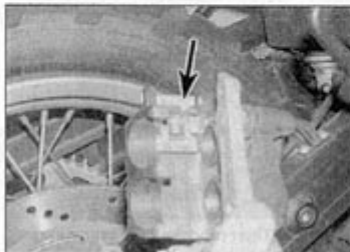
14 Lubricate the new dust seals with clean brake fluid and install them in the upper grooves in the caliper bores.

15 Lubricate the pistons with clean brake fluid and install them closed-end first into the caliper bores. Using your thumbs, push the pistons all the way in, making sure they enter the bore squarely without dislodging the seals.



6.7 Rear brake caliper components

- |              |                |
|--------------|----------------|
| 1 Pistons    | 3 Piston seals |
| 2 Dust seals |                |



6.8 Pad spring (arrowed) - Tiger models

16 Check that the caliper body is able to slide freely on the slider pins on the bracket. Separate the bracket from the caliper by sliding them apart (see illustration 2.17 or 2.26). Clean off all traces of corrosion and hardened grease. Check the rubber boots in the caliper. If they are damaged or deteriorated, they should be replaced with new ones (but check with a Triumph dealer as they do not list them as being available separately). Apply a smear of copper or silicone based grease to the slider pins. Slide the bracket back onto the caliper.

17 Fit the pad spring back into the caliper, making sure it locates correctly (see illustrations 2.15d and 2.18 or 6.8).

### Installation

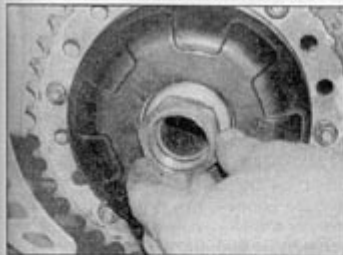
18 If not already done, carry out the checks in Step 16.

19 If necessary, push the pistons a little way back into the caliper using hand pressure or a piece of wood as leverage.

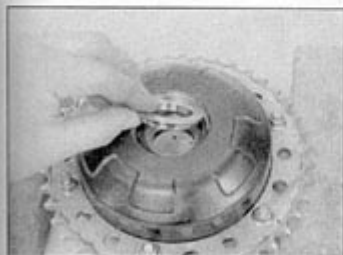
20 If removed, install the brake pads (see Section 2).

21 Slide the caliper onto the brake disc, making sure the pads sit squarely each side of the disc (see illustrations 6.6a and b, or 6.6c or 6.6d). Install the caliper mounting bolts and tighten them to the torque setting specified at the beginning of the Chapter.

22 If removed, connect the brake hose to the caliper, using new sealing washers on each side of the union. Align the hose as noted on removal (see illustration 2.14a, 2.14b or 6.5). Tighten the banjo bolt to the torque setting specified at the beginning of the Chapter.



7.3c Remove the nut ...



7.3f Remove the spacer for safekeeping if required

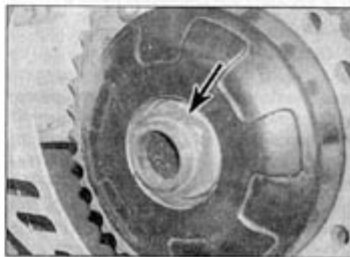
23 On Daytona, Speed Triple and Sprint ST models, install the rear wheel if removed (see Section 14). On Sprint RS models, install the exhaust silencer if removed (see Chapter 4).

24 Top up the master cylinder reservoir with DOT 4 brake fluid (see Daily (pre-ride) checks) and bleed the hydraulic system as described in Section 10. Check that there are no leaks and thoroughly test the operation of the brake before riding the motorcycle.

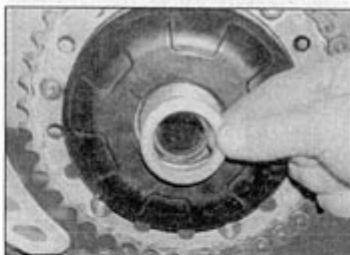
## 7 Rear brake disc – inspection, removal and installation

### Inspection

1 Refer to Section 4 of this Chapter, noting that the dial gauge should be attached to the swingarm.



7.3a Apply the rear brake and slacken the nut (arrowed)



7.3d ... and the dished washer, noting which way round it fits



7.3g Slide the thrust washer off the end of the axle ...

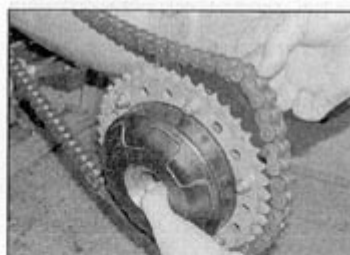
### Removal

2 Remove the rear wheel (see Section 14).

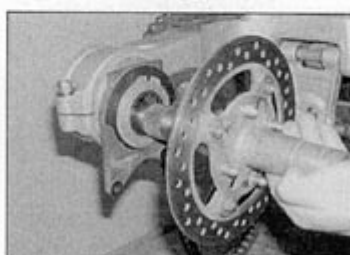
3 On Daytona, Speed Triple and Sprint ST models, unscrew the bolts securing the chainguards and remove them. Have an assistant apply the rear brake hard, then slacken the sprocket coupling nut (see illustration). Displace the rear caliper (see Section 6). Slacken the drive chain adjuster clamp bolt (see illustration). Remove the coupling nut and its washer, noting which way round it fits, then slide the sprocket coupling off the axle and disengage it from the chain (see illustrations). Note the shouldered spacer in the outside of the coupling and remove it for safekeeping if required (see illustration). Slide the thrust washer off the end of the axle, then draw the axle/disc carrier out of the hub, noting which way round it fits (see illustrations). Note that Triumph specify



7.3b Slacken the clamp bolt (arrowed)



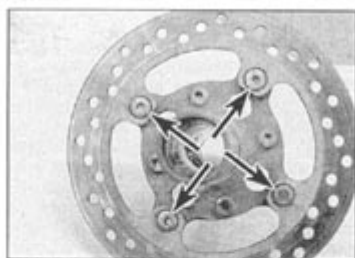
7.3e Slide the sprocket coupling off the axle and disengage the chain



7.3h ... then draw the axle/disc carrier out of the hub



## 6•14 Brakes, wheels and tyres



7.5 Rear disc bolts (arrowed) - Daytona, Speed Triple and Sprint ST models

to use a new sprocket coupling nut on installation.

4 On all models, mark the relationship of the disc to the carrier or wheel, and note which side of the carrier the disc sits on, so it can be installed in the same position (unless you are fitting a new disc).

5 Unscrew the disc retaining bolts, loosening them evenly and a little at a time in a criss-cross pattern to avoid distorting the disc, then remove the disc from the carrier or wheel (see illustration). On Daytona, Speed Triple and Sprint ST models, you may have to counter-hold the nuts. Discard the bolts as Triumph specify that new ones should be used.

### Installation

6 Before installing the disc, make sure there is no dirt or corrosion where the disc seats on the hub, particularly right in the angle of the seat, as this will not allow the disc to sit flat when it is bolted down and it will appear to be warped when checked or when using the rear brake.

7 Mount the disc on the carrier or wheel making sure it is the correct way round, and on Daytona, Speed Triple and Sprint models, on the correct side (see illustration 7.5). Align the previously applied matchmarks (if you're reinstalling the original disc).

8 Install new bolts (on Daytona, Speed Triple and Sprint ST models the nuts can be reused), then tighten them evenly and a little at a time in a criss-cross pattern to the torque setting



7.9a Slide the sprocket coupling onto the axle

specified at the beginning of the Chapter. Clean off all grease from the brake disc using acetone or brake system cleaner. If a new brake disc has been installed, remove any protective coating from its working surfaces.

9 On Daytona, Speed Triple and Sprint ST models, slide the axle/disc carrier fully into the hub, making sure it is the correct way round (see illustration 7.3h). Fit the shouldered spacer into the outside of the sprocket coupling if removed (see illustration 7.3f). Slide the thrust washer onto the axle (see illustration 7.3g). Fit the sprocket coupling into the chain and slide it onto the axle (see illustration). Fit the dish washer so that its outer rim is against the spacer and the inner rim is raised off it, then fit the nut and tighten it finger-tight (see illustrations 7.3d and c). Install the brake caliper (see Section 6). Tighten the coupling nut to the torque setting specified at the beginning of the Chapter, applying the rear brake to prevent the coupling turning. Stake the rim of the nut into the cutout in the end of the axle (see illustration).

10 Install the rear wheel (see Section 14). Refer to Chapter 1 and adjust the drive chain slack.

11 Operate the brake pedal several times to bring the pads into contact with the disc. Check the operation of the brake carefully before riding the motorcycle.



7.9b Stake the rim of the nut against the detent in the axle

### 8 Rear brake master cylinder - removal, overhaul and installation

1 If the master cylinder is leaking fluid, or if the lever does not produce a firm feel when the brake is applied, and bleeding the brakes does not help (see Section 10), and the hydraulic hose and brake caliper are in good condition, then master cylinder overhaul is recommended.

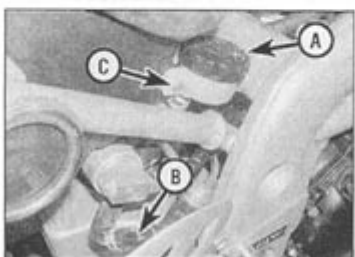
2 Before disassembling the master cylinder, read through the entire procedure and make sure that you obtain any replacement parts required. Also, you will need some new DOT 4 brake fluid, some clean rags and internal circlip pliers. **Note:** To prevent damage to the paintwork from spilled brake fluid, always cover the surrounding components when working on the master cylinder.

**Caution:** Disassembly, overhaul and reassembly of the brake master cylinder must be done in a spotlessly clean work area to avoid contamination and possible failure of the brake hydraulic system components.

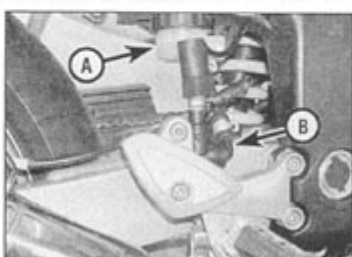
#### Removal

3 On Daytona, Speed Triple and Sprint models, remove the seat cowlings, and on Tiger models remove the right-hand side panel (see Chapter 7).

4 Place some rags around the master cylinder and prepare a small container to hold some brake fluid. Remove the reservoir cap, diaphragm plate and diaphragm (see illustrations). Release the clamp securing the



8.4a Reservoir cap (A), hose union (B) and reservoir bolt (C) - Daytona



8.4b Reservoir (A) and hose union (B) - Sprint



8.4c Reservoir ...





8.4d ... and hose union (arrowed) – Tiger

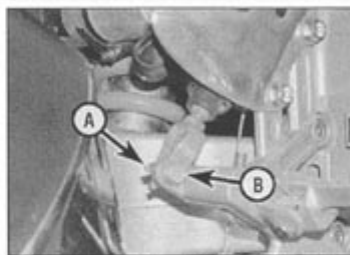
reservoir hose to the union on the master cylinder and detach the hose, pinching its end as you do to retain the fluid, then place the end in the container and allow the reservoir to drain. Refit the diaphragm, plate and cap.

5 Remove the bolt securing the reservoir to the frame and remove it, being prepared to catch any drops from the end of the hose.

6 Remove the retaining clip from the clevis pin securing the master cylinder pushrod to the brake pedal (see illustrations). Withdraw the clevis pin and separate the pushrod from the pedal.

7 On Sprint and Tiger models, displace the rubber boot from the top of the master cylinder and detach the brake light switch wiring connectors (see illustration).

8 Unscrew the brake hose banjo bolt or brake light switch and separate the brake hose from the master cylinder, noting its alignment (see



8.6a Remove the retaining clip (A) and slide out the clevis pin (B)

illustrations). Discard the two sealing washers as they must be replaced with new ones. Wrap the end of the hose in a clean rag and suspend the hose in an upright position or bend it down carefully and place the open end in a clean container. The objective is to prevent excessive loss of brake fluid, fluid spills and system contamination.

9 Unscrew the two bolts securing the master cylinder to the footrest bracket and remove the master cylinder, on Daytona and Speed Triple models noting how the bottom bolt secures the brake light switch, and that there is an equivalent spacer with the top bolt, both fitting between the cylinder and the footrest bracket, and also how the bolts secure the heel guard (see illustrations).

#### Overhaul

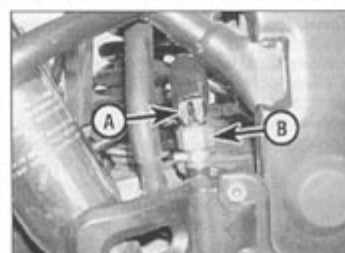
10 If required, mark the position of the clevis



8.6b On Tiger models, access to the clevis (arrowed) is restricted

locknut on the pushrod, then slacken the locknut and thread the clevis and nut off the pushrod (see illustration).

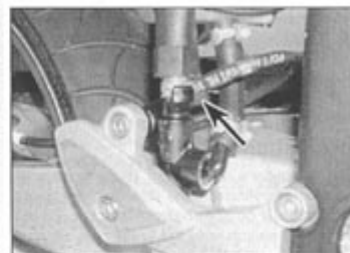
11 Dislodge the rubber dust boot from the



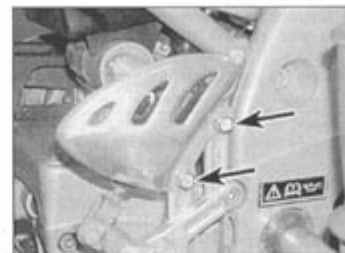
8.7 Brake light switch wiring connectors (A), brake light switch (B) – Tiger shown



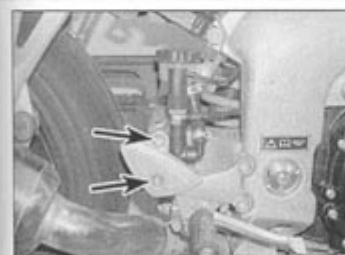
8.8a Note the alignment of the hose before removing the banjo bolt (arrowed) or switch



8.8b On Sprint models, note how the hose butts against the lug (arrowed)



8.9a Master cylinder mounting bolts (arrowed) – Daytona and Speed Triple



8.9b Master cylinder mounting bolts (arrowed) – Sprint



8.9c Master cylinder mounting bolts (arrowed) – Tiger



8.10 Hold the clevis and slacken the locknut

## 6•16 Brakes, wheels and tyres



8.11 Remove the dust boot from the bottom of the master cylinder

base of the master cylinder to reveal the pushrod retaining circlip (see illustration).

12 Depress the pushrod and, using circlip pliers, remove the circlip (see illustration). Slide out the pushrod, piston assembly and spring (see illustration). If they are difficult to remove, apply low pressure compressed air to the fluid outlet. Lay the parts out in the proper order to prevent confusion during reassembly.

13 Clean all of the parts with clean brake fluid.

**Caution:** Do not, under any circumstances, use a petroleum-based solvent to clean brake parts. If compressed air is available, use it to dry the parts thoroughly (make sure it's filtered and unlubricated).

14 Check the master cylinder bore for corrosion, scratches, nicks and score marks.

If damage is evident, the master cylinder must be replaced with a new one. If the master cylinder is in poor condition, then the caliper should be checked as well.

15 Inspect the reservoir hose for cracks or splits and replace it with a new one if necessary. If required, remove the circlip securing the hose union to the master cylinder



8.12a Depress the pushrod and remove the circlip

and pull the union out. Discard the O-ring as a new one must be used.

16 Install a new piston and spring, regardless of the apparent condition of the old ones. Fit them according to the layout of the old piston assembly (see illustration 8.12b).

17 Fit the spring into the master cylinder.

18 Lubricate the piston assembly with clean brake fluid. Fit the assembly into the master cylinder, making sure it is the correct way round. Make sure the lips on the cup do not turn inside out when they are slipped into the bore.

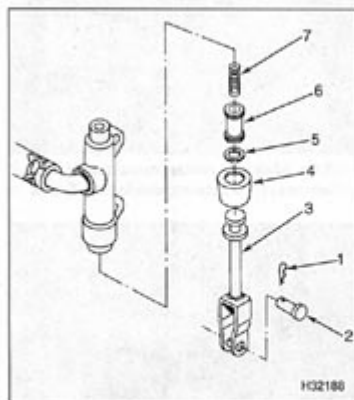
19 Fit the new rubber boot onto the rod and locate the lower rim in its groove. Install and depress the pushrod, then fit a new circlip (see illustration 8.12a). Fit the inner rim of the boot into the groove in the master cylinder (see illustration 8.11).

20 If removed, fit a new reservoir hose union O-ring, then push the union into the master cylinder and secure it with the circlip.

21 If removed, thread the clevis locknut and the clevis onto the master cylinder pushrod end. Position the clevis as noted on removal, then tighten the locknut securely (see illustration 8.10).

### Installation

22 On Daytona and Speed Triple models, fit the master cylinder bolts into the heel guard and locate it on the footrest bracket. Fit the brake light switch onto the lower bolt, aligning it correctly, and the equivalent spacer onto the top bolt. Locate the master cylinder and tighten the bolts to the torque setting



8.12b Rear master cylinder components

- |                  |                   |
|------------------|-------------------|
| 1 Retaining clip | 5 Circlip         |
| 2 Clevis pin     | 6 Piston assembly |
| 3 Push rod       | 7 Spring          |
| 4 Rubber boot    |                   |

specified at the beginning of the Chapter (see illustration 8.9a).

23 On Sprint and Tiger models, fit the master cylinder onto the footrest bracket and tighten its mounting bolts to the torque setting specified at the beginning of the Chapter (see illustration 8.9b or 8.9c).

24 Connect the brake hose to the master cylinder, using new sealing washers on each side of the union, and aligning the hose as noted on removal (see illustration 8.8a and b). Tighten the banjo bolt or brake light switch to the torque setting specified at the beginning of the Chapter. On Sprint and Tiger models, connect the brake light switch wiring connectors, then fit the rubber boot over them (see illustration 8.7).

25 Install the reservoir and secure it with the bolt. Ensure that the hose is correctly routed, then connect it to the union on the master cylinder and secure it with the clamp (see illustration 8.4a, 8.4b or 8.4c and d). Check that the hose is secure and clamped at the reservoir end as well. If the clamps have weakened, use new ones.

26 Align the brake pedal with the master cylinder pushrod clevis, then slide in the clevis pin and secure it with the retaining clip (see illustration 8.6a or b).

27 Fill the fluid reservoir with new DOT 4 brake fluid (see Daily (pre-ride) checks) and bleed the system following the procedure in Section 10.

28 Fit the rubber diaphragm, making sure it is correctly seated, the diaphragm plate and the cap onto the master cylinder reservoir (see illustration).

29 On Daytona, Speed Triple and Sprint models, install the seat cowling, and on Tiger models install the right-hand side panel (see Chapter 7).

30 Check the operation of the brake carefully before riding the motorcycle.

## 9 Brake hoses and unions – inspection and renewal

### Inspection

1 Brake hose condition should be checked regularly and the hoses renewed at the specified interval (see Chapter 1).

2 Twist and flex the hoses while looking for cracks, bulges and seeping fluid. Check extra carefully around the areas where the hoses connect with the banjo fittings, as these are common areas for hose failure.

3 Check the banjo union fittings connected to the brake hoses. If the union fittings are rusted, scratched or cracked, fit new hoses.

### Renewal

4 The brake hoses have banjo union fittings on each end. Cover the surrounding area with plenty of rags and unscrew the banjo bolt at each end of the hose or pipe, noting its



8.28 Fit the diaphragm, plate and cap

alignment (see illustration). Note that on Sprint and Tiger models, the hose from the rear brake master cylinder is secured by the brake light switch instead of a banjo bolt – displace the rubber boot from the top of the master cylinder and detach the brake light switch wiring connectors (see illustration 8.7). Free the hose from any clips or guides and remove it, noting its routing. Discard the sealing washers on the hose unions.

5 Position the new hose, making sure it isn't twisted or otherwise strained, and abut the tab on the hose union with the lug on the component casting, where present. Otherwise align the hose as noted on removal. Install the hose banjo bolts using new sealing washers on both sides of the unions. Tighten the banjo bolts (or brake light switch) to the torque setting specified at the beginning of this Chapter. Make sure the hoses are correctly aligned and routed clear of all moving components.

6 Flush the old brake fluid from the system, refill with new DOT 4 brake fluid (see Daily (pre-ride) checks) and bleed the air from the system (see Section 10). Check the operation of the brakes carefully before riding the motorcycle.

## 10 Brake system – bleeding

### Air bleeding

1 Bleeding the brakes is simply the process of removing all the air bubbles from the brake fluid reservoirs, the hoses and the brake calipers. Bleeding is necessary whenever a brake system hydraulic connection is loosened, when a component or hose is replaced or renewed, or when the master cylinder or caliper is overhauled. Leaks in the system may also allow air to enter, but leaking brake fluid will reveal their presence and warn you of the need for repair.

2 To bleed the brakes, you will need some new DOT 4 brake fluid, a length of clear vinyl or plastic tubing, a small container partially filled with clean brake fluid, some rags and a



9.4 Remove the banjo bolt and separate the hose from the caliper; there is a sealing washer on each side of the fitting

ring spanner to fit the brake caliper bleed valves.

3 Cover the fuel tank and other painted components to prevent damage in the event that brake fluid is spilled.

4 When bleeding the brakes, look for any 'high spots' in the system where air bubbles could become trapped and eliminate them by displacing the component and positioning it where bubbles are less likely to get trapped. Wiggling or tapping any such spots will help to dislodge any bubbles already trapped.

5 Remove the reservoir cap clamp where fitted, cap or cover, diaphragm plate (where fitted) and diaphragm (see illustrations 5.27a or b (front) or 8.28 (rear)). Slowly pump the brake lever or pedal a few times, until no air bubbles can be seen floating up from the holes in the bottom of the reservoir. This bleeds the air from the master cylinder end of the line. Loosely refit the reservoir cap or cover.

6 Pull the dust cap off the bleed valve (see illustrations). Attach one end of the clear vinyl or plastic tubing to the bleed valve and submerge the other end in the brake fluid in the container (see illustration).

7 Remove the reservoir cap and check the fluid level. Do not allow the fluid level to drop below the lower mark during the bleeding process.

8 Carefully pump the brake lever or pedal three or four times and hold it in (front) or down (rear) while opening the caliper bleed valve. When the valve is opened, brake fluid

will flow out of the caliper into the clear tubing and the lever will move toward the handlebar or the pedal will move down.

9 Retighten the bleed valve, then release the brake lever or pedal gradually. Repeat the process until no air bubbles are visible in the brake fluid leaving the caliper, or if the fluid is being changed until new fluid is coming out, and the lever or pedal is firm when applied. On completion, disconnect the bleeding equipment, then tighten the bleed valve to the torque setting specified at the beginning of the Chapter and install the dust cap.

### HAYNES HINT

Old brake fluid is invariably much darker in colour than new fluid, making it easy to see when all old fluid has been expelled from the system.

10 Install the diaphragm, plate (where fitted) and cap or cover. Wipe up any spilled brake fluid and check the entire system for leaks.

### HAYNES HINT

If it's not possible to produce a firm feel to the lever or pedal the fluid may be aerated. Let the brake fluid in the system stabilise for a few hours and then repeat the procedure when the tiny bubbles in the system have settled out.

### Fluid change

11 Changing the brake fluid is a similar process to bleeding the brakes and requires the same materials plus a suitable tool for siphoning the fluid out of the hydraulic reservoir. Also ensure that the container is large enough to take all the old fluid when it is flushed out of the system.

12 Follow Steps 3, 4 and 6 above, then remove the reservoir cap clamp where fitted, cap or cover, diaphragm plate (where fitted) and diaphragm and siphon the old fluid out of the reservoir. Fill the reservoir with new brake fluid, then follow Step 8.



10.6a Front brake caliper bleed valve (arrowed) – Daytona, Speed Triple and Sprint models



10.6b Rear brake caliper bleed valve (arrowed) – Tiger models



10.6c To bleed the brakes, you need a spanner, a short section of clear tubing, and a clear container half-filled with brake fluid

## 6•18 Brakes, wheels and tyres

13 Retighten the bleed valve, then release the brake lever or pedal gradually. Keep the reservoir topped-up with new fluid to above the LOWER level at all times or air may enter the system and greatly increase the length of the task. Repeat the process until new fluid can be seen emerging from the bleed valve.

14 Disconnect the hose, tighten the bleed valve to the specified torque and install the dust cap.

15 Top-up the reservoir, install the diaphragm, plate (where fitted) and cap or cover, wipe up any spilled brake fluid and check the entire system for leaks.

16 Check the operation of the brakes before riding the motorcycle.

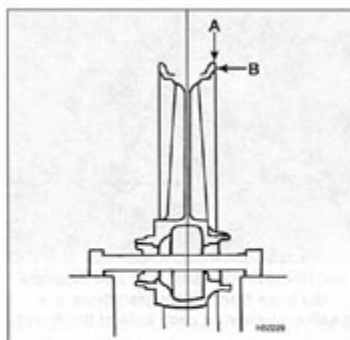
### 11 Wheels – inspection and repair

1 In order to carry out a proper inspection of the wheels, it is necessary to support the bike upright so that the wheel being inspected is raised off the ground. Position the motorcycle on an auxiliary stand. Clean the wheels thoroughly to remove mud and dirt that may interfere with the inspection procedure or mask defects. Make a general check of the wheels (see Chapter 1) and tyres (see *Daily (pre-ride) checks*).

2 Attach a dial gauge to the fork or the swingarm and position its tip against the side of the rim (see illustration). Spin the wheel slowly and check the axial (side-to-side) runout of the rim. In order to accurately check radial (out of round) runout with the dial gauge, the wheel would have to be removed from the machine, and the tyre from the wheel. With the axle clamped in a vice and the dial gauge positioned on the top of the rim, the wheel can be rotated to check the runout.

3 An easier, though slightly less accurate, method is to attach a stiff wire pointer to the fork or the swingarm and position the end a fraction of an inch from the wheel (where the wheel and tyre join). If the wheel is true, the distance from the pointer to the rim will be constant as the wheel is rotated. **Note: If wheel runout is excessive, check the wheel bearings very carefully before renewing the wheel.**

4 The wheels should also be visually inspected for cracks, flat spots on the rim and other damage. On cast wheels, look very



11.2 Check the wheel for radial (out-of-round) runout (A) and axial (side-to-side) runout (B)

closely for dents in the area where the tyre bead contacts the rim. Dents in this area may prevent complete sealing of the tyre against the rim, which leads to deflation of the tyre over a period of time. If damage is evident, or if runout in either direction is excessive, the wheel will have to be replaced with a new one. Never attempt to repair a damaged cast alloy wheel.

5 On spoked wheels (Tiger model), check for loose or broken spokes as described in Chapter 1, Section 12. Spoke renewal and tensioning must be carried out by a wheel building specialist.

### 12 Wheels – alignment check

1 Misalignment of the wheels, which may be due to a cocked rear wheel or a bent frame or fork yokes, can cause strange and possibly serious handling problems. If the frame or yokes are at fault, repair by a frame specialist or replacement with new parts are the only alternatives.

2 To check the alignment you will need an assistant, a length of string or a perfectly straight piece of wood or a ruler. A plumb bob or other suitable weight will also be required.

3 In order to make a proper check of the wheels it is necessary to support the bike in

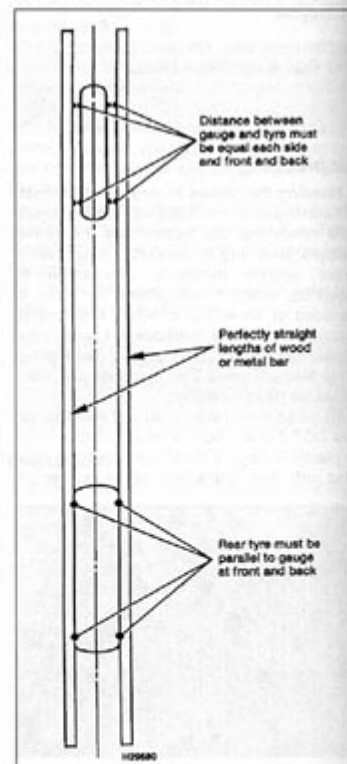
an upright position, using an auxiliary stand (or on its centrestand – Sprint ST). Measure the width of both tyres at their widest points. Subtract the smaller measurement from the larger measurement, then divide the difference by two. The result is the amount of offset that should exist between the front and rear tyres on both sides.

4 If a string is used, have your assistant hold one end of it about halfway between the floor and the rear axle, touching the rear sidewall of the tyre.

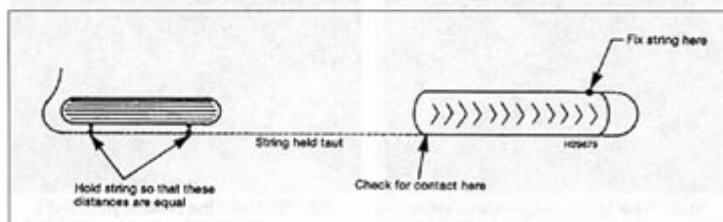
5 Run the other end of the string forward and pull it tight so that it is roughly parallel to the floor (see illustration). Slowly bring the string into contact with the front sidewall of the rear tyre, then turn the front wheel until it is parallel with the string. Measure the distance from the front tyre sidewall to the string.

6 Repeat the procedure on the other side of the motorcycle. The distance from the front tyre sidewall to the string should be equal on both sides.

7 As previously mentioned, a perfectly straight length of wood or metal bar may be substituted for the string (see illustration). The procedure is the same.



12.7 Wheel alignment check using a straight-edge

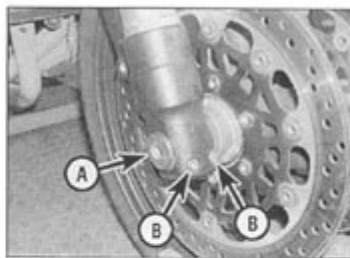


12.5 Wheel alignment check using string

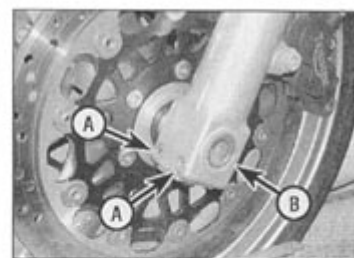




13.3a Remove the screw and detach the cable if required



13.3b On Daytona and Speed Triple models, unscrew the axle bolt (A), then the clamp bolts (B) on each fork



13.4 On Sprint models, slacken the clamp bolts (A), then unscrew the axle (B)

8 On Sprint RS and Tiger models, if the distance between the string and tyre is greater on one side, or if the rear wheel appears to be cocked, refer to Chapter 1, Section 1 and check that the chain adjuster markings coincide on each side of the swingarm.

9 If the front-to-back alignment is correct, the wheels still may be out of alignment vertically.

10 Using a plumb bob, or other suitable weight, and a length of string, check the rear wheel to make sure it is vertical. To do this, hold the string against the tyre upper sidewall and allow the weight to settle just off the floor. When the string touches both the upper and lower tyre sidewalls and is perfectly straight, the wheel is vertical. If it is not, place thin spacers under one leg of the stand until it is.

11 Once the rear wheel is vertical, check the front wheel in the same manner. If both wheels are not perfectly vertical, the frame and/or major suspension components are bent.

on an auxiliary stand and support it under the crankcase so that the front wheel is off the ground. Always make sure the motorcycle is properly supported.

2 Displace the front brake calipers (see Section 3). Support the calipers with a piece of wire or a bungee cord so that no strain is placed on the hydraulic hoses. There is no need to disconnect the hoses from the calipers. **Note:** Do not operate the front brake lever with the calipers removed.

3 On Daytona and Speed Triple models, if required, remove the screw securing the speedometer cable in the drive housing on the right-hand side of the wheel and detach the cable, but note that it can remain attached to the housing if you don't need to completely remove it for any reason (see illustration). Unscrew the axle bolt from the right-hand end of the axle (see illustration). Slacken the axle clamp bolts on the bottom of each fork.

4 On Sprint models, slacken the axle clamp bolts on the bottom of the left-hand fork, then unscrew the axle (see illustration).

5 On Tiger models, slacken the nut on the right-hand end of the axle and remove the washer (see illustration).

6 Support the wheel, then withdraw the axle from the left-hand side and lower it to the ground (see illustrations). Use a drift to drive out the axle if required. Roll the wheel out from between the forks.

7 Remove the speedometer drive housing from the right-hand side of the wheel on

Daytona, Speed Triple and Sprint models, and from the left-hand side on Tiger models, noting how it fits (see illustration 13.11a). Remove the spacer from the left-hand side of the wheel on Daytona, Speed Triple and Sprint models, and from the right-hand side on Tiger models (see illustration 13.11b).

**Caution:** Don't lay the wheel down and allow it to rest on a disc – the disc could become warped. Set the wheel on wood blocks so the disc doesn't support the weight of the wheel, or keep it upright.

8 Check the axle for straightness by rolling it 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). If the equipment is available, place the axle in V-blocks and check for runout using a dial gauge. If the axle is bent, replace it with a new one.

9 Check the condition of the wheel bearings (see Section 15).

### Installation

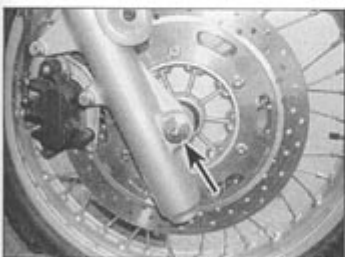
10 Apply lithium-based grease to the lips of the bearing seals, to the speedometer drive gear in the housing, to the axle and to the spacer.

11 Manoeuvre the wheel into position. Fit the speedometer drive housing into the right-hand side of the wheel on Daytona, Speed Triple and Sprint models, and into the left-hand side on Tiger models, locating the cutouts in the drive gear in the housing over

### 13 Front wheel – removal and installation

#### Removal

1 On Daytona and Sprint ST models, remove the belly-pan (see Chapter 7). Put the motorcycle on the centrestand (Sprint ST), or



13.5 On Tiger models, unscrew the axle nut (arrowed)

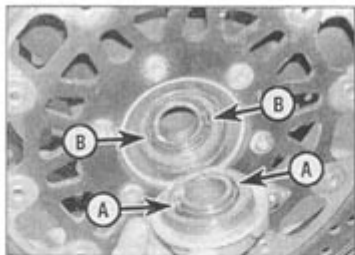


13.6a Support the wheel and withdraw the axle



13.6b On Daytona and Speed Triple models, slide a screwdriver or bar through the hole in the end of the axle as a handle

## 6•20 Brakes, wheels and tyres



13.11a Fit the drive housing, locating the cutouts (A) over the tabs (B) ...



13.11b ... and fit the wheel spacer



13.12 Make sure the drive housing locates correctly against the fork (arrowed)

the tabs on the driveplate in the wheel (see illustration). Align the housing so that the cable or wiring exits backwards. Fit the spacer into the left-hand side of the wheel on Daytona, Speed Triple and Sprint models, and into the right-hand side on Tiger models (see illustration).

12 Lift the wheel into place between the forks, making sure the spacer and drive housing remain in position, and locating the drive housing correctly against the fork (see illustration). Slide the axle in from the left-hand side (see illustration 13.6a).

13 On Daytona and Speed Triple models, install the axle bolt and tighten it to the torque setting specified at the beginning of the Chapter (see illustrations). Move the bike off its stand and pump the forks a few times.

Now tighten the axle clamp bolts on the bottom of each fork to the specified torque setting (see illustration 13.3b). If removed, fit the speedometer cable into the drive housing and secure it with the screw (see illustration 13.3a).

14 On Sprint models, tighten the axle to the torque setting specified at the beginning of the Chapter (see illustration 13.4). Move the bike off its stand and pump the forks a few times. Now tighten the axle clamp bolts on the bottom of the left-hand fork to the specified torque setting.

15 On Tiger models, fit the washer and nut onto the end of the axle and tighten the nut finger-tight only (see illustration 13.5). Move the bike off the stand and pump the forks a few times. Now tighten the nut to the torque

setting specified at the beginning of the Chapter.

16 Install the brake calipers, making sure the pads sit squarely on each side of the discs (see Section 3).

17 On Daytona and Sprint ST models, install the belly-pan (see Chapter 7).

18 Apply the front brake a few times to bring the pads back into contact with the discs.

19 Check for correct operation of the front brake before riding the motorcycle.

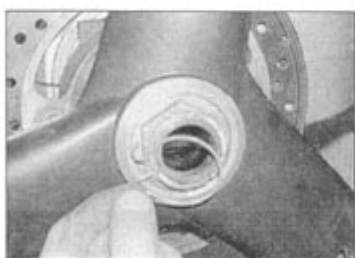
#### 14 Rear wheel – removal and installation



13.13a Install the axle bolt ...



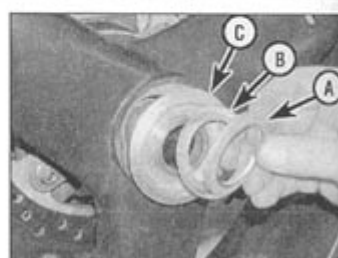
13.13b ... and tighten it to the specified torque



14.3a Remove the retaining clip ...



14.3b ... then unscrew the nut ...



14.3c ... remove the dished washer (A), plain washer (B) and conical spacer (C) ...

#### Removal

##### Daytona, Speed Triple and Sprint ST models

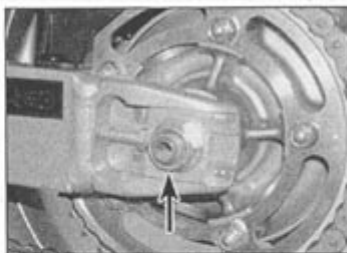
1 Support the motorcycle securely in an upright position using the centrestand (Sprint ST only) or an auxiliary stand.

2 Remove the exhaust silencer (see Chapter 4).

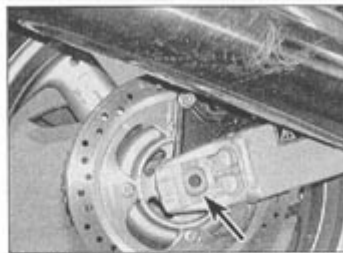
3 Remove the wheel nut retaining clip (see illustration). Unscrew the wheel nut and remove the dished washer, the plain washer and the conical spacer, noting how they fit (see illustrations) – prevent the wheel from turning either by applying the rear brake hard, or by counter-holding the sprocket coupling



14.3d ... and draw the wheel off the axle



14.7a Unscrew the axle nut (arrowed) and remove the washer and adjustment position marker



14.7b Withdraw the axle (arrowed), noting how its head locates in the adjustment marker

nut on the other side (see illustration 14.11). Draw the wheel off the axle and remove it (see illustration).

4 Check the hub bearings and sprocket coupling bearing (see Section 15).

#### Sprint RS and Tiger models

5 Support the motorcycle securely in an upright position using an auxiliary stand.

6 Refer to Chapter 1 and slacken the drive chain. Displace the rear brake caliper (see Section 6). Make sure no strain is placed on the hydraulic hose. There is no need to disconnect the hose from the caliper. **Note:** Do not operate the brake pedal with the caliper removed.

7 On Sprint RS models, unscrew the axle nut and remove the washer (see illustration). Remove the adjustment position marker from the left-hand end of the axle. Support the wheel then withdraw the axle along with the right-hand adjustment position marker and lower the wheel to the ground (see illustration). Disengage the chain from the sprocket and remove the wheel from between the swingarm ends. Note how the caliper carrier locates between the wheel and the swingarm and remove it if required. Remove the plain spacer from the left-hand side of the wheel and the shouldered spacer from the right-hand side for safekeeping if required.



**HAYNES HINT** If you are working outside or on a dirty floor, tie the chain to the rear sub-frame, or lay some paper or rag on the ground for the chain to rest on, to prevent any dust and grit sticking to it.

8 On Tiger models, remove the axle retaining clip from each side (see illustration). Unscrew the axle bolt on the right-hand side and remove the washer. Support the wheel then withdraw the axle from the left-hand side and lower the wheel to the ground. Disengage the chain from the sprocket and remove the wheel from between the swingarm ends. Note how the caliper carrier locates between the wheel and the swingarm. Remove the plain spacer from the left-hand side of the wheel and the shouldered spacer from the right-

hand side for safekeeping if required. Also note that there is a shouldered spacer in the caliper carrier – if you remove the carrier, note which way round it fits.

9 Check the axle for straightness by rolling it 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). If the equipment is available, place the axle in V-blocks and check for runout using a dial gauge. If the axle is bent, replace it with a new one.

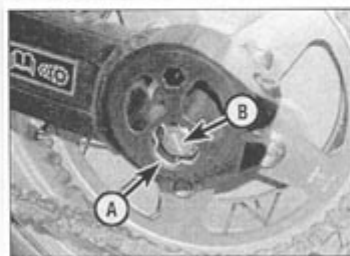
10 Check the wheel bearings and sprocket coupling bearings (see Section 15).

#### Installation

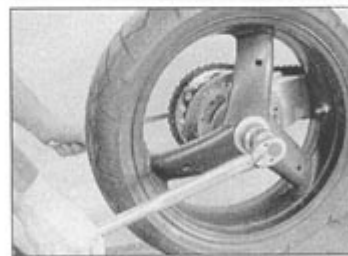
##### Daytona, Speed Triple and Sprint ST models

11 Slide the wheel onto the axle, then fit the conical spacer, the plain washer and the dished washer (see illustration 14.3d and c) – fit the dished washer so that its outer rim sits on the plain washer and the inner rim is raised off it. Fit the wheel nut and tighten it to the torque setting specified at the beginning of the Chapter (see illustration 14.3b) – prevent the wheel from turning either by applying the rear brake hard, or by counter-holding the sprocket coupling nut on the other side (see illustration). Fit the wheel nut retaining clip (see illustration 14.3a).

12 Install the exhaust silencer (see Chapter 4).

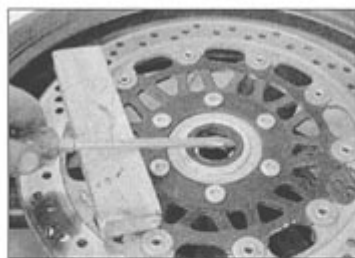


14.8 Retaining clip (A), axle head (B) – Tiger models



14.11 Tighten the wheel nut to the specified torque

## 6•22 Brakes, wheels and tyres



15.3 Lever out the grease seals



15.4a Remove the speedometer drive plate ...



15.4b ... and the circlip

ends of the swingarm and engage the drive chain with the sprocket. Lift the wheel into position, making sure the caliper bracket and the spacers remain in place, and slide the axle through from the left-hand side. Make sure it passes through the caliper bracket. Check that everything is correctly aligned, then fit the axle bolt with its washer into the right-hand end and tighten it to the torque setting specified at the beginning of the Chapter, counter-holding the axle head if it turns (see illustration 14.8). Fit the axle retaining clips, making sure they locate in their grooves. Adjust the chain slack as described in Chapter 1.

17 Install the brake caliper, making sure the pads sit squarely on each side of the disc (see Section 5).

18 Operate the brake pedal several times to bring the pads into contact with the disc. Check the operation of the rear brake carefully before riding the bike.

### 15 Wheel, sprocket coupling and hub bearings – removal, inspection and installation

#### Front wheel bearings

**Note:** Always renew the wheel bearings in pairs, never individually. Avoid using a high pressure cleaner on the wheel bearing area.

1 Remove the wheel (see Section 13). A caged ball bearing is fitted in each side of the wheel.

2 Set the wheel on blocks so as not to allow the weight of the wheel to rest on either brake disc.

3 Lever out the grease seal on each side of the wheel using a large flat-bladed screwdriver, taking care not to damage the rim (see illustration). Discard the seals if they are damaged or have deteriorated.

**HAYNES HINT** Position a piece of wood against the wheel to prevent the screwdriver shaft damaging it when levering the grease seal out.

4 Remove the speedometer drive plate from the right-hand side of the wheel on Daytona, Speed Triple and Sprint models, and from the left-hand side on Tiger models, noting how it fits (see illustration). Remove the circlip from the left-hand side of the wheel on Daytona, Speed Triple and Sprint models, and from the right-hand side on Tiger models (see illustration). Discard the circlip if it is weakened or deformed and obtain a new one.

5 Using a metal rod (preferably a brass drift punch) inserted through the centre of one bearing, tap evenly around the inner race of the other bearing to drive it from the hub (see illustrations). The bearing spacer will also come out.

6 Lay the wheel on its other side so that the remaining bearing faces down. Drive the bearing out of the wheel using the same technique as above.

7 If the bearings are of the unsealed type or

are only sealed on one side, clean them with a high flash-point solvent (one which won't leave any residue) and blow them dry with compressed air (don't let the bearings spin as you dry them). Apply a few drops of oil to the bearing. **Note:** If the bearing is sealed on both sides don't attempt to clean it.

**HAYNES HINT** Refer to Tools and Workshop Tips (Section 5) for more information about bearings.

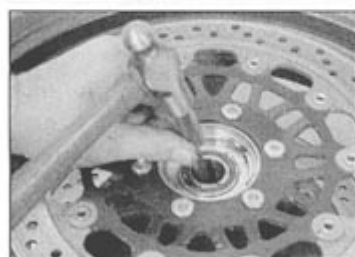
8 Hold the outer race of the bearing and rotate the inner race – if the bearing doesn't turn smoothly, has rough spots or is noisy, replace it with a new one.

9 If the bearing is good and can be re-used, wash it in solvent once again and dry it, then pack the bearing with the recommended grease (see Chapter 1 Specifications).

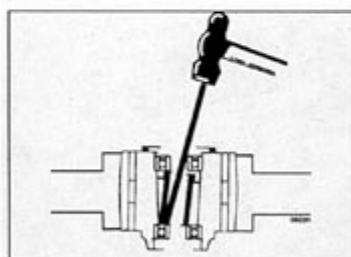
10 Thoroughly clean the hub area of the wheel. Install a bearing into its recess in one side of the hub, with the marked or sealed side facing outwards. Using the old bearing (if new ones are being fitted), a bearing driver or a socket large enough to contact the outer race of the bearing, drive it in until it's completely seated (see illustration).

11 Turn the wheel over and install the bearing spacer. Drive the other bearing into place as described above.

12 Fit the speedometer drive plate into the right-hand side of the wheel on Daytona, Speed Triple and Sprint models, and into the left-hand side on Tiger models, locating the



15.5a Knock out the bearings using a drift ...



15.5b ... locating it as shown

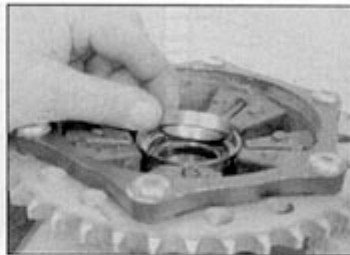


15.10 A socket can be used to drive in the bearing

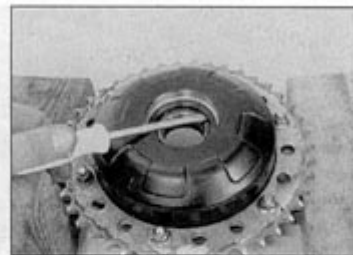




15.13 Fit the grease seal and tap it into place



15.25 Remove the spacer from inside the coupling



15.26 Lever out the grease seal

tabs on the drive plate rim in the cutouts in the hub (see illustration 15.4a). Fit the circlip into the left-hand side of the wheel on Daytona, Speed Triple and Sprint models, and into the right-hand side on Tiger models, using a new one if necessary, and making sure it locates in its groove (see illustration 15.4b).

13 Apply a smear of grease to the lips of one seal, then press it into the wheel, using a seal or bearing driver, a suitable socket or a piece of wood (see illustration). Turn the wheel over and fit the other seal.

14 Clean off all grease from the brake discs using acetone or brake system cleaner then install the wheel (see Section 13).

#### Rear wheel bearings – Sprint RS and Tiger models

15 Remove the rear wheel (see Section 14). Lift the sprocket coupling out of the wheel, noting how it fits. A caged ball bearing is fitted in each side of the wheel.

16 Set the wheel on wood blocks with the disc facing up.

17 Lever out the grease seal on the right-hand side of the wheel using a large flat-bladed screwdriver, taking care not to damage the rim of the hub (see Haynes Hint above) (see illustration 15.3). Discard the seal if it is damaged or deteriorated. Remove the circlip securing the bearing.

18 Using a metal rod (preferably a brass drift punch) inserted through the centre of one bearing, tap evenly around the inner race of the other bearing to drive it from the hub. The bearing spacer will also come out.

19 Lay the wheel on its other side so that the remaining bearing faces down. Drive the bearing out of the wheel using the same technique as above.

20 Refer to Steps 7 to 9 above and check the bearings.

21 Thoroughly clean the hub area of the wheel. Install a bearing into its recess in one side of the hub, with the marked or sealed side facing outwards. Using the old bearing (if new ones are being fitted), a bearing driver or a socket large enough to contact the outer race of the bearing, drive it in until it's completely seated (see illustration 15.10).

22 Turn the wheel over and install the bearing spacer. Drive the other bearing into place as described above.

23 Fit the circlip into the right-hand side of the wheel, making sure it locates correctly in its groove. Apply a smear of grease to the lips of the new grease seal, and press it into the right-hand side of the wheel, using a seal or bearing driver, a suitable socket or a flat piece of wood (see illustration 15.13).

24 Clean off all grease from the brake disc using acetone or brake system cleaner. Install the sprocket coupling assembly. Install the wheel (see Section 14).

#### Sprocket coupling bearing

25 On Daytona, Speed Triple and Sprint ST models, remove the rear sprocket coupling (see Chapter 5). On Sprint RS and Tiger models, remove the rear wheel (see Section 14), then lift the sprocket coupling out of the wheel, noting how it fits. On Sprint RS

and Tiger models, and if not already done on all other models, remove the spacer from inside the coupling (see illustration).

26 Using a large flat-bladed screwdriver lever out the grease seal from the outside of the coupling, taking care not to damage the rim of the coupling (see Haynes Hint above) (see illustration). Discard the seal if it is damaged or deteriorated. On Sprint RS models, remove the circlip from the coupling. Discard it if it has weakened or is deformed.

27 Support the coupling on blocks of wood and drive the bearing out from the inside using a bearing driver or socket (see illustration).

28 Refer to Steps 7 to 9 above and check the bearing.

29 Thoroughly clean the bearing recess in the coupling then fit the bearing into the outside of the coupling, with the marked or sealed side facing out. Using the old bearing (if a new one is being fitted), a bearing driver or a socket large enough to contact the outer race of the bearing, drive it in until it is completely seated (see illustration). On Sprint RS models, secure the bearing with the circlip, using a new one if necessary, and making sure it locates in its groove.

30 Apply a smear of grease to the lips of the new seal, and press it into the coupling, using a seal or bearing driver or a suitable socket if necessary (see illustration).

31 Check the sprocket coupling/rubber dampers (see Chapter 5). On Tiger models, check the condition of the hub O-ring and replace it with a new one if necessary.



15.27 Drive the bearing out from the inside



15.29 A socket can be used to drive in the bearing



15.30 Press or drive the seal into the coupling

## 6•24 Brakes, wheels and tyres



15.34a Remove the circlip ...



15.34b ... and the caliper carrier ...

32 On Daytona, Speed Triple and Sprint ST models, install the sprocket coupling (see Chapter 5). On Sprint RS and Tiger models, fit the sprocket coupling into the wheel, then install the wheel (see Section 14).

### Rear hub assembly bearings – Daytona, Speed Triple and Sprint ST models

33 Remove the rear axle/brake disc carrier (see Section 7).

34 Remove the large circlip on the inner end of the hub and slide off the brake caliper carrier, noting how it locates on the swingarm (see illustrations). Draw the hub assembly out of the swingarm (see illustration).

35 The hub assembly houses a caged ball bearing and a needle roller bearing. Triumph specify that the bearings are a press-fit, and so require special tools for removal and installation. They suggest that if the bearings are worn and need renewing, it is easier to renew the hub assembly as a unit with the

bearings already installed. You will have to check on the relative cost, both in money and time.

36 Refer to Steps 7 to 9 above and check the bearings.

37 Using a large flat-bladed screwdriver lever out the grease seal from the inner end of the hub, taking care not to damage the rim of the hub (see Haynes Hint above). Discard the seal if it is damaged or deteriorated. Remove the circlip from the outer end of the hub. Discard it if it has weakened or is deformed.

38 Support the coupling on blocks of wood and press or drive the bearings out from the inside, referring to *Tools and Workshop Tips* in the Reference Section for more information on removal methods. If the bearings are too tight, take the hub to a workshop equipped with an hydraulic press. A second circlip and grease seal are fitted behind the needle bearing.

39 Thoroughly clean the bearing recesses in the hub. Install the new bearings, seals and circlips in a reverse of the removal procedure.

Apply a smear of grease to the lips of the new seals and to the needle bearing.

40 Slide the hub assembly into the swingarm (see illustration 15.34c). Fit the brake caliper carrier onto the hub, locating its slot over the peg on the swingarm as shown, and secure it with the circlip (see illustration).

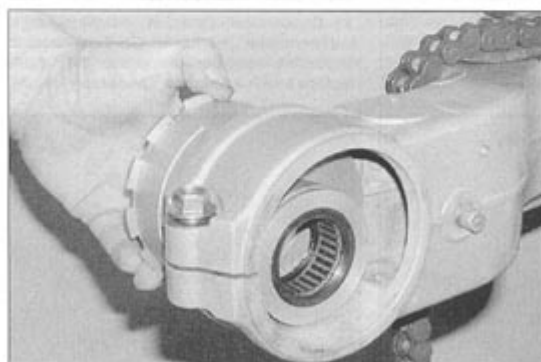
41 Install the rear axle/brake disc carrier (see Section 7).

### 16 Tyres – general information and fitting

#### General information

1 Tiger models have tubed tyres due to their spoke wheel design. All other models are fitted with tubeless tyres. Tyre sizes are given in the Specifications at the beginning of this chapter.

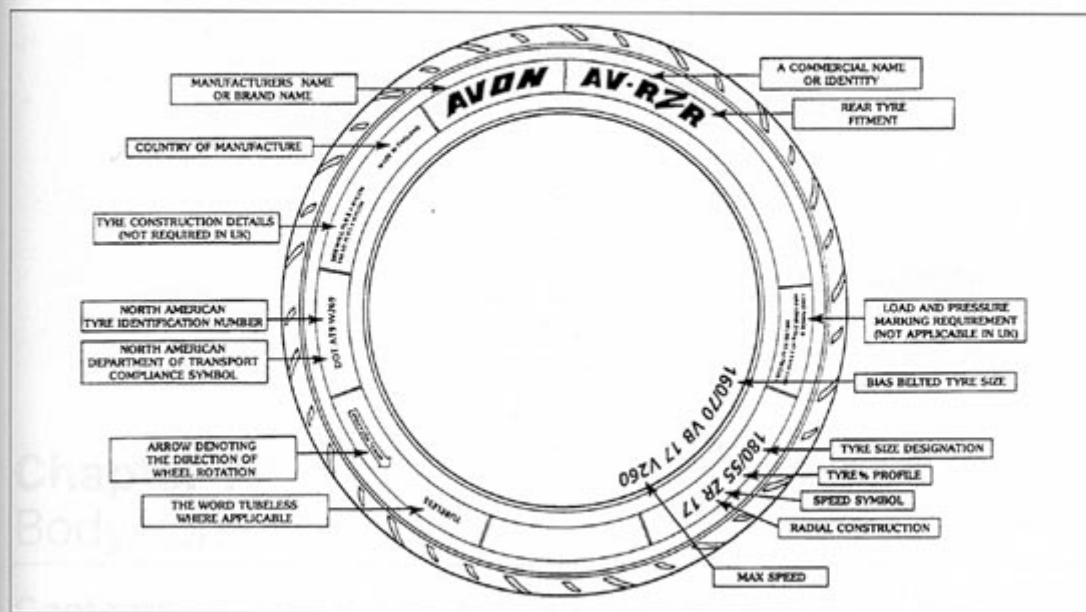
2 Refer to the Daily (pre-ride) checks listed at the beginning of this manual for tyre maintenance.



15.34c ... then withdraw the hub assembly from the swingarm



15.40 Locate the slot in the carrier over the peg (arrowed)



16.3 Common tyre sidewall markings

**Fitting new tyres**

3 When selecting new tyres, refer to the tyre information label on the swingarm and the tyre options listed in the owners handbook. Ensure that front and rear tyre types are compatible, the correct size and correct speed rating; if necessary seek advice from a Triumph dealer or tyre fitting specialist (see illustration).

4 It is recommended that tyres are fitted by a motorcycle tyre specialist rather than attempted in the home workshop. This is particularly relevant in the case of tubeless tyres because the force required to break the seal between the wheel rim and tyre bead is substantial, and is usually beyond the capabilities of an individual working with normal tyre levers. Additionally, the specialist will be able to balance the wheels

after tyre fitting.

5 Note that punctured tubeless tyres can in some cases be repaired. Seek the advice of a Triumph dealer or a motorcycle tyre fitting specialist concerning tyre repairs. In the case of tubed tyres (Tiger model) always fit a new inner tube if a puncture occurs and ensure that the item which caused the puncture is not still held in the tyre tread.

## Chapter 7

### Bodywork

#### Contents

|                                                          |   |                                                    |   |
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| Front mudguard – removal and installation .....          | 6 | Seats – removal and installation .....             | 2 |
| General information .....                                | 1 | Windshield – removal and installation .....        | 5 |

#### 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



#### 1 General Information

This Chapter covers the procedures necessary to remove and install the body parts. Since many service and repair operations on these motorcycles require the removal of the body parts, the procedures are grouped here and referred to from other Chapters.

In the case of damage to the body parts, it is usually necessary to remove the broken component and replace it with a new (or used) one. The material that the body panels are composed of doesn't lend itself to conventional repair techniques. There are however some shops that specialise in 'plastic welding', so it may be worthwhile seeking the advice of one of these specialists before consigning an expensive component to the bin.

When attempting to remove any body panel, first study it closely, noting any fasteners and associated fittings, to be sure of returning everything to its correct place on installation. In some cases the aid of an assistant will be required when removing panels, to help avoid the risk of damage to paintwork. Once the evident fasteners have been removed, try to withdraw the panel as described but **DO NOT FORCE IT** – if it will not release, check that all fasteners have been removed and try again. Where a panel engages another by means of tabs, be careful not to break the tab or its mating slot or to damage the paintwork. Remember that a few moments of patience at this stage will save you a lot of money in replacing broken fairing panels! To undo quick-release fasteners, turn them 90° anti-clockwise.

Many of the bolts used on the motorcycle are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to purchase a set. Make sure you

get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be useful in addition to the bits.

When installing a body panel, first study it closely, noting any fasteners and associated fittings removed with it, to be sure of returning everything to its correct place. Check that all fasteners and damping/rubber mounts are in good condition; any of these must be replaced with new ones if faulty before the panel is reassembled. Check also that all mounting brackets are straight and repair or renew them if necessary before attempting to install the panel. Where assistance was required to remove a panel, make sure your assistant is on hand to install it. To install quick-release fasteners, turn them 90° clockwise.

Tighten the fasteners securely, but be careful not to overtighten any of them or the panel may break (not always immediately) due to the uneven stress.



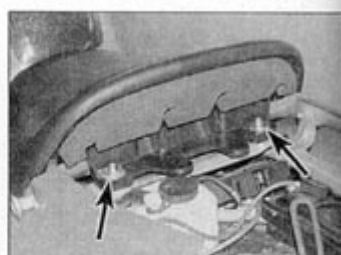
## 7•2 Bodywork



2.1a Turn the key and lift the rear of the seat ...



2.1b ... then draw it backwards and remove it, noting how the tab (arrowed) locates



2.1c Remove the bolt on each rear corner ...

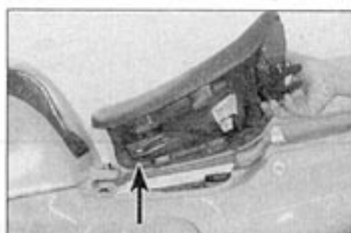
### 2 Seats – removal and installation

#### Removal

**1** On Daytona and Speed Triple models, to remove the passenger seat, insert the ignition key into the seat lock located on the left-hand side of the bike, and turn it anti-clockwise to unlock the seat (see illustration). Lift up the rear of the seat and draw it backwards, noting how the tab at the front locates (see illustration). To remove the rider's seat, first remove the passenger seat. Unscrew the two bolts securing the rear of the seat and remove it, noting how the tab at the front locates under the tank bracket (see illustrations).

**2** On Sprint models, insert the ignition key into the seat lock located on the left-hand side of the bike, and turn it anti-clockwise to unlock the seat (see illustration). Lift up the rear of the seat and draw it backwards, noting how the tab at the front locates (see illustration).

**3** On Tiger models, to remove the passenger seat, insert the ignition key into the seat lock located on the left-hand side of the bike, and turn it anti-clockwise to unlock the seat (see illustration). Lift up the rear of the seat and draw it backwards, noting how the hooks at the front locate under the frame cross-member (see illustration). To remove the rider's seat, first remove the passenger seat. Pull back the



2.1d ... then lift the rear of the seat and draw it back, noting how the tab (arrowed) locates



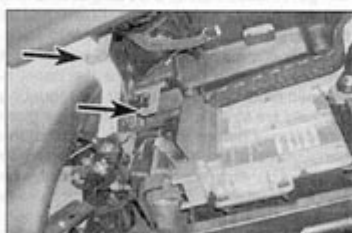
2.2a Turn the key and lift the rear of the seat ...



2.2b ... then draw it backwards and remove it, noting how the tab (arrowed) locates



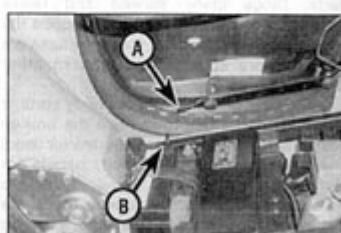
2.3a Turn the key and lift the rear of the seat ...



2.3b ... then draw it backwards and remove it, noting how the hooks (arrowed) locate



2.3c Pull back on the release ring ...



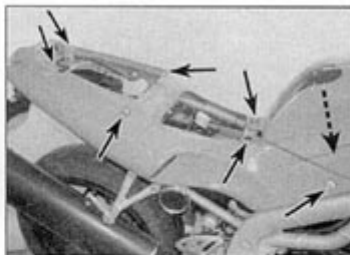
2.3d ... then lift the rear of the seat and draw it back, noting how the tab (A) on each side locates under the hook (B) on each frame rail

#### Installation

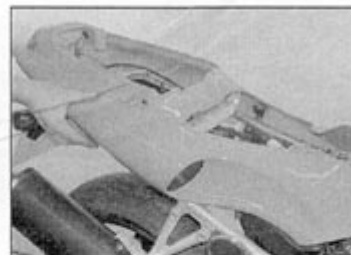
**4** Installation is the reverse of removal. Push down on the seat to engage the latch.



3.2 Disconnect the tail light wiring connector



3.3a Undo the screws (arrowed) ...



3.3b ... and carefully draw the cowling back

### 3 Fairing and body panels – removal and installation

#### Daytona models

##### Seat cowling

- 1 Remove the seats (see Section 2).
- 2 Disconnect the tail light assembly wiring connector (see illustration).
- 3 Remove the eight screws securing the seat cowling, noting the washers, then carefully draw it back and off the bike (see illustrations).
- 4 Installation is the reverse of removal. Check the tail and brake lights after connecting the wiring.

##### Fuel tank cover

- 5 Remove the five screws securing the cover, noting the washers, then carefully lift it off the tank (see illustrations).
- 6 Installation is the reverse of removal.

##### Cockpit trim panels

- 7 Release the quick-release fastener and undo the normal screw securing the trim panel and remove it, noting how it fits (see illustrations).
- 8 Installation is the reverse of removal. Make sure the panel locates correctly with the fairing and fairing side panel.

##### Belly pan

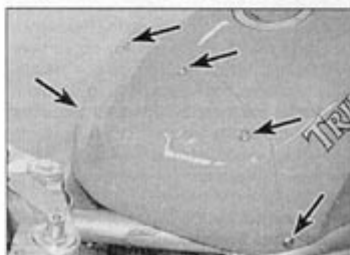
- 9 Unscrew the bolt securing each side of the belly pan (see illustration). Support the belly

pan, then release the four quick-release fasteners on each side and carefully lower the belly pan off the fairing side panels (see illustration).

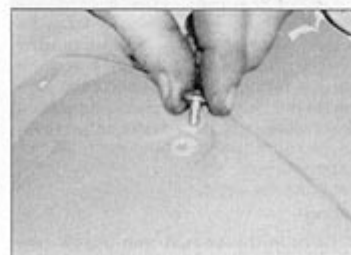
- 10 Installation is the reverse of removal.

##### Fairing side panels

- 11 Remove the cockpit trim panel (see



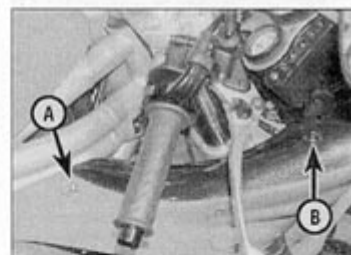
3.5a Undo the screws (arrowed) ...



3.5b ... noting the nylon washers ...



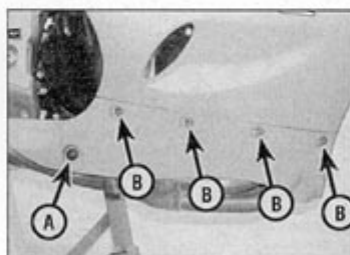
3.5c ... and remove the cover



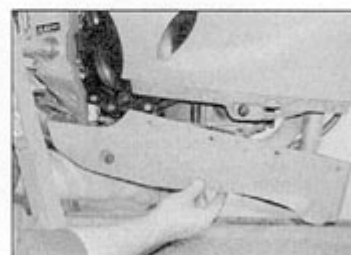
3.7a Release the fastener (A) and undo the screw (B) ...



3.7b ... and remove the trim panel

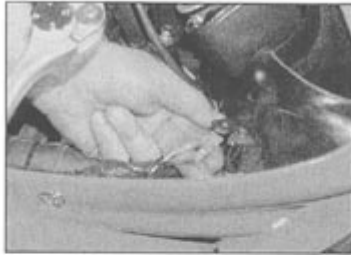


3.9a Unscrew the bolt (A) and release the fasteners (B) ...

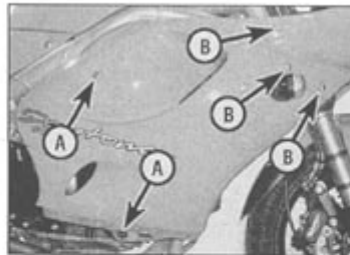


3.9b ... and remove the belly pan

## 7•4 Bodywork



3.11 Disconnect the turn signal wiring connectors



3.13a Unscrew the bolts (A) and release the fasteners (B) ...



3.13b ... and remove the panel

above). Disconnect the turn signal wiring connectors (see illustration).

12 Remove the belly pan (see above).

13 Unscrew the bolts securing the side and bottom of the panel (see illustration). Release the three quick-release fasteners securing the panel to the fairing, then carefully draw the panel away, noting how it engages with the fairing along its front edge (see illustration).

14 Installation is the reverse of removal. Make sure the panel locates correctly with the fairing. Check the turn signals after connecting the wiring.

#### Fairing

15 Remove the cockpit trim panels (see above), and the rear view mirrors (see Section 4).

16 Remove the screw in the top of each air intake (see illustration).

17 Release the three quick-release fasteners securing the fairing to the side panel (see illustration 3.13a).

18 Ease the fairing forward off the headlights, detaching the air ducts as you do so (see illustration). When it becomes accessible, either release the sidelight bulbholder (applicable markets) by turning it a quarter turn anti-clockwise, or disconnect its wiring connector (see illustration). Also, if fitted, disconnect the alarm system LED wiring connector (see illustration).

19 Carefully draw the fairing forwards and remove it (see illustration).

20 Installation is the reverse of removal. Do not forget to fit the sidelight bulbholder and

connect the alarm LED, where fitted. Make sure the air ducts locate correctly onto the fairing (see illustration 3.18a), and the peg on the inside of the fairing at the front locates into the hole in the headlight assembly (see illustration).

#### Speed Triple models

##### Seat cowlings

21 Remove the seats (see Section 2).

22 Disconnect the tail light assembly wiring connector (see illustration 3.2).

23 Remove the eight screws securing the seat cowlings, noting the washers, then carefully draw it back and off the bike (see illustrations 3.3a and b).

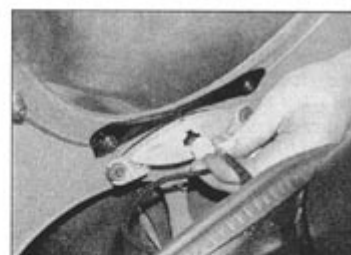
24 Installation is the reverse of removal.



3.16 Undo the screw (arrowed) on each side



3.18a Detach the air intake ducts (arrowed) from the fairing



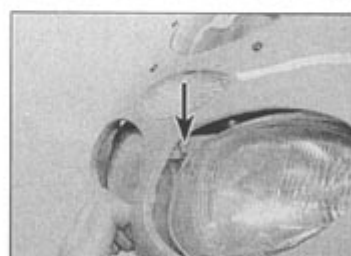
3.18b Release the sidelight bulbholder ...



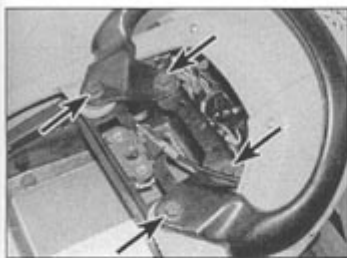
3.18c ... and disconnect the LED if fitted



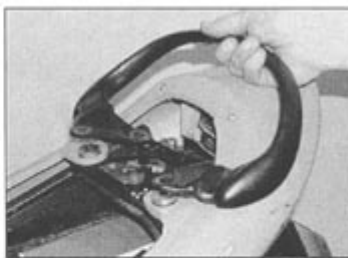
3.19 Draw the fairing off the bike



3.20 Locate the peg on the fairing in the hole (arrowed)



3.28a Unscrew the bolts (arrowed) ...



3.28b ... and remove the grab-rail



3.29 Disconnect the tail light wiring connector

Check the tail and brake lights after connecting the wiring.

#### Fuel tank cover

- 25 Remove the five screws securing the cover, noting the washers, then carefully lift it off the tank (see illustrations 3.5a, b and c).  
26 Installation is the reverse of removal.

#### Sprint ST models

##### Seat cowl

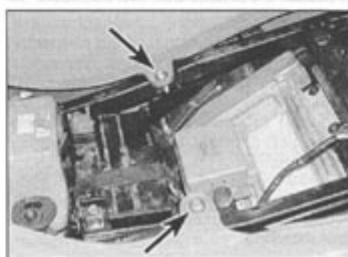
- 27 Remove the seat (see Section 2).  
28 Unscrew the four bolts securing the grab-rail and remove it (see illustrations).  
29 Disconnect the tail light assembly wiring connector (see illustration).  
30 Remove the screws securing the seat cowl, noting the washers, then carefully pull the sides away at the front to release the two pegs on each side from their grommets (see illustrations). Carefully draw the seat cowl back and off the bike (see illustration).  
31 Installation is the reverse of removal. Check the tail and brake lights after connecting the wiring.

##### Fairing side panels

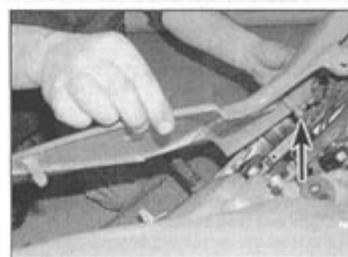
- 32 If required, remove the screws securing the inner panel to the side panel and remove it, noting how it fits – the side panels can be removed with the inner panels in place, but it is easier if they are removed first (see illustration).  
33 Remove the screws securing the side panel, then carefully draw it away, noting how

it engages with the fairing along its front edge and the belly panel along its lower edge (see illustrations).

- 34 Installation is the reverse of removal. Make sure the panel locates correctly with the fairing and belly pan.



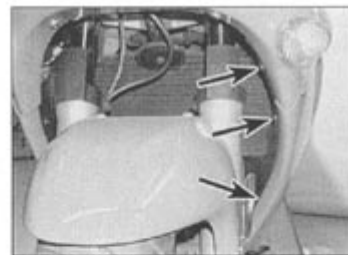
3.30a Remove the screws (arrowed) ...



3.30b ... then pull the sides away to release the pegs (arrowed) ...



3.30c ... and remove the seat cowl



3.32a Undo the screws (arrowed) ...



3.32b ... and remove the inner panel ...

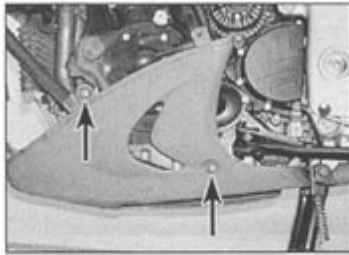


3.33a ... then undo the screws (arrowed) ...

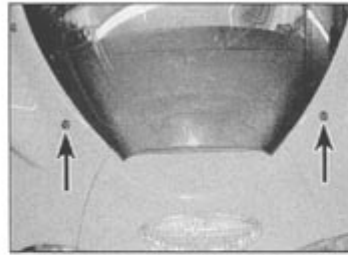


3.33b ... and remove the side panel

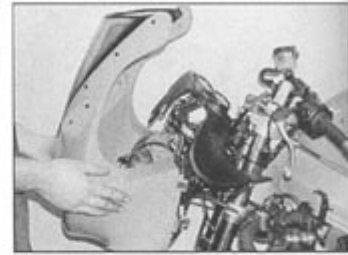
## 7•6 Bodywork



3.36 Unscrew the bolts (arrowed) and remove the belly pan



3.40 Undo the two lower windshield screws (arrowed)



3.42a Ease the fairing off the headlights ...

**Belly pan**

35 Remove the fairing side panels (see above).

36 Unscrew the bolts securing each side of the belly pan and carefully lower it (see illustration).

37 Installation is the reverse of removal.

**Fairing**

38 Remove the fairing side panels (see above).

39 Remove the rear view mirrors (see Section 4).

40 Remove the two bottom screws securing the windshield (see illustration).

41 Remove the remaining screws securing the fairing.

42 Ease the fairing forward off the headlights,

noting how the pegs locate (see illustration). When it becomes accessible, either release the sidelight bulbholder (applicable markets) by turning it a quarter turn anti-clockwise, or disconnect its wiring connector and disconnect the turn signal wiring connector (see illustrations). Also, if fitted, disconnect the alarm system LED wiring connector.

43 Installation is the reverse of removal. Do not forget to connect the sidelight, alarm system LED (if fitted), and turn signal wiring connectors.

**Sprint RS models****Seat cowl**

44 Remove the seat (see Section 2).

45 Unscrew the four bolts securing the grab-

rail and remove it (see illustrations 3.28a and b).

46 Disconnect the tail light assembly wiring connector (see illustration 3.29).

47 Remove the screws securing the seat cowl, noting the washers, then carefully pull the sides away at the front to release the two pegs on each side from their grommets (see illustrations 3.30a and b). Carefully draw the seat cowl back and off the bike (see illustration 3.30c).

48 Installation is the reverse of removal. Check the tail and brake lights after connecting the wiring.

**Fairing side panels**

49 Remove the screws securing the side panel, then carefully draw it away, noting how it engages with the fairing along its front edge, and disconnect the turn signal wiring connectors (see illustrations).

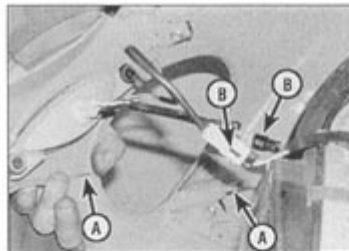
50 Installation is the reverse of removal. Make sure the panel locates correctly with the fairing. Check the turn signals after connecting the wiring.

**Fairing**

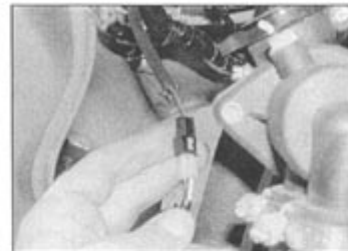
51 Remove the rear view mirrors (see Section 4).

52 Remove the screws securing the fairing to each fairing side panel (see illustration 3.49a).

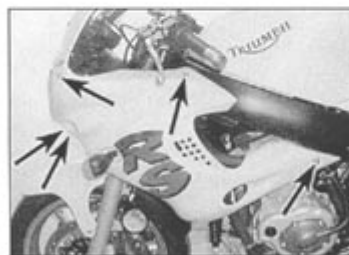
53 Ease the fairing forward off the headlights, noting how the pegs locate in the grommets



3.42b ... noting how the pegs (A) locate. Disconnect the sidelight and LED wiring connectors (B) ...



3.42c ... and the turn signal wiring connectors



3.49a Undo the screws (arrowed) ...



3.49b ... and displace the panel ...



3.49c ... then disconnect the turn signal wiring connectors





3.53a Ease the fairing off the headlights, noting how the pegs locate



3.53b Release the sidelight bulbholder ...



3.53c ... and disconnect the LED if fitted

under the headlight (see illustration). When it becomes accessible, either release the sidelight bulbholder (applicable markets) by turning it a quarter turn anti-clockwise, or disconnect its wiring connector (see illustration). Also, if fitted, disconnect the alarm system LED wiring connector (see illustration).

54 Carefully draw the fairing forwards and remove it, noting how it engages with the side panels (see illustration).

55 Installation is the reverse of removal. Do not forget to fit the sidelight bulbholder and connect the alarm LED where fitted.

#### Tiger models

##### Side panels

56 Remove the seats (see Section 2).

57 To remove the right-hand side panel, undo the two screws securing the trim panel to the fuel tank and remove it, noting how the tab at the front engages (see illustration). Undo the two screws securing the side panel, then carefully draw it away to release the central peg from its grommet (see illustration).

58 To remove the left-hand side panel, undo the screw securing the trim panel to the fuel tank, then carefully draw it away to release the peg from its grommet and remove it, noting how the tab at the front engages (see illustrations). Undo the two screws securing the side panel, then carefully draw it away to release the central peg from its grommet (see illustration 3.57b).

59 Installation is the reverse of removal.

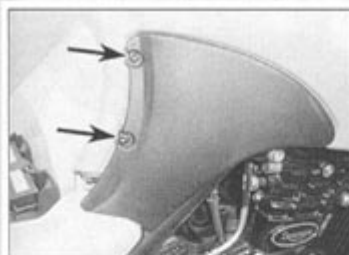
#### Luggage rack and tail light cover

60 Prise out the blanking caps from the rear mountings (see illustration). Unscrew the four bolts securing the rack and cover – leave the rear bolts loose in situ. Lift the rack and cover away together, noting the spacers for the rear mounts and the rubber washers on all mountings. Separate them if required.

61 Installation is the reverse of removal. Make sure the large rubber washers are fitted between the rack and the cover at the front, and the small ones are fitted between the spacers and the cover at the back.

#### Fairing

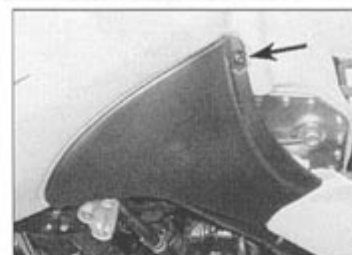
62 Remove the two screws securing each turn signal panel, then draw the panel away and disconnect the wiring connectors (see illustrations).



3.57a Undo the screws (arrowed) and remove the trim panel ...



3.57b ... then undo the side panel screws and draw it away to release the peg from its grommet (arrowed)



3.58a Undo the screw (arrowed) ...



3.58b ... and draw the panel away to release the peg from its grommet (arrowed), noting how the tab at the front locates



3.60 Luggage rack/tail light cover mounting bolts (arrowed)



3.62a Undo the screws (arrowed) ...

## 7•8 Bodywork

- 63 Remove the rear view mirrors (see Section 4).  
 64 Remove the windshield (see Section 5).  
 65 Remove the two screws at the front of the fairing and the screw on each side at the bottom (see illustration). Ease the fairing forward off the headlights and remove it (see illustration).  
 66 Installation is the reverse of removal.

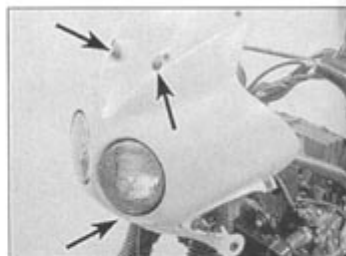
#### 4 Rear view mirrors – removal and installation

##### Removal

- 1 On Daytona models, unscrew the bolts on the inside of the fairing and remove the mirror along with its rubber insulator pad (see illustration).  
 2 On Speed Triple and Tiger models, lift the rubber cover off the base of the mirror, then unscrew it from its mount.  
 3 On Sprint ST models, undo the screws securing the cockpit trim panels and remove the panels (see illustrations). Pull back the rubber boot from the base of the mirror, then unscrew the two nuts on the inside, counter-holding the bolts (see illustration). Remove the mirror along with its rubber insulator pad.  
 4 On Sprint RS models, unscrew the two nuts on the inside of the fairing and remove the



3.62b ... then displace the panel and disconnect the wiring connectors



3.65a Undo the screws (arrowed) ...

mirror along with its rubber insulator pad (see illustration).

##### Installation

- 5 Installation is the reverse of removal.

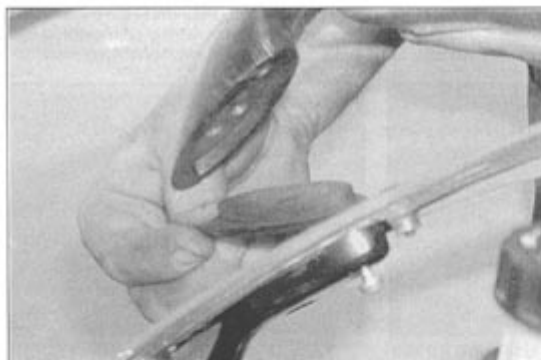
#### 5 Windshield – removal and installation

##### Removal

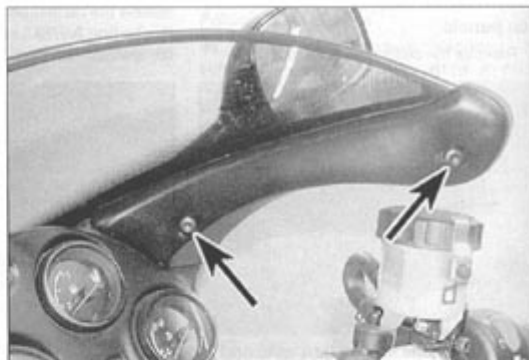
- 1 Remove the screws securing the windshield to the fairing and remove the windshield.



3.65b ... and remove the fairing



4.1 Unscrew the bolts and remove the mirror and its rubber pad



4.3a Undo the screws (arrowed) ...



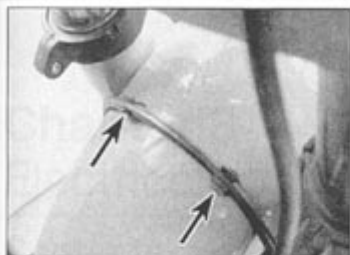
4.3b ... and remove the trim panel



4.3c Mirror mounting bolts (arrowed)



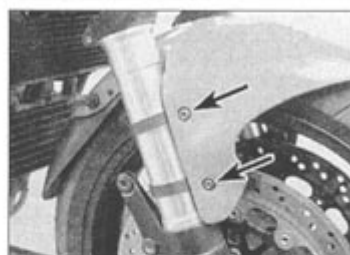
4.4 Unscrew the nuts on the inside and remove the mirror



6.1a Release the brake hose from the clips (arrowed)



6.1b Undo the screw (arrowed) and detach the cable



6.1c Unscrew the bolts (arrowed) ...

noting how it fits. Make sure none of the rubber wellnuts drop out of the fairing, and check that they are all in good condition.

### Installation

2 Installation is the reverse of removal. Do not overtighten the screws.

## 6 Front mudguard – removal and installation

### Removal

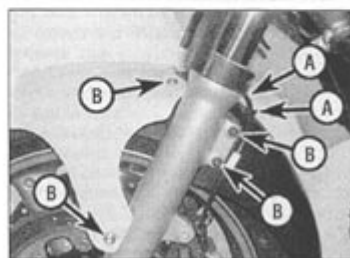
1 On Daytona and Speed Triple models, displace the left-hand brake caliper (see Chapter 6), then release the brake hose from its clips on the top of the mudguard (see illustration). Remove the screw securing the speedometer cable to the drive housing on the front wheel and detach it, then draw it out of its guide on the mudguard (see



6.1d ... and remove the mudguard

illustration). Unscrew the two bolts securing each side of the mudguard, then draw it forwards and off the bike (see illustrations).

2 On Sprint and Tiger models, displace the left-hand brake caliper (see Chapter 6), then release the brake hose from its clips on the top of the mudguard (see illustration).



6.2 Release the brake hose from the clips (A), then remove the screws (B) on each side

Remove all the screws securing each section of the front mudguard to the other and to the forks, then separate the sections and remove them, noting how they fit together.

### Installation

3 Installation is the reverse of removal.

## Chapter 8

### Electrical system

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| Horn – check and renewal                                         | 24            |                                                          |               |

#### 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

##### Battery

###### Capacity

|                                    |           |
|------------------------------------|-----------|
| T595 Daytona and T509 Speed Triple | 12V, 14Ah |
| All other models                   | 12V, 12Ah |

###### Type

|                                    |                |
|------------------------------------|----------------|
| T595 Daytona and T509 Speed Triple | Yuasa YB14L-A2 |
| All other models                   | GS GTX14-BS    |

###### Current leakage

|  |            |
|--|------------|
|  | 1 mA (max) |
|--|------------|

###### Charging rate/time

|                                    |                         |
|------------------------------------|-------------------------|
| T595 Daytona and T509 Speed Triple | 1.4A for 15 to 20 hours |
| All other models                   | 1.2A for 5 hours        |

##### Starter motor brushes

|                |      |
|----------------|------|
| Minimum length | 8 mm |
|----------------|------|

##### Alternator

|                |     |
|----------------|-----|
| Nominal output | 40A |
|----------------|-----|

##### Fuse

|         |                                                           |
|---------|-----------------------------------------------------------|
| Ratings | refer to the information on the inside of the fusebox lid |
|---------|-----------------------------------------------------------|

##### Bulbs

|                   |               |
|-------------------|---------------|
| Headlight         | 12V 60/55W H4 |
| Brake/tail light  | 12V 21/5W     |
| Turn signal light | 12V 10W       |

## 8•2 Electrical system

## Torque wrench settings

|                                                         |       |
|---------------------------------------------------------|-------|
| Rear brake light switch – Sprint and Tiger models ..... | 25 Nm |
| Oil pressure switch .....                               | 13 Nm |
| Starter motor mounting bolts .....                      | 10 Nm |
| Coolant inlet union screws .....                        | 12 Nm |
| Alternator mounting bolts .....                         | 20 Nm |

## 1 General information

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

The regulator maintains the charging system output within the specified range to prevent overcharging, and the rectifier converts the ac (alternating current) output of the alternator to dc (direct current) to power the lights and other components and to charge the battery. The alternator rotor is mounted on the top of the crankcase.

The starter motor is mounted on the top of the crankcase. The starting system includes the motor, the battery, the relay and the various wires and switches.

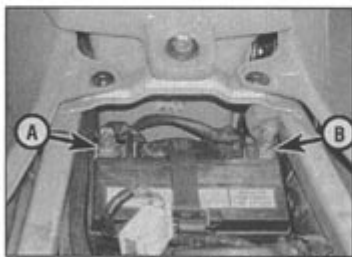
**Note:** Keep in mind that electrical parts, once purchased, cannot be returned. To avoid unnecessary expense, make very sure the faulty component has been positively identified before buying a replacement part.

Many of the bolts used on Triumph motorcycles are of the Torx type. Unless you are already equipped with a good range of Torx bits, you are advised to obtain a set. Make sure you get bits that can be used in conjunction with a socket set so that a torque wrench can be applied – a Torx key set will not be adequate on its own, though will be useful in addition to the bits.

## 2 Electrical system – fault finding



**Warning:** To prevent the risk of short circuits, the ignition (main) switch must always be OFF and the battery negative (–ve) terminal should be disconnected before any of the bike's



3.2a Disconnect the negative terminal first (A), then the positive (B) – Daytona shown

other electrical components are disturbed. Don't forget to reconnect the terminal securely once work is finished or if battery power is needed for circuit testing.

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

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

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

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

5 The basic tools needed for electrical fault finding include a battery and bulb test circuit, a continuity tester, a test light, and a jumper wire. A multimeter capable of reading volts,

ohms and amps is also very useful as an alternative to the above, and is necessary for performing more extensive tests and checks.



Refer to Fault Finding Equipment in the Reference section for details of how to use electrical test equipment.

## 3 Battery – removal, installation, inspection and maintenance

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

## Removal and installation

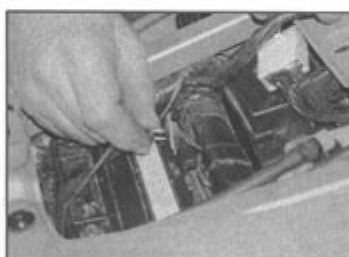
1 Remove the seat(s) (see Chapter 7).

2 Unscrew the negative (–ve) terminal bolt first and disconnect the lead from the battery (see illustration). Lift up the insulating cover to access the positive (+ve) terminal, then unscrew the bolt and disconnect the lead. Release the battery strap and remove the battery from the bike, on T595 and T509 models disconnecting the breather hose from its union as you do (see illustrations).

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



Battery corrosion can be kept to a minimum by applying a layer of petroleum jelly or dielectric grease (available as a spray) to the terminals after the cables have been connected.

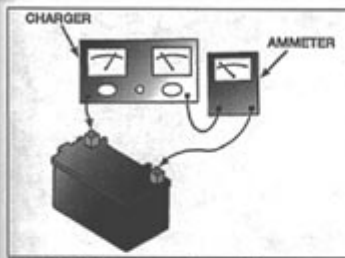


3.2b Unhook the strap ...



3.2c ... and remove the battery





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

### Inspection and maintenance

5 T595 Daytona and T509 Speed Triple models are fitted with a standard battery which requires regular checks of the electrolyte level (see Chapter 1), as well as the checks detailed below. Note that Triumph supply a conversion kit for these models to enable them to use the maintenance-free battery used on later models.

6 The battery fitted on all other models is of the maintenance-free (sealed) type, therefore requiring no specific maintenance. However, the following checks should still be regularly performed.

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

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

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

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

11 The condition of the battery can be assessed by measuring the voltage present at the battery terminals. Connect the voltmeter positive (+ve) probe to the battery positive (+ve) terminal, and the negative (-ve) probe to the battery negative (-ve) terminal. When fully charged there should be 12.8 volts (or more) present. If the voltage falls below 12.3 volts

the battery must be removed, disconnecting the negative (-ve) terminal first, and recharged as described in Section 4.

### 4 Battery – charging

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

1 Remove the battery (see Section 3).

2 Connect the charger to the battery, making sure that the positive (+ve) lead on the charger is connected to the positive (+ve) terminal on the battery, and the negative (-ve) lead is connected to the negative (-ve) terminal. The battery should be charged at the specified rate for the specified time if it was completely flat, or until the voltage across the terminals reaches 12.8V (allow the battery to stabilise for 30 minutes after charging before taking a voltage reading). Exceeding this can cause the battery to overheat, buckling the plates and rendering it useless. Few owners will have access to an expensive current controlled charger, so if a normal domestic charger is used check that after a possible initial peak, the charge rate falls to a safe level (see illustration). If the battery becomes hot during charging stop. Further charging will

cause damage. **Note:** In emergencies, the maintenance-free type battery can be charged at a higher rate of around 3.0 to 6.0 amps for a period of 1 hour maximum. However, this is not recommended and the low amp charge is by far the safer method of charging the battery.

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

4 Install the battery (see Section 3).

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

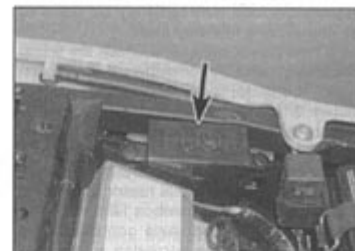
### 5 Fuses – check and renewal

1 The electrical system is protected by fuses of different ratings. All fuses (with the exception of the main fuse on 2000 Sprint models and Tiger models) are housed in the fusebox, which is located under the rider's seat (see illustrations). On 2000 Sprint models and Tiger models the main fuse is contained in a holder in the loom (see illustration).

2 To access the fuses, remove the seat(s) (see Chapter 7) and unclip the fusebox lid



**5.1a** Fusebox (arrowed) – Daytona and Speed Triple models



**5.1b** Fusebox (arrowed) – Sprint models



**5.1c** Fusebox (arrowed) – Tiger models

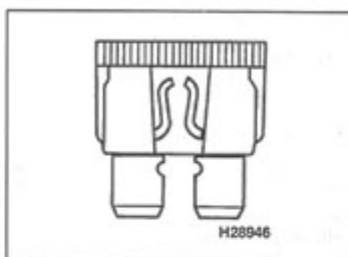


**5.1d** Main fuse – Tiger models

## 8•4 Electrical system



5.2 Unclip the lid to access the fusebox fuses – the identity, location and rating of each fuse is marked in the lid



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



6.4a Main beam relay (1), dip beam relay (2), turn signal relay (3) – Daytona and Speed Triple models

(see illustration). The identity, location and rating of each fuse is marked on the inside of the lid.

3 The fuses can be removed and checked visually. If you can't pull the fuse out with your fingertips, use a suitable pair of pliers. A blown fuse is easily identified by a break in the element (see illustration), or can be tested for continuity using an ohmmeter or continuity tester – if there is no continuity, it has blown. Each fuse is clearly marked with its rating and must only be replaced by a fuse of the same rating. If a spare fuse is used, always replace it with a new one so that a spare of each rating is carried on the bike at all times.

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

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

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

## 6 Lighting system – check

1 The battery provides power for operation of the headlight, tail light, brake light, turn signals and instrument cluster lights. If none of the lights operate, always check battery voltage before proceeding. Low battery voltage indicates either a faulty battery or a defective charging system. Refer to Section 3 for battery checks and Sections 29 and 30 for charging system tests. Also, check the condition of the fuses (see Section 5). When checking for a blown filament in a bulb, it is advisable to back up a visual check with a continuity test of the filament as it is not always apparent that a bulb has blown. When testing for continuity, remember that on tail light and turn signal bulbs it is often the metal body of the bulb which is the earth (ground).

### Headlight

2 If the headlights fail to work, check the bulb(s) and the bulb terminals and wiring connector first (see Section 7), then the circuit fuses (see Section 5). If they are all good, check for battery voltage at the relevant (hi or low beam) supply wire terminal on the headlight wiring connector, with the ignition switch and light switch ON, and the dip beam/main beam switch set appropriately,

referring to the *Wiring Diagrams* at the end of the Chapter to identify the wiring for your model. If voltage is present, check for continuity between the earth wire terminal and the battery negative (-ve) terminal. If there is no continuity, check the earth (ground) circuit for an open or poor connection.

3 If no voltage is indicated, check the wiring between the headlight, relays, light switches and the ignition switch, then check the switches themselves.

4 To access the headlight relays, remove the seats on Daytona and Speed Triple models, the seat cowl on Sprint RS models, and the fairing on Sprint ST and Tiger models (see Chapter 7). Disconnect the relevant relay from its connector block (see illustrations) – on Sprint and Tiger models, Triumph advise that the exact location of each relay is subject to change, so it is impracticable to specify its exact position in the relay pack – identify the relay by the coloured tag around the wiring going into it. On 1999 Sprint ST models, the main beam relay tag is black, and the dip beam relay tag is white. On 2000 Sprint ST models, Sprint RS models and Tiger models, the main beam relay tag is red, and the dip beam relay tag is white. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the *Wiring Diagrams* at the end of the Chapter.

5 The easiest way to test the relays is by substituting the suspect one with a known good one – if the low beam is not working and



6.4b Relay pack – Sprint ST models. Identify the correct relay from the coloured identity tags (arrowed)



6.4c Relay pack (arrowed) – Sprint RS models. Identify the correct relay from the coloured identity tags



6.4d Relay pack – Tiger models. Identify the correct relay from the coloured identity tags (arrowed)

the hi beam is, swap the relays and see if the problem follows.

6 The relays should have terminal identification numbers and a small circuit diagram marked on their underside – use this and the appropriate wiring diagram at the end of this Chapter to identify the activating power in and out terminals, and the main power in and out terminals that provide the power to the lights. Using an ohmmeter or continuity tester, connect the positive (+ve) probe to the relay's main power in terminal, and the negative (-ve) probe to the relay's main power out terminal. There should be no continuity. Leaving the meter connected, and using a fully charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the activating power in terminal, and the negative (-ve) terminal to the activating power out terminal. At this point the relay should close and the multimeter read 0 ohms (continuity) – there should be an audible click as the relay closes.

### Tail light

7 If the tail light fails to work, check the bulb(s) and the bulb terminals and wiring connector first (see Section 9), then the circuit fuses (see Section 5). If they are all good, check for battery voltage at the supply wire terminal on the tail light wiring connector, with the ignition switch and light switch ON, referring to the *Wiring Diagrams* at the end of the Chapter to identify the wiring for your model. Also check for continuity between the wiring connector terminals on the tail light side of the wiring connector and the corresponding terminals in the bulbholder. If

voltage and continuity are present, check for continuity between the earth wire terminal and the battery negative (-ve) terminal. If there is no continuity, check the earth (ground) circuit for an open or poor connection.

8 If no voltage is indicated, check the wiring between the tail light, the light switch and the ignition switch, then check the switches themselves.

### Sidelight (applicable markets)

9 If the sidelight fails to work, check the bulb and the bulb terminals and wiring connectors first (see Section 7), then the circuit fuses. If they are all good, check for battery voltage at the supply wire terminal on the sidelight wiring connector, with the ignition switch and light switch ON, referring to the *Wiring Diagrams* at the end of the Chapter to identify the wiring for your model. Also check for continuity between the wiring connector terminals on the tail light side of the wiring connector and the corresponding terminals in the bulbholder. If voltage and continuity are present, check for continuity between the earth wire terminal and the battery negative (-ve) terminal. If there is no continuity, check the earth (ground) circuit for an open or poor connection.

10 If no voltage is indicated, check the wiring between the sidelight, the light switch and the ignition switch, then check the switches themselves.

### Brake light

11 If the brake light fails to work, check the bulb(s) and the bulb terminals and wiring connector first (see Section 9), then the circuit fuses (see Section 5). If they are all good,

check for battery voltage at the supply wire terminal on the tail light wiring connector, with the ignition switch ON, and the brake lever or pedal applied, referring to the *Wiring Diagrams* at the end of the Chapter to identify the wiring for your model. Also check for continuity between the wiring connector terminals on the tail light side of the wiring connector and the corresponding terminals in the bulbholder. If voltage and continuity are present, check for continuity between the earth wire terminal and the battery negative (-ve) terminal. If there is no continuity, check the earth (ground) circuit for an open or poor connection.

12 If no voltage is indicated, check the brake light switches (see Section 14), then the wiring between the tail light and the switches.

### Instrument and warning lights

13 See Section 16.

### Turn signal lights

14 If one light fails to work, check the bulb and the bulb terminals first, then the wiring connectors (see Section 12). If none of the turn signals work, first check the signal circuit fuse (see Section 5).

15 If the fuse is good, see Section 11 for the turn signal circuit check.

## 7 Headlight bulb and sidelight bulb – renewal

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

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

### Headlight

1 On Daytona, Sprint ST models and Tiger models, you have to remove the headlight assembly to get decent access to the bulbs (see Section 8). On Sprint RS models, remove the fairing side panel(s) for best access, although small hands might be able to reach the bulb assembly without removing the panels.

2 On Speed Triple models, slacken the headlight rim clamp screw, then support the headlight and remove the rim. Carefully draw the light unit out of the shell, noting how it fits. Release the bulbholder from the light unit.

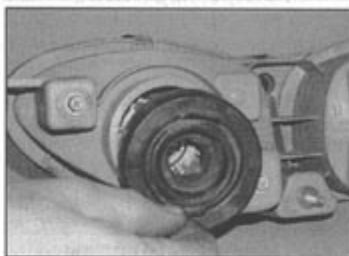
3 On Sprint RS models, remove the headlight connector cover, then disconnect the wiring connector (see illustration).

4 On all models, remove the rubber dust cover, noting how it fits (see illustration). Release the bulb retaining clip, noting how it fits, then remove the bulb (see illustrations).

5 Fit the new bulb, bearing in mind the



7.3 Remove the cover and disconnect the wiring connector (arrowed)



7.4a Remove the rubber cover, noting how it fits ...



7.4b ... then release the clip ...



7.4c ... and remove the bulb

## 8•6 Electrical system



**7.9 Release the bulbholder from the sidelight**

information in the Note above. Make sure the tabs on the bulb fit correctly in the slots in the bulb housing, and secure it in position with the retaining clip.

6 Install the dust cover, making sure it is correctly seated and with the 'TOP' mark at the top, and connect the wiring connector.

7 Install or reassemble the headlight and fairing panel(s) as required. Check the operation of the headlight.



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

### Sidelight

8 On Daytona, Sprint and Tiger models, remove the fairing (see Chapter 7).



**8.2a On Daytona models, unscrew the nut on the underside ...**



**8.2d ... and disconnect the wiring connectors**



**7.12 Carefully pull the bulb out of the holder**

9 On Daytona and Sprint, if not already done, release the bulbholder from the sidelight by turning it a quarter turn anti-clockwise (see illustration).

10 On Speed Triple models, slacken the headlight rim clamp screw, then support the headlight and remove the rim. Carefully draw the light unit out of the shell, noting how it fits. Release the bulbholder from the light unit.

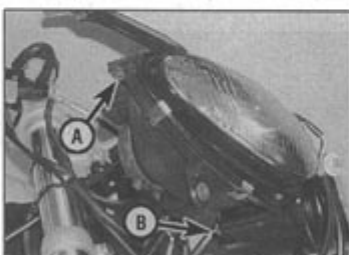
11 On Tiger models, remove the headlight assembly for best access to the bulbholders, though you might be able to get at them if you have small hands – they are located in the back of each light unit. Release the bulbholder from the light.

12 Carefully pull the bulb out of the holder and install the new bulb (see illustration).

13 Install or reassemble the headlight and fairing as required. Check the operation of the sidelight.



**8.2b ... and the nut on each end ...**



**8.2e On Sprint models, there is a screw on each end (A), and a nut on the underside (B)**

## 8 Headlight assembly – removal and installation

### Removal

1 On Daytona, Sprint and Tiger models, remove the fairing (see Chapter 7).

2 On Daytona and Sprint models, remove the three nuts (Daytona) or two screws and nut (Sprint) securing the headlight assembly, then displace it from its mounts, noting how it fits, and disconnect the wiring connectors (see illustrations). On Daytona models, access to the lower nut is restricted by the horn – displace it if required (see Section 25). If required, remove the headlight bulbs (see Section 7). Check the condition of the rubber grommets on each mounting and replace them with new ones if damaged, deformed or deteriorated – note that the grommet for the lower mounting could fall out of its cut-out, so remove it for safekeeping if it is loose.

3 On Speed Triple models, trace the wiring from the headlights and disconnect it at the connectors. Support the headlight assembly, then unscrew the two clamp bolts and remove the clamp and the headlights. To remove an individual light, disconnect its wiring connector, then unscrew the bolt securing it to the central mounting piece and remove the light.

4 On Tiger models, unscrew the three bolts securing the headlight assembly, then displace it from its mounts, noting how it fits, and disconnect the wiring connectors (see illustration). If required, remove the headlight



**8.2c ... then displace the headlight ...**

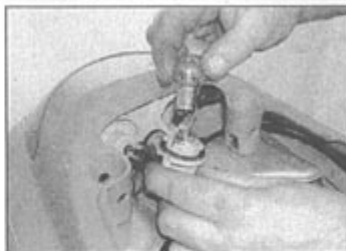


**8.4 Headlight mounting bolts (arrowed) – Tiger models**





9.1a Release the bulbholder from the tail light ...



9.1b ... then release the bulb from the holder



9.2a Undo the screws (arrowed) ...

bulbs (see Section 7). If required, the lights can be separated from the casing - all components are available individually.

#### Installation

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

### 9 Brake/tail and licence plate bulbs - renewal

#### Brake/tail lights

1 On Daytona, Speed Triple and Sprint models, remove the passenger seat (see Chapter 7). Turn the bulbholder anti-clockwise and withdraw it from the tail light (see illustration). Push the bulb into the holder and twist it anti-clockwise to remove it (see illustration).

2 On Tiger models, undo the screws securing the tail light lens and remove the lens (see illustrations). Push the bulb into the holder and twist it anti-clockwise to remove it (see illustration).



9.2b ... and remove the lens



9.2c Push the bulb in and twist it anti-clockwise to release it

3 Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place. **Note:** The pins on the bulb are offset so it can only be installed one way. It is a good idea to use a paper towel or dry cloth when handling the new bulb to prevent injury if the bulb should break and to increase bulb life.

4 On Daytona, Speed Triple and Sprint models, fit the bulbholder into the tail light and turn it clockwise to secure it (see illustration 9.1a). Install the seat (see Chapter 7).

5 On Tiger models, fit the tail light lens and secure it with the screws, taking care not to overtighten them as it is easy to strip the threads or crack the lens.

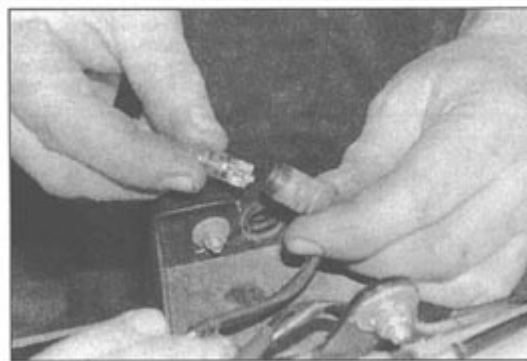
#### Licence plate light

6 On Daytona and Speed Triple models, to replace the licence plate bulb, remove the seat cowling (see Chapter 7), then ease the bulbholder out of the back of the licence plate light, and pull the bulb out of the holder (see illustrations).

7 On Sprint and Tiger models, there is no separate licence plate bulb - the licence plate is illuminated by the tail light bulbs.



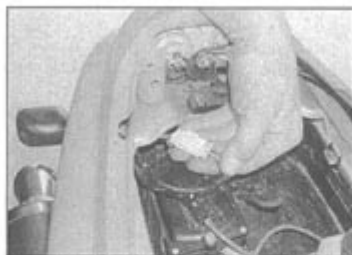
9.6a Ease the bulbholder from the back of the light unit ...



9.6b ... and pull the bulb out of the holder



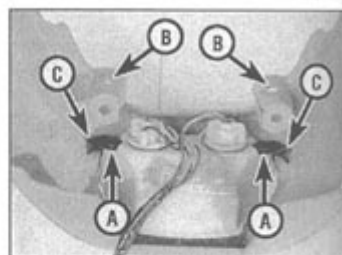
## 8•8 Electrical system



10.2a Tail light wiring connector – Daytona and Speed Triple models



10.2b Tail light wiring connector – Sprint models



10.3 Unscrew the bolts (A) via the holes (B), noting how the brackets (C) locate

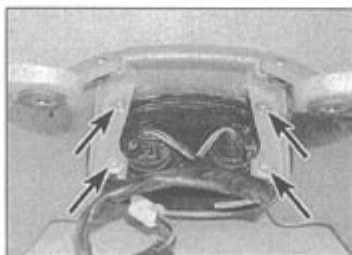
## 10 Tail light assembly – removal and installation

**Removal**

- 1 Remove the passenger seat (see Chapter 7). On Tiger models, remove the luggage rack and tail light cover (see Chapter 7).
- 2 On Daytona, Speed Triple and Sprint models, either remove the bulbholders (see illustration 9.1a), or disconnect the tail light assembly wiring connector (see illustrations).
- 3 On Daytona and Speed Triple models, unscrew the two bolts securing the tail light, accessing them via the holes in the seat cowling rear mounts, and noting how the brackets locate (see illustration). Withdraw the tail light from the back of the cowling.
- 4 On Sprint models, for best access to the tail light nuts, remove the seat cowling (see Chapter 7), though with small hands and a small spanner you can access them in situ. Unscrew the four nuts securing the tail light and withdraw it from the seat cowling (see illustration).
- 5 On Tiger models, unscrew the two nuts securing the tail light and remove it from the back of the bike.

**Installation**

- 6 Installation is the reverse of removal. Check the operation of the tail light and the brake light.



10.4 Tail light assembly nuts – Sprint models

## 11 Turn signal circuit – check

- 1 Most turn signal problems are the result of a burned out bulb or corroded socket. This is especially true when the turn signals function properly in one direction, but fail to flash in the other direction. Check the bulbs and the sockets (see Section 12) and the wiring connectors. Also, check the signal circuit fuse (see Section 5) and the switch (see Section 20).
- 2 The battery provides power for operation of the turn signal lights, so if they do not operate, also check the battery voltage. Low battery voltage indicates either a faulty battery or a defective charging system. Refer to Section 3 for battery checks and Sections 30 and 31 for charging system tests.
- 3 If the bulbs, sockets, connectors, fuse, switch and battery are good, check the turn signal relay. Remove the seats on Daytona and Speed Triple models, the seat cowling on Sprint RS models, and the fairing on Sprint ST and Tiger models (see Chapter 7). Disconnect the relevant relay from its connector block (see illustration 6.4a, b, c or d) – on Sprint and Tiger models, Triumph advise that the exact location of each relay is subject to change, so it is impracticable to specify its exact position in the relay pack – identify the relay by the coloured tag around the wiring going into it. On 1999 Sprint ST models, the turn signal relay tag is red. On 2000 Sprint ST models, Sprint RS models and Tiger models, the relay tag is blue.

If the tag is missing, identify the relay by the colour of the wires going into it, referring to the *Wiring Diagrams* at the end of the Chapter. Triumph do not provide any specific test data for the relay itself, so the easiest way to test it is by substituting the suspect one with a known good one. You can however test the wiring to and from the relay as follows.

- 4 Check for voltage at the orange/green wire in the relay wiring connector with the ignition ON. If no voltage is present, using the appropriate wiring diagram at the end of this Chapter check the wiring between the relay and the fusebox, and then to the ignition (main) switch. If voltage was present, first check for continuity to earth in the black or black/green wire, then check for voltage at the light green/brown wire with the ignition ON, and with the switch turned to either LEFT or RIGHT. If no voltage is present, replace the relay with a new one. If voltage was present, check the wiring between the relay, turn signal switch and turn signal lights for continuity. Turn the ignition OFF when the check is complete.

## 12 Turn signal bulbs – renewal

**Front turn signals – Sprint ST models**

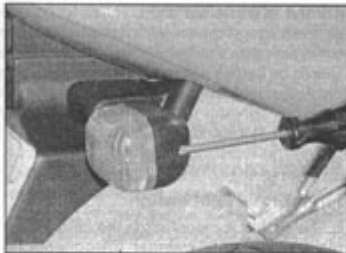
- 1 Remove the fairing side panel (see Chapter 7).
- 2 If required, disconnect the turn signal wiring connector. Undo the screws securing the bulbholder to the lens assembly and withdraw the bulbholder (see illustration).
- 3 Push the bulb into the holder and twist it anti-clockwise to remove it. Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place.
- 4 Fit the holder onto the lens, and secure it with the screws. Do not overtighten the screw as the threads could be damaged.

**All turn signals – all other models**

- 5 Remove the screw securing the turn signal



12.2 Undo the screws (arrowed) and remove the bulbholder



12.5 Remove the screw and detach the lens ...



12.6 ... and remove the bulb



12.7 Make sure the tab locates correctly when fitting the lens

lens and remove the lens, noting how it fits (see illustration).

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

7 Fit the lens onto the holder, making sure the tab locates correctly (see illustration). Do not overtighten the screw as the lens or threads could be damaged.

### 13 Turn signal assemblies – removal and installation

#### Front

##### Removal

1 On Daytona models, remove the fairing side panel (see Chapter 7). Unscrew the nut securing the turn signal to the inside of the panel and withdraw it from the outside, taking care not to snag the wiring, and noting the arrangement of the washer, plate and rubber block (see illustration).

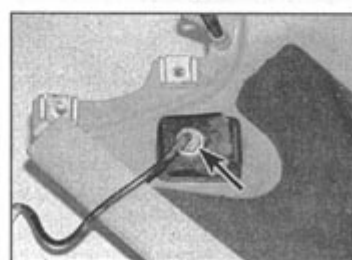
2 On Speed Triple models, pull the rubber boot off the turn signal mount. Disconnect the wiring connectors, then draw the boot off the wiring. Unscrew the nut, noting the arrangement of the washers, and withdraw

the turn signal from the bracket, taking care not to snag the wiring.

3 On Sprint ST models, remove the fairing side panel, and if required for best access, the fairing (see Chapter 7). Disconnect the turn signal wiring connector. Undo the screws securing the turn signal to the fairing and withdraw it, noting how it fits (see illustration).

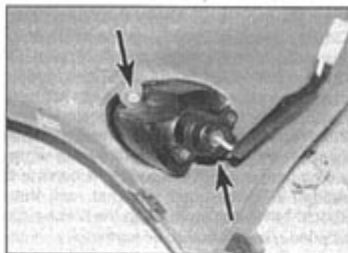
4 On Sprint RS models, remove the fairing side panel (see Chapter 7). Pull the rubber boot off the turn signal mount, then draw the boot off the wiring (see illustration). Unscrew the nut, noting the arrangement of the washers, and withdraw the turn signal from the bracket, taking care not to snag the wiring.

5 On Tiger models, remove the two screws securing each turn signal panel, then draw it away and disconnect the wiring connectors

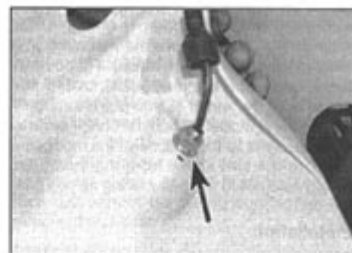


13.1 Front turn signal nut (arrowed) – Daytona

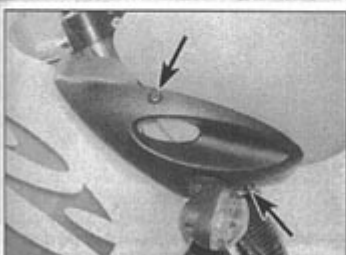
(see illustrations). Unscrew the nut on the inside, counter holding the screw on the outside, then withdraw the turn signal, taking care not to snag the wiring (see illustration).



13.3 Front turn signal screws (arrowed) – Sprint ST



13.4 Front turn signal nut (arrowed) – Sprint RS



13.5a Undo the screws (arrowed) ...

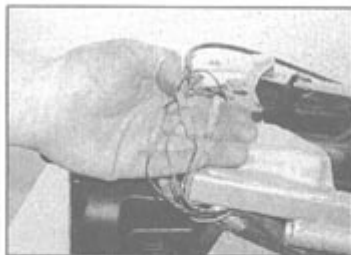


13.5b ... and displace the panel



13.5c Turn signal nut (arrowed) – Tiger

## 8•10 Electrical system



13.8 Rear turn signal wiring connectors – Daytona shown

**Installation**

6 Installation is the reverse of removal. Make sure the wiring is correctly routed and securely connected. Check the operation of the turn signals.

**Rear****Removal**

7 On Daytona and Speed Triple models, remove the seat cowl (see Chapter 7). On Sprint models, remove the seat (see Chapter 7). On Tiger models, remove the luggage rack and tail light cover (see Chapter 7).

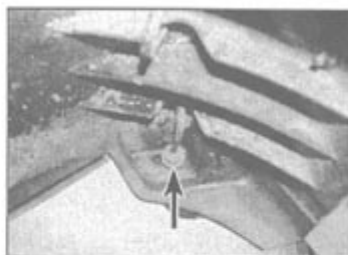
8 Trace the wiring back from the turn signal and disconnect it at the connectors (see illustration). Release the wiring from any clips and feed it through to the turn signal.

9 On Daytona, Speed Triple and Sprint models, unscrew the nut securing the turn signal to the inside of the mudguard, then remove the washers, noting their arrangement, and remove the mounting plate where fitted (see illustration). Remove the turn signal from the mudguard, taking care not to snag the wiring as you pull it through.

10 On Tiger models, undo the screw securing the turn signal from the mudguard. Remove the turn signal from the mudguard, taking care not to snag the wiring as you pull it through.

**Installation**

11 Installation is the reverse of removal. Make sure the wiring is correctly routed and



13.9 The turn signal is secured by a nut (arrowed) on the inside of the mudguard

securely connected. Check the operation of the turn signals.

## 14 Brake light switches – check and renewal

**Circuit check**

1 Before checking the switches, check the brake light circuit (see Section 6, Step 11).

2 The front brake light switch is mounted on the underside of the brake master cylinder. Disconnect the wiring connectors from the switch (see illustration). Using a continuity tester, connect the probes to the terminals of the switch. With the brake lever at rest, there should be no continuity. With the brake lever applied, there should be continuity. If the switch does not behave as described, replace it with a new one.

3 The rear brake light switch is mounted on the right-hand side, above the brake pedal. On Daytona and Speed Triple models, trace the wiring from the switch and disconnect it at the connector. On Sprint and Tiger models, pull the rubber boot off the switch and disconnect the wiring connectors (see illustration). Using a continuity tester, connect the probes to the terminals on the wiring connector or the switch, according to model. With the brake pedal at rest, there should be no continuity. With the brake pedal applied, there should be continuity. If the switch does not behave as described, replace it with a new one.

4 If the switches are good, check for voltage at the orange/green wire terminal on the connector with the ignition switch ON – there should be battery voltage. If there's no voltage present, check the wiring between the switch and the ignition switch (see the *Wiring Diagrams* at the end of this Chapter).

**Switch renewal****Front brake light switch**

5 The switch is mounted on the underside of the brake master cylinder. Disconnect the wiring connectors from the switch (see illustration 14.2).

6 Remove the single screw securing the switch to the bottom of the master cylinder and remove the switch.

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

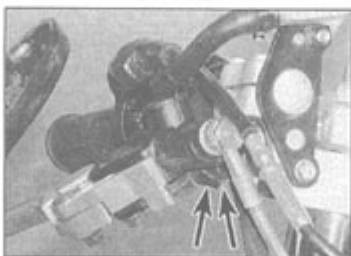
**Rear brake light switch**

8 The rear brake light switch is mounted on the right-hand side, above the brake pedal. On Daytona and Speed Triple models, trace the wiring from the switch and disconnect it at the connector. Free the wiring from any clips or ties and feed it through to the switch. On Sprint and Tiger models, pull the rubber boot off the switch and disconnect the wiring connectors (see illustration 14.3).

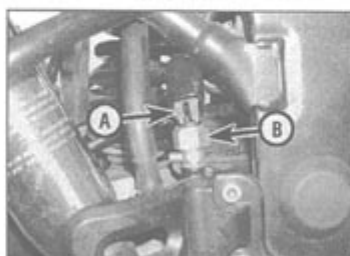
9 On Daytona and Speed Triple models, detach the lower end of the switch spring from the brake pedal. Unscrew and remove the switch from the adjuster nut in the bracket (see illustration).

10 On Sprint and Tiger models, have some rag handy to catch any fluid spills, then unscrew the brake light switch and separate the brake hose from the master cylinder, noting its alignment. Discard the two sealing washers as they must be replaced with new ones. Wrap the end of the hose in a clean rag and suspend the hose in an upright position or bend it down carefully and place the open end in a clean container. The objective is to prevent excessive loss of brake fluid, fluid spills and system contamination.

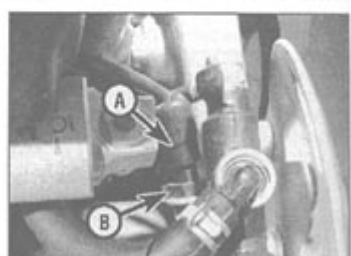
11 On Daytona and Speed Triple models, installation is the reverse of removal. Make sure the brake light is activated just before the rear brake pedal takes effect. If adjustment is



14.2 Front brake switch wiring connectors (arrowed)



14.3 Rear brake light switch wiring connectors (A), rear brake light switch (B) – Tiger shown



14.9 Rear brake light switch (A) and adjuster nut (B) – Daytona and Speed Triple

necessary, hold the switch and turn the adjuster nut on the switch body until the brake light is activated when required (see illustration 14.9).

12 On Sprint and Tiger models, connect the brake hose to the master cylinder, using new sealing washers on each side of the union, and aligning the hose as noted on removal (see illustration 14.3). Tighten brake light switch to the torque setting specified at the beginning of the Chapter. Connect the brake light switch wiring connectors, then fit the rubber boot over them.

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

#### Check

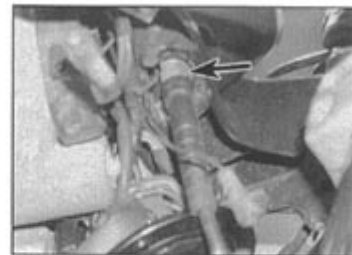
1 Triumph provide no specific test data for the instruments themselves. Check that the wiring connectors are securely connected both to the instrument cluster and at the other end of the wiring to the source. Check all wires for continuity from pin to pin, referring to the wiring diagrams at the end of the Chapter. Note that there are in-line resistors for the tachometer and temperature gauge, and on Sprint ST and Tiger models the fuel gauge – refer to Chapter 4 for test details.

2 Check that all earth wires have a good connection. If all the wiring is good, it is possible that there are faults in the sensors or electronic control module (ECM) of the engine management system which provide much of the information to the instruments. Refer to Chapter 4 for details. If all checks point at faulty instruments rather than wiring or engine management system, take the instrument cluster to a Triumph dealer for further assessment. Individual components are available. If any of the warning lights or instrument lights fail, refer to Section 16.

3 Note that if the speedometer is not working on Daytona and Speed Triple models, the most likely cause is a broken cable, which should be checked first. Remove the headlight to access the knurled ring securing it to the instrument cluster (see Section 8) (see illustration 15.4b). It is



15.4a Disconnect the wiring connectors ...



15.4b ... then unscrew the ring (arrowed) and detach the cable



15.4c Undo the screws (arrowed) ...



15.4d ... and remove the instruments

secured to the drive gear on the wheel by a single screw.

#### Removal

4 On Daytona models, remove the fairing (see Chapter 7), then remove the headlight (see Section 8). Disconnect the instrument cluster wiring connectors (see illustration). Unscrew the knurled ring securing the speedometer cable and detach it (see illustration). Remove the screws securing the instrument cluster and lift it off the bracket (see illustrations).

5 On Speed Triple models, disconnect the instrument cluster wiring connectors. Unscrew the knurled ring securing the speedometer cable and detach it. Remove the screws securing the instrument cluster and lift it off the bracket, turning the handlebars as required to access the screws.

6 On Sprint ST models, remove the fairing

(see Chapter 7). Unscrew the nuts securing the instrument cluster and lift it off the bracket, then disconnect the wiring connectors and remove the cluster (see illustration).

7 On Sprint RS models, remove the fairing (see Chapter 7). Pull back the rubber cover and disconnect the wiring connector from the instrument cluster (see illustration). Remove the screws securing the cluster and lift it off the stay (see illustration).

8 On Tiger models, remove the fairing (see Chapter 7), then remove the headlight (see Section 8). Unscrew the nuts securing the instrument cluster and lift it off the bracket, then disconnect the wiring connectors and remove the cluster.

#### Installation

9 Installation is the reverse of removal. Check all the rubber mounting grommets for cracks



15.6 Instrument cluster nuts (arrowed) – Sprint ST



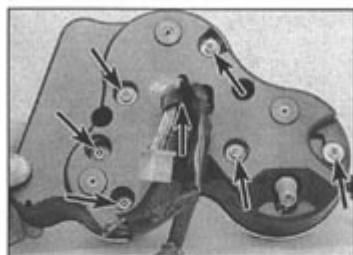
15.7a Pull back the rubber cover and disconnect the wiring connector



15.7b Undo the screws (arrowed) and remove the instruments



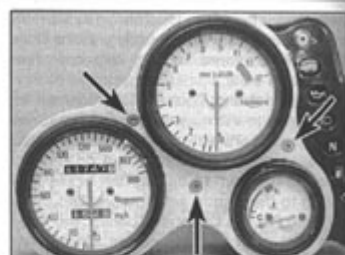
# 8•12 Electrical system



16.1a Unscrew the nuts (arrowed) ...



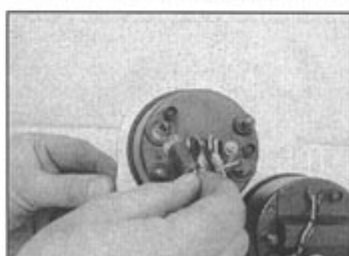
16.1b ... and remove the grommets ...



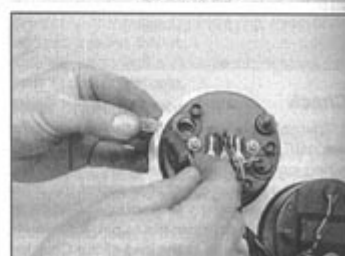
16.1c ... then undo the three screws (arrowed) ...



16.1d ... and lift the instruments out of the casing



16.1e Pull out the bulbholder ...



16.1f ... and renew the bulb

and deterioration and replace them with new ones if necessary. Make sure the instruments are installed with all washers, collars and grommets previously installed.

## 16 Instrument and warning light bulbs - renewal

1 On Daytona and Speed Triple models, remove the instrument cluster (see Section 15). To replace instrument illumination bulbs, unscrew the six nuts on the back of the cluster and remove the rubber grommets, then undo the three screws on the front of the cluster (see illustrations). Lift the instrument assembly out of the casing (see illustration). Pull the relevant bulbholder out of the instrument, then pull the bulb out of the holder and install a new one (see illustrations). To replace warning light bulbs, remove the instrument assembly from the housing as described above, then lift the warning light assembly out (see illustration). Pull the relevant bulbholder out of the assembly, then pull the bulb out of the holder and install a new one (see illustration).

2 On Sprint ST models, remove the fairing (see Chapter 7). Some of the instrument illumination bulbs are accessible without removing anything else (see illustration). For others, and for the warning light bulbs, undo the screws securing the shroud and remove it. If there are any you can't get at, either displace the headlight or the instrument cluster to access them (see Section 8 or 15). Pull the relevant bulbholder out of the



16.1g Lift out the warning light assembly ...



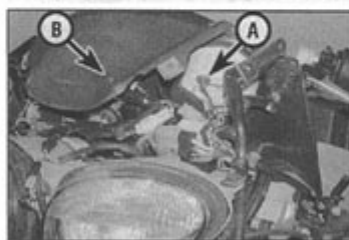
16.1h ... then pull out the bulbholder to access the bulb

assembly, then pull the bulb out of the holder and install a new one (see illustration).

3 On Sprint RS models, remove the instrument cluster (see Section 15). Undo the screws on the back of the cluster and lift the casing off. Twist the relevant bulbholder anti-

clockwise to release it, then pull out the bulb and replace it with a new one.

4 On Tiger models, remove the fairing (see Chapter 7). Some of the instrument illumination bulbs and all of the warning light bulbs are accessible without removing anything else (see illustration). For others,



16.2 On Sprint ST, some bulbs are accessible (A), otherwise remove the shroud (B) or displace the cluster



16.4 Warning light bulbs - Tiger models



displace the instrument cluster to access them (see Section 15), and if necessary displace the instrument itself from its mount. Pull the relevant bulbholder out of the assembly, then pull the bulb out of the holder and install a new one.

### 17 Relays – general information, check and renewal

#### General information

**Note:** Changes to relay location and application are given below where known. If you are in any doubt regarding the quantity, function and location of any relays, refer to your Triumph dealer.

1 On Daytona and Speed Triple models, all the relays are housed under the seats (see illustration 6.4a).

2 On Sprint ST to VIN 89736 models, the headlight and turn signal relays are housed behind the fairing, and the engine management relays (ECM power, cooling fan and fuel pump) are housed behind the seat cowling on the right-hand side. On Sprint ST models from VIN 89737-on, the ECM power relay is under the seat, and the headlight and turn signal relays are behind the fairing (see illustration 6.4b) – the fuel pump and cooling fan relays are no longer fitted.

3 On Sprint RS models, the ECM power relay is under the seat, and the headlight and turn signal relays are behind the seat cowling on the right-hand side (see illustration 6.4c). Fuel pump and cooling fan relays are not fitted.

4 On Tiger models, the ECM power relay is under the seat, along with the cooling fan and fuel pump relays to VIN 89736. From VIN 89737-on the fuel pump and cooling fan relays are no longer fitted. The headlight and turn signal relays are behind the fairing (see illustration 6.4d).

5 The cooling fan relay, where fitted, is covered in Chapter 3. The headlight relays are covered in Section 6 of this Chapter. The ECM and fuel pump relays (where fitted) are covered in Chapter 4. The starter relay is covered in Section 26 of this Chapter.



18.6a Unscrew the steering stem nut ...

#### Check and renewal

7 To check the relays, remove the seats, seat cowling and/or the fairing, according to your model as outlined above. On Sprint and Tiger models, Triumph advise that the exact location of each relay is subject to change, so it is impracticable to specify its exact position in the relay pack – identify the relay by the coloured tag around the wiring going into it.

8 On 1999 Sprint ST models, the main beam relay tag is black, the dip beam relay tag is white, the turn signal relay tag is red, the headlight cut-out relay (daytime lights-on models only) tag is blue, the cooling fan relay tag is blue, the fuel pump relay tag is white and the ECM relay tag is red. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the Wiring Diagrams at the end of the Chapter.

9 On 2000 Sprint ST models, Sprint RS models and Tiger models, the main beam relay tag is red, and the dip beam relay tag is white, the turn signal relay tag is red on Sprint and blue on Tiger, the headlight cut-out relay (daytime lights-on models only) tag is yellow on Sprint, and on Tiger models there is no tag. If the tag is missing, identify the relay by the colour of the wires going into it, referring to the Wiring Diagrams at the end of the Chapter.

10 Triumph do not provide any specific test data for the relays, so the best way to test it is by substituting the suspect one with a known good one – if the low beam is not working and the hi beam is, swap the relays and see if the problem follows.

11 The relays should have terminal identification numbers and a small circuit diagram marked on their underside – use this to identify the activating power in and out terminals, and the main power in and out terminals that provide the power to the lights. Using an ohmmeter or continuity tester, connect the positive (+ve) probe to the relay's main power in terminal, and the negative (-ve) probe to the relay's main power out terminal. There should be no continuity. Leaving the meter connected, and using a fully charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of the battery to the activating power in terminal, and the negative (-ve) terminal to the activating power out terminal. At this point the

relay should close and the multimeter read 0 ohms (continuity) – there should be an audible click as the relay closes.

12 If you are replacing a relay, first disconnect the battery negative (-ve) terminal. The relays have terminals on their underside which plug directly into sockets – simply pull the relay out of its socket, and fit the new one in.

### 18 Ignition (main) switch – check, removal and installation



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

#### Check

1 Trace the ignition (main) switch wiring back from the base of the switch and disconnect it at the connector, removing the fairing, fairing side panels or fuel tank as required by your model. Make the checks on the switch side of the connector.

2 Using an ohmmeter or a continuity tester, check the continuity of the connector terminal pairs (see the Wiring Diagrams at the end of this Chapter). Continuity should exist between the terminals connected by a solid line on the diagram when the switch key is turned to the indicated position.

3 If the switch fails any of the tests, replace it with a new one.

#### Removal

4 Trace the ignition (main) switch wiring back from the base of the switch and disconnect it at the connector, removing the fairing, fairing side panels or fuel tank as required by your model (it is advisable to remove them anyway to prevent the possibility of damage should a tool slip when removing the top yoke).

5 On Speed Triple models with one-piece handlebars, and on Sprint and Tiger models, displace the handlebars from the top yoke (see Chapter 5). Secure the handlebar assemblies so that the master cylinder is upright, making sure there is no strain on the hoses, cables or wiring. On all models, slacken the fork clamp bolts in the top yoke – on Daytona and Speed Triple models with separate handlebars, to access the clamp bolts, slacken the handlebar clamp bolts, then slide the handlebars down the forks until the locating pins are clear of the holes in the underside of the yoke, and twist them round until the fork clamp bolts in the top yoke are accessible.

6 Unscrew the steering stem nut and remove it along with its washer, where fitted. On Daytona and Speed Triple models, this requires the use of a special Triumph tool (Pt. No. T3880300), or a suitable equivalent (see illustration). Lift the top yoke up off the steering stem and position it clear, using a rag to protect the tank and other components (see illustration).



18.6b ... and draw the yoke up off the forks

## 8•14 Electrical system



18.7 Ignition switch bolts (arrowed)

7 Two shear-head bolts mount the ignition switch to the underside of the top yoke (see illustration). The heads of the bolts must be drilled round using a suitable punch or drift, or drilled off, before the switch can be removed. Mount the yoke in a vice equipped with soft jaws and padded out with rags to do this. Remove the bolts and withdraw the switch from the top yoke.

**Installation**

8 Installation is the reverse of removal. Obtain new shear-head bolts and tighten them until their heads shear off. Make sure wiring connectors are securely connected and correctly routed. Tighten the steering stem nut, the fork clamp bolts, the handlebar bolts, in that order, to the torque settings specified at the beginning of Chapter 5, and refer to Sections 5 and 8 in that Chapter for procedural details and illustrations.

## 19 Handlebar switches – check

1 Generally speaking, the switches are reliable and trouble-free. Most troubles, when they do occur, are caused by dirty or corroded contacts, but wear and breakage of internal parts is a possibility that should not be overlooked. If breakage does occur, the entire switch and related wiring harness will have to be replaced with a new one, as individual parts are not available.

2 The switches can be checked for continuity using an ohmmeter or a continuity test light.

3 Trace the wiring harness of the switch in question back to its connectors and disconnect them, removing the fairing, fairing side panels or fuel tank as required by your model.

4 Check for continuity between the terminals of the switch harness with the switch in the various positions (i.e. switch off – no continuity, switch on – continuity) – see the *Wiring Diagrams* at the end of this Chapter.

5 If the continuity check indicates a problem exists, refer to Section 20, remove the switch and spray the switch contacts with electrical contact cleaner. If they are accessible, the



20.3a Right-hand switch housing screws (arrowed) – Daytona shown



20.3b Left-hand switch housing screws (arrowed) – Daytona shown

## 20 Handlebar switches – removal and installation

**Removal**

1 If the switch is to be removed from the bike, rather than just displaced from the handlebar, trace the wiring harness of the switch in question back to its connectors and disconnect them, removing the fairing, fairing side panels or fuel tank as required by your model. Work back along the harness, freeing it from all the relevant clips and ties, noting its correct routing.

2 Disconnect the wiring connectors from the front brake light switch if removing the right-hand switch (see illustration 14.2).

3 Unscrew the handlebar switch screws (either on the back or the underside of the switch) and free the switch from the handlebar by separating the halves (see illustrations). On Sprint ST and Tiger models, when removing the right-hand switch, detach the throttle cable, noting how it fits – refer to Chapter 4, Section 10 for details.

**Installation**

4 Installation is the reverse of removal. Make sure the locating pin in the switch housing locates in the hole in the handlebar. Make



21.2 Disconnect the wiring connector (arrowed) from the switch



21.4 Neutral switch (arrowed)

sure the wiring connectors are correctly routed and securely connected.

## 21 Neutral switch – check, removal and installation

**Check**

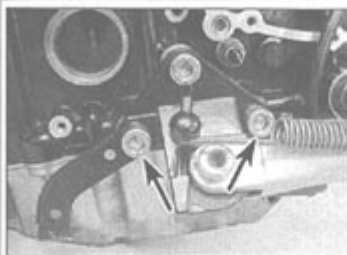
1 If the neutral light fails to come on, first check the circuit fuse (see Section 5) and the bulb in the instrument cluster (see Section 16).

2 The switch is located on the left-hand side of the engine just below the front sprocket cover. Disconnect the wiring connector from the switch (see illustration).

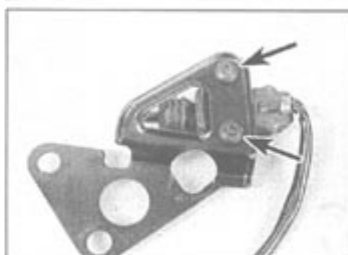
3 With the connector disconnected and the ignition switched ON, the neutral light should be out. If not, the wire between the connector and instrument cluster must be earthed (grounded) at some point.

4 Check for continuity between the terminal on the switch and the crankcase. With the transmission in neutral, there should be continuity. With the transmission in gear, there should be no continuity. If there is no continuity when in neutral, remove the switch (see below), and check that the contact plunger is not damaged or seized in the switch body (see illustration).

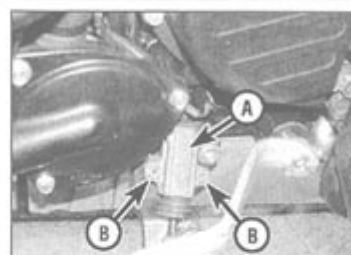
5 If the continuity tests prove the switch is good, check for voltage (ignition ON) at the terminal on the wiring connector. If there's no voltage present, check the wire between the switch and the bulb, and if that is good, check for voltage in the other wire to the bulb (see



**22.7** Unscrew the bolts (arrowed) and remove the sidestand assembly



**22.8a** Sidestand switch screws (arrowed) – Daytona, Speed Triple and Sprint



**22.8b** Sidestand switch (A) and its mounting bolts (B) – Tiger

the *Wiring Diagrams* at the end of this Chapter).

### Removal

6 The switch is on the left-hand side of the engine just below the front sprocket cover. On Daytona models, remove the belly pan (see Chapter 7). Drain the engine oil (see Chapter 1).

7 Disconnect the wiring connector from the switch (see illustration 21.2).

8 Unscrew the switch and withdraw it from the casing (see illustration 21.4). Discard the sealing washer as a new one should be used.

### Installation

9 Install the switch using a new sealing washer and tighten it securely.

10 Connect the wiring connector. Check the operation of the neutral light. Fill the engine with oil (see Chapter 1 and Daily (pre-ride) checks). On Daytona, install the belly pan (see Chapter 7).

### 22 Sidestand switch – check and renewal

#### Check

1 The sidestand switch is mounted on the sidestand bracket (see illustration 22.8b). The switch is part of the safety circuit which prevents or stops the engine running if the transmission is in gear whilst the sidestand is down, and prevents the engine from starting if the transmission is in gear unless the sidestand is up, and unless the clutch is pulled in. Before checking the electrical circuit, check the fuse (see Section 5).

2 Trace the wiring from the switch and disconnect it at the connector, removing the fairing side panels or fuel tank as required by your model.

3 Check the operation of the switch using an ohmmeter or continuity test light. Connect the meter probes to the terminals on the switch side of the connector. With the sidestand up there should be continuity (zero resistance)

between the terminals, and with the stand down there should be no continuity (infinite resistance).

4 If the switch does not perform as expected, it is defective and must be renewed.

5 If the switch is good, check the other components in the starter circuit as described in the relevant sections of this Chapter. If all components are good, check the wiring between the various components (see the *Wiring Diagrams* at the end of this Chapter).

#### Renewal

6 The sidestand switch is mounted on the sidestand bracket. Trace the wiring from the switch and disconnect it at the connector, removing the fairing, fairing side panels or fuel tank as required by your model. Work back along the switch wiring, freeing it from any relevant retaining clips and ties, noting its correct routing.

7 On Daytona, Speed Triple and Sprint models, unscrew the bolts securing the sidestand bracket to the frame and displace it (see illustration).

8 Undo the screws or bolts securing the switch and remove the switch, noting how it fits (see illustrations).

9 Fit the new switch and tighten the screws or bolts securely. On Daytona, Speed Triple and Sprint models, install the sidestand assembly and tighten the bolts securely (see illustration 22.7).



**23.1** Clutch switch (arrowed)

10 Make sure the wiring is correctly routed up to the connector and retained by all the necessary clips and ties. Reconnect the wiring connector and check the operation of the sidestand switch.

### 23 Clutch switch – check and renewal

#### Check

1 The clutch switch is mounted in the clutch lever bracket (see illustration). The switch is part of the safety circuit which prevents or stops the engine running if the transmission is in gear whilst the sidestand is down, and prevents the engine from starting if the transmission is in gear unless the sidestand is up and the clutch lever is pulled in. The switch isn't adjustable.

2 To check the switch, trace the wiring from the switch and disconnect it at the connector. Connect the probes of an ohmmeter or a continuity tester to the two terminals on the switch side of the connector. With the clutch lever pulled in, continuity should be indicated. With the clutch lever out, no continuity (infinite resistance) should be indicated.

3 If the switch is good, turn the ignition on and check that there is voltage at one of the terminals on the loom side of the connector, and check that the other terminal has continuity with earth (ground). If not check the wiring. Otherwise, check the other components in the starter circuit as described in the relevant sections of this Chapter, and check the wiring between the various components (see the *Wiring Diagrams* at the end of this Chapter).

#### Renewal

4 The clutch switch is mounted in the clutch lever bracket (see illustration 23.1).

5 Trace the wiring from the switch and disconnect it at the connector. Use a small screwdriver to release the clip on the underside of the switch and pull it out

## 8•16 Electrical system



23.5 Release the clip and withdraw the switch

of the clutch lever bracket (see illustration).  
6 Installation is the reverse of removal.

## 24 Horn – check and renewal

**Check**

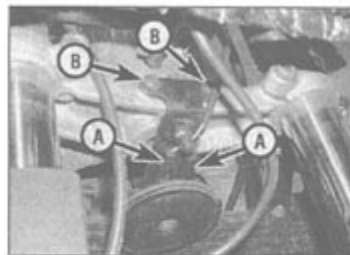
- 1 If the horn doesn't work, first check the circuit fuse (see Section 5) and the battery (see Section 3).
- 2 The horn is mounted on the instrument/headlight bracket on Daytona models (see illustration 8.2a), or on the bottom yoke on all other models (see illustrations). Remove the fairing for best access (see Chapter 7).
- 3 Unplug the wiring connectors from the horn. Using two jumper wires, apply battery voltage directly to the terminals on the horn. If the horn sounds, check the button in the switch housing (see Section 19) and the wiring between the switch housing and the horn (see Wiring Diagrams at the end of this Chapter).
- 4 If the horn doesn't sound, replace it with a new one.

**Renewal**

- 5 The horn is mounted on the instrument/headlight bracket on Daytona models (see illustration 8.2a), or on the bottom yoke on all other models (see illustrations). Remove the fairing for best access (see Chapter 7).



25.3 Oil pressure switch wiring connector (arrowed)



24.2a Horn wiring connectors (A) and mounting bolts (B) – Sprint models

- 6 Unplug the wiring connectors from the horn. Unscrew the bolt(s) securing the horn and remove it from the bike.
- 7 Install the horn and securely tighten the bolt(s). Connect the wiring connectors to the horn. Install the fairing (see Chapter 7).

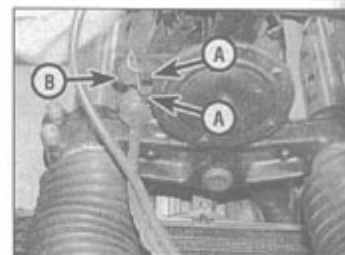
## 25 Oil pressure switch – check, removal and installation

**Check**

- 1 The oil pressure warning light should come on when the ignition (main) switch is turned ON and extinguish a few seconds after the engine is started; on Sprint RS models, the low oil pressure symbol should flash. If the oil pressure warning light comes on whilst the engine is running, stop the engine immediately and carry out an oil level check (see Daily (pre-ride) checks), and if the level is correct, an oil pressure check (see Chapter 2).
- 2 If the oil pressure warning light does not come on when the ignition is turned on, check the bulb (see Section 16) and circuit fuse (see Section 5).
- 3 The oil pressure switch is screwed into the crankcase on the right-hand side (see illustration). On Daytona and Sprint ST models remove the right-hand fairing side panel for access (see Chapter 7). Pull the wiring connector off the switch. With the ignition switched ON, earth (ground) the wire on the crankcase and check that the warning light comes on. If the light comes on, the



25.8 Unscrew the switch, noting the sealing washers and how the oil hose is secured



24.2b Horn wiring connectors (A) and mounting bolt (B) – Tiger models

switch is proven defective and must be replaced with a new one.

- 4 If the light still does not come on, check for voltage at the wire terminal. If there is no voltage present, check the wiring between the switch, the instrument cluster and ECM for continuity (see the wiring diagrams at the end of this Chapter).

5 If the warning light comes on whilst the engine is running, yet the oil pressure is satisfactory, remove the wire from the oil pressure switch. With the wire detached and the ignition switched ON the light should be out. If it is illuminated, the wire between the switch and instrument cluster must be earthed (grounded) at some point. If the wiring is good, the switch must be assumed faulty and renewed.

**Removal**

- 6 On Daytona and Sprint ST models remove the right-hand fairing side panel for access (see Chapter 7).
- 7 Pull the wiring connector off the switch. (see illustration 25.3).
- 8 Unscrew the oil pressure switch, noting how it also secures the oil hose, and withdraw it from the crankcase (see illustration). Be prepared to catch any residual oil from the pipe. Discard the sealing washers as new ones should be used.

**Installation**

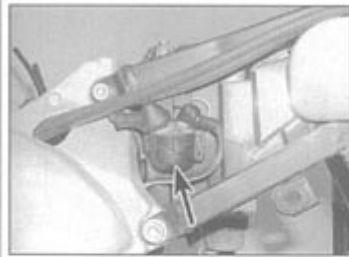
- 9 Install the switch using new sealing washers on each side of the oil hose union and tighten it to the torque setting specified at the beginning of the Chapter (see illustration 25.8). Attach the wiring connector (see illustration 25.3).
- 10 Run the engine and check that the switch operates correctly without leakage.
- 11 On Daytona and Sprint ST models install the right-hand fairing side panel (see Chapter 7).

## 26 Starter relay – check and renewal

**Check**

- 1 If the starter circuit is faulty, first check the main fuse (see Section 5).
- 2 On Daytona and Sprint models, remove the





**26.2a Starter relay (arrowed) - Sprint models**

left-hand fairing side panel (see Chapter 8). Trace the lead from the top of the starter motor to the starter relay, removing the seat(s) or seat cowl as required by your model (see illustrations). Lift the rubber terminal cover and unscrew the nut securing the starter motor lead to its terminal; position the lead away from the relay terminal. With the ignition switch ON, the engine kill switch in the 'RUN' position, and the transmission in neutral, press the starter switch. The relay should be heard to click.

3 If the relay doesn't click, switch off the ignition and remove the relay as described below; test it as follows.

4 Set a multimeter to the ohms x 1 scale and connect it across the relay's starter motor and battery lead terminals. Using a fully-charged 12 volt battery and two insulated jumper wires, connect the positive (+ve) terminal of



**26.2b Starter relay (arrowed) - Tiger models**

the battery to the white/red wire terminal on the relay, and the negative (-ve) terminal to the black/pink wire terminal on the relay. At this point the relay should be heard to click and the multimeter read 0 ohms (continuity). If this is the case the relay is proved good. If the relay does not click when battery voltage is applied and indicates no continuity (infinite resistance) across its terminals, it is faulty and must be replaced with a new one.

5 If the relay is good, check for battery voltage at the white/red wire terminal on the loom side of the relay wiring connector when the starter button is pressed. If voltage is present, check the other components in the starter circuit as described in the relevant sections of this Chapter. If no voltage was present, check the wiring between the various components (see Wiring Diagrams at the end of this Chapter).



**27.2a Slacken the clamp screw and detach the hose from the union**



**27.2b Undo the screws (arrowed) and remove the union**



**27.3 Lift the rubber cover, then unscrew the nut (arrowed) and detach the lead**



**27.4a Unscrew the bolts ...**

### Renewal

6 Remove the seat(s) (see Chapter 7). Disconnect the battery negative (-ve) lead before removing the relay. On Daytona and Sprint models, remove the left-hand fairing side panel (see Chapter 7). Trace the lead from the top of the starter motor to the starter relay, removing the seat cowl as required by your model.

7 Disconnect the relay wiring connectors, displacing the relay from its mount to access them if required (see illustrations 26.2a and b). Lift the rubber terminal covers, then unscrew the two nuts securing the starter motor and battery leads to the relay and detach the leads, noting which fits where. Remove the relay with its rubber sleeve from its mounting lug on the frame.

8 Installation is the reverse of removal. Make sure the terminal nuts are securely tightened. Connect the negative (-ve) lead last when reconnecting the battery.

### 27 Starter motor - removal and installation

#### Removal

1 Remove the seat(s), and on Daytona and Sprint models the left-hand fairing side panel, then on Sprint ST remove the belly pan (see Chapter 7). Disconnect the battery negative (-ve) lead. The starter motor is mounted on the crankcase, behind the cylinder block. Drain the cooling system (see Chapter 1).

2 Slacken the clamp securing the coolant hose to the inlet union on the engine and detach the hose (see illustration). Undo the screws securing the union and remove it (see illustration). Discard the gasket as a new one must be used.

3 Peel back the rubber terminal cover and unscrew the nut securing the lead to the starter motor (see illustration). Detach the lead.

4 Unscrew the two bolts securing the starter motor bolt (see illustration). Draw the starter motor out of the crankcase and remove it (see illustration).



**27.4b ... and remove the starter motor**

## 8•18 Electrical system



27.6 Fit a new O-ring and smear it with grease

5 Remove the O-ring on the end of the starter motor and discard it as a new one must be used.

### Installation

6 Fit a new O-ring onto the end of the starter motor, making sure it is seated in its groove, and smear it with grease (see illustration).

7 Manoeuvre the motor into position and slide it into the crankcase (see illustration 27.4b). Ensure that the starter motor teeth mesh correctly with those of the starter idle/reduction gear. Install the mounting bolts and tighten them to the torque setting specified at the beginning of the Chapter (see illustration 27.4a).

8 Connect the lead to the starter motor and secure it with the nut (see illustration). Make sure the rubber cover is correctly seated over the terminal.

9 Remove all traces of old gasket from the mating surfaces of the coolant union and the engine. Install the union using a new gasket smeared on both sides with a suitable sealant, and tighten the screws to the specified torque setting (see illustration). Fit the hose onto the union and tighten the clamp to secure it (see illustration 27.2a).

10 Fill the cooling system (see Chapter 1). Connect the battery negative (-ve) lead and install the seat(s) and fairing panels (see Chapter 7).



28.3 Unscrew the two long bolts, noting the O-rings fitted on them



27.8 Secure the lead with the nut and fit the rubber boot

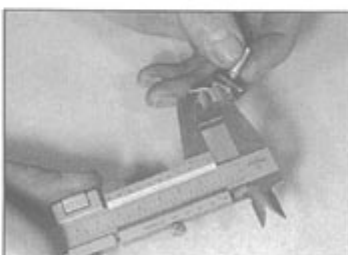
### 28 Starter motor – disassembly, inspection and reassembly

#### Disassembly

- 1 Remove the starter motor (see Section 27).
- 2 Make some alignment marks between the housing and both end covers.
- 3 Unscrew the two long bolts, then remove the rear cover from the motor, noting how it locates (see illustration). Discard the O-ring as a new one should be used.
- 4 Wrap insulating tape around the teeth of the starter motor gear – this will protect the oil seal from damage as the front cover is removed. Remove the front cover from the motor along with its O-ring, and discard the O-ring.
- 5 Withdraw the armature from the housing.
- 6 Unscrew the nut from the terminal bolt and remove the insulating washer and the O-ring (see illustrations 28.14d, c and b). Withdraw the terminal bolt and brushplate assembly from the housing (see illustration 28.14a).
- 7 Lift the brush springs and slide the brushes out from their holders.

#### Inspection

**Note:** No replacement parts are available from Triumph for the starter motor. If the following checks indicate a worn or faulty internal component, seek the advice of a Triumph dealer or auto electrical specialist before buying a new starter motor.



28.8 Measuring brush length – replace brushes if they are worn beyond service limit



27.9 Install the union using a new gasket

8 The parts of the starter motor that are most likely to wear are the brushes. Measure the length of the brushes and compare the results to the service limit in this Chapter's Specifications (see illustration). If the brushes are not worn excessively, nor cracked, chipped, or otherwise damaged, they may be re-used.

9 Inspect the commutator for scoring, scratches and discoloration. The commutator can be cleaned and polished with crocus cloth, but do not use sandpaper or emery paper. After cleaning, wipe away any residue with a cloth soaked in electrical system cleaner or denatured alcohol.

10 Using an ohmmeter or a continuity test light, check for continuity between the commutator bars (see illustration). Continuity should exist between each bar and all of the others. Also, check for continuity between the commutator bars and the armature shaft. There should be no continuity (infinite resistance) between the commutator and the shaft. If the checks indicate otherwise, the armature is defective.

11 Check for continuity between the brushplate brush and the brushplate itself, and between the terminal bolt brush and the terminal bolt itself. There should be continuity in both cases.

12 Check the starter gear for worn, cracked, chipped and broken teeth. If the gear is damaged or worn, renew the starter motor.

13 Inspect the end covers for signs of cracks or wear. Inspect the magnets in the main housing and the housing itself for cracks.



28.10 Inspect the commutator segments for wear and test as described in the text



28.14a Install the terminal bolt ...



28.14b ... then fit the O-ring ...



28.14c ... the insulating washer ...

### Reassembly

14 Ensure that the rubber insulating seat is in place on the terminal bolt, then insert the bolt through the rear cover (see illustration). Fit the O-ring and the insulating washer and secure them in place with the nut (see illustrations).

15 Lift the brush springs on the brushplate and slide the brushes back into position in their holders, then install the brushplate assembly in the rear cover making sure its tab is correctly located in the slot in the cover (see illustration). Make sure the O-ring is fitted to the cover.

16 Insert the armature into the rear end cover taking care not to damage the brushes (see illustration). As it is inserted, locate the brushes on the commutator bars. Check that each brush is securely pressed against the commutator by its spring and is free to move easily in its holder.



28.16 Fit the armature into the rear cover ...



28.17b ... aligning the marks made on removal (arrowed)



28.14d ... and the terminal nut

17 Fit the main housing over the armature, aligning the marks made on removal (see illustrations).

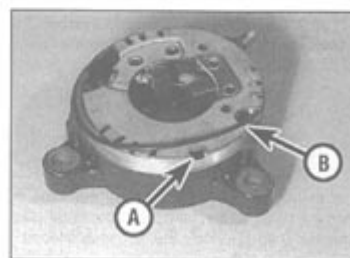
18 Fit the O-ring to the front end cover and carefully slide the cover into position, aligning



28.17a ... and fit the main housing over the armature ...



28.18 Fit the front cover, again aligning the marks made on removal (arrowed)



28.15 Align the brushplate tab with the slot in the cover (A) and fit the cover O-ring (B)

the marks made on removal (see illustration). Remove any protective tape from the gear teeth.

19 Check the marks made on removal are correctly aligned then fit the long bolts and tighten them securely (see illustration 28.3).

20 Install the starter motor (see Section 27).

### 29 Charging system testing - general information and precautions

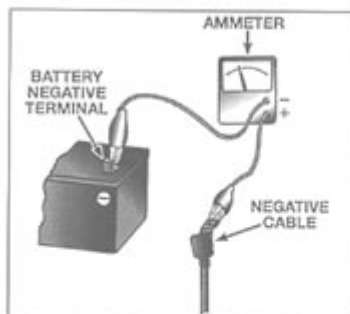
1 If the performance of the charging system is suspect, the system as a whole should be checked first, followed by testing of the individual components. **Note:** Before beginning the checks, make sure the battery is fully charged and that all system connections are clean and tight.

2 Checking the output of the charging system and the performance of the various components within the charging system requires the use of a multimeter (with voltage, current and resistance checking facilities), though a simple voltmeter will at least be able to tell what if any voltage is being put out.

3 When making the checks, follow the procedures carefully to prevent incorrect connections or short circuits, as irreparable damage to electrical system components may result if short circuits occur.

4 If a multimeter is not available, the job of checking the charging system should be left to a Triumph dealer or automotive electrician.

## 8•20 Electrical system



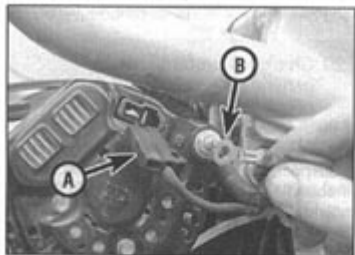
30.3 Checking the charging system leakage rate – connect the ammeter as shown

### 30 Charging system – leakage and output test

1 If the charging system of the machine is thought to be faulty, remove the seat(s) (see Chapter 7) and perform the following checks.

#### Leakage test

**Caution:** Always connect an ammeter in series, never in parallel with the battery, otherwise it will be damaged. Do not turn the ignition ON or operate the starter motor when the ammeter is connected – a sudden surge in current will blow the meter's fuse.



31.3 Disconnect the wiring connector (A) and the earth lead (B)



31.4b ... and remove the alternator

2 Turn the ignition switch OFF and disconnect the lead from the battery negative (-ve) terminal.

3 Set the multimeter to the Amps function and connect its negative (-ve) probe to the battery negative (-ve) terminal, and positive (+ve) probe to the disconnected negative (-ve) lead (see illustration). Always set the meter to a high amps range initially and then bring it down to the mA (milli Amps) range; if there is a high current flow in the circuit it may blow the meter's fuse.

4 No current flow should be indicated. If current leakage is indicated (generally greater than 0.1 mA), there is a short circuit in the wiring. Using the wiring diagrams at the end of this Chapter, systematically disconnect individual electrical components, checking the meter each time until the source is identified.

5 If no leakage is indicated, disconnect the meter and connect the negative (-ve) lead to the battery, tightening it securely.

#### Output test

6 Start the engine and warm it up to normal operating temperature.

7 To check the regulated voltage output, allow the engine to idle and connect a multimeter set to the 0 to 20 volts DC scale (voltmeter) across the terminals of the battery (positive (+ve) lead to battery positive (+ve) terminal, negative (-ve) lead to battery negative (-ve) terminal). Slowly increase the engine speed briefly to around 5000 rpm and note the reading obtained. Triumph provide no data on the specific output of their charging system, but the regulated voltage should be around 13.5 to 15.0 V. If the voltage

is outside these limits, check the alternator/regulator/rectifier (see Section 31).



**Clues to a faulty regulator are constantly blowing bulbs, with brightness varying considerably with engine speed, and battery overheating.**

### 31 Alternator/regulator/rectifier – check, removal and installation

#### Removal

1 Remove the seat(s), and on Daytona and Sprint models the left-hand fairing side panel, then on Sprint ST remove the belly pan (see Chapter 7). Disconnect the battery negative (-ve) lead. The starter motor is mounted on the crankcase, behind the cylinder block.

2 Drain the cooling system (see Chapter 1). Slacken the clamp securing the coolant hose to the inlet union on the engine and detach the hose (see illustration 27.2a).

3 Disconnect the alternator wiring connector, then pull the rubber boot off the earth terminal, unscrew the nut and detach the earth lead (see illustration).

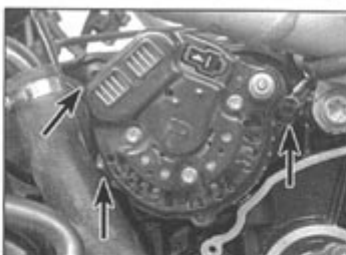
4 Unscrew the three alternator mounting bolts, noting the earth lead(s) secured by the rear bolt (see illustration). Withdraw the alternator from the engine, leaving the shock absorber rubbers in the driveshaft housing (see illustration). Discard the alternator O-ring as a new one should be used.

#### Testing

**Note:** No replacement parts are available from Triumph for the alternator. If the following checks indicate a worn or faulty internal component, seek the advice of a Triumph dealer or auto electrical specialist before buying a new alternator.

5 The following checks can be made without removing the alternator from the engine, although the alternator wiring must first be disconnected as described in Step 3.

6 Undo the three screws securing the alternator end cover, and the nut on the earth terminal, noting the sleeve, and remove the cover (see illustrations).



31.4a Unscrew the bolts (arrowed) ...

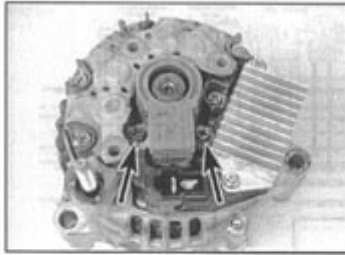


31.6a Remove the terminal nut and sleeve, then undo the screws (arrowed) ...



31.6b ... and remove the cover

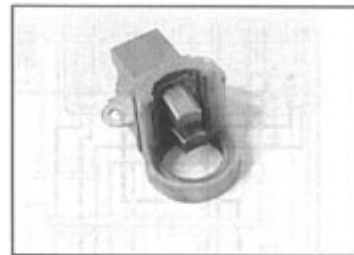




31.7a Undo the screws (arrowed) ...



31.7b ... and remove the brush holder



31.7c Check the length and condition of the brushes as described

7 Remove the two screws securing the brush holder and remove the holder, noting how the brushes locate (see illustrations). Inspect the holder for any signs of damage. Measure the brush lengths (i.e. the amount of brush extending from the holder) (see illustration). Triumph provide no minimum length specification, but generally on this type of alternator around 4.0 to 5.0 mm is common.

8 Whilst the brush holder is removed, clean the slip rings with a rag moistened with solvent (see illustration). If they are badly marked, tidy them up with very fine emery cloth.

9 Triumph provide no test data for the regulator and rectifier, which are integral with the alternator. If the charging system tests in the previous section indicate a fault, take the unit to a Triumph dealer for further assessment.

10 Check the condition of the rubber dampers in the drive housing and renew them if they are hardened, compacted or damaged.

11 Further testing of the alternator components should be left to a Triumph

dealer or auto electrician. This also applies to removal of the rotor and bearing renewal.

#### Installation

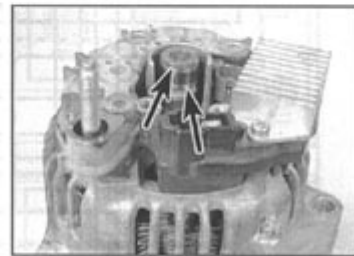
12 If not already done, install the brush holder, making sure the brushes locate correctly against the slip rings, and secure it with the screws (see illustrations 31.7b and a). Fit the end cover and secure it with the three screws, then fit the sleeve and terminal nut (see illustration 31.8b and a).

13 If removed, fit the rubber dampers into the housing, using a smear of grease to secure them in place if necessary (see illustration).

14 Fit a new O-ring onto the alternator and smear it with oil (see illustration).

15 Install the alternator and fit the mounting bolts (see illustration 31.4b), not forgetting to connect the earth lead(s) with the rear bolt (see illustration). Tighten the bolts to the torque setting specified at the beginning of the Chapter.

16 Fit the hose onto the union and tighten the clamp to secure it (see illustration 27.2a). Fill the cooling system (see Chapter 1).



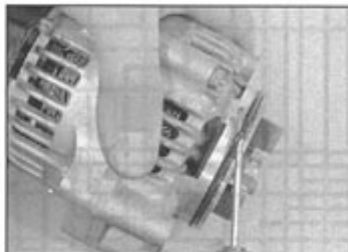
31.8 Check the condition of the slip rings (arrowed) and clean them up if necessary

17 Reconnect the alternator wiring connector, then attach the earth lead and secure it with the nut (see illustration 31.3). Fit the rubber boot over the terminal.

18 Connect the battery negative (-ve) lead and install the seat(s), and on Daytona and Sprint models the fairing panels (see Chapter 7).



31.13 Fit the rubber dampers into the housing

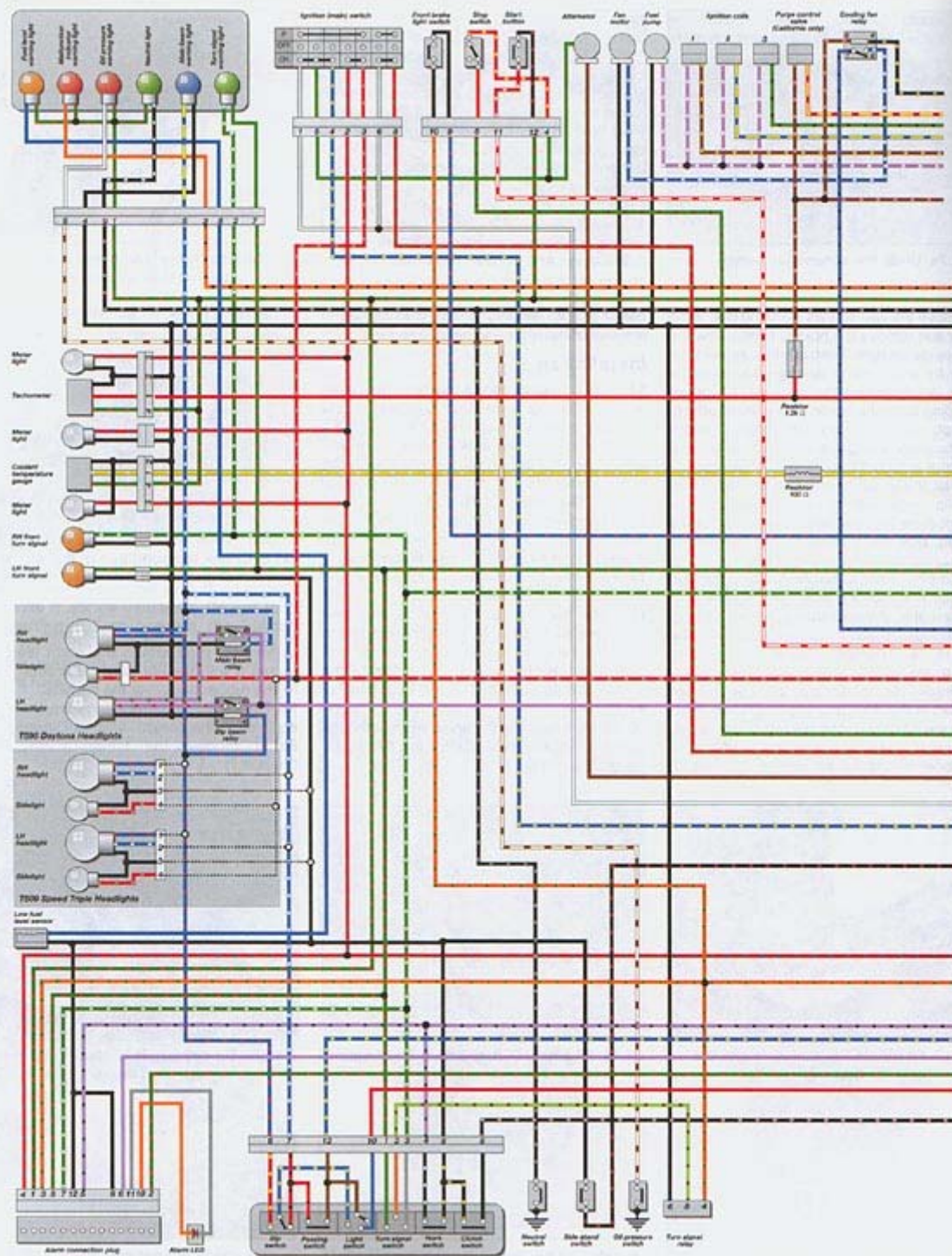


31.14 Fit a new O-ring onto the alternator



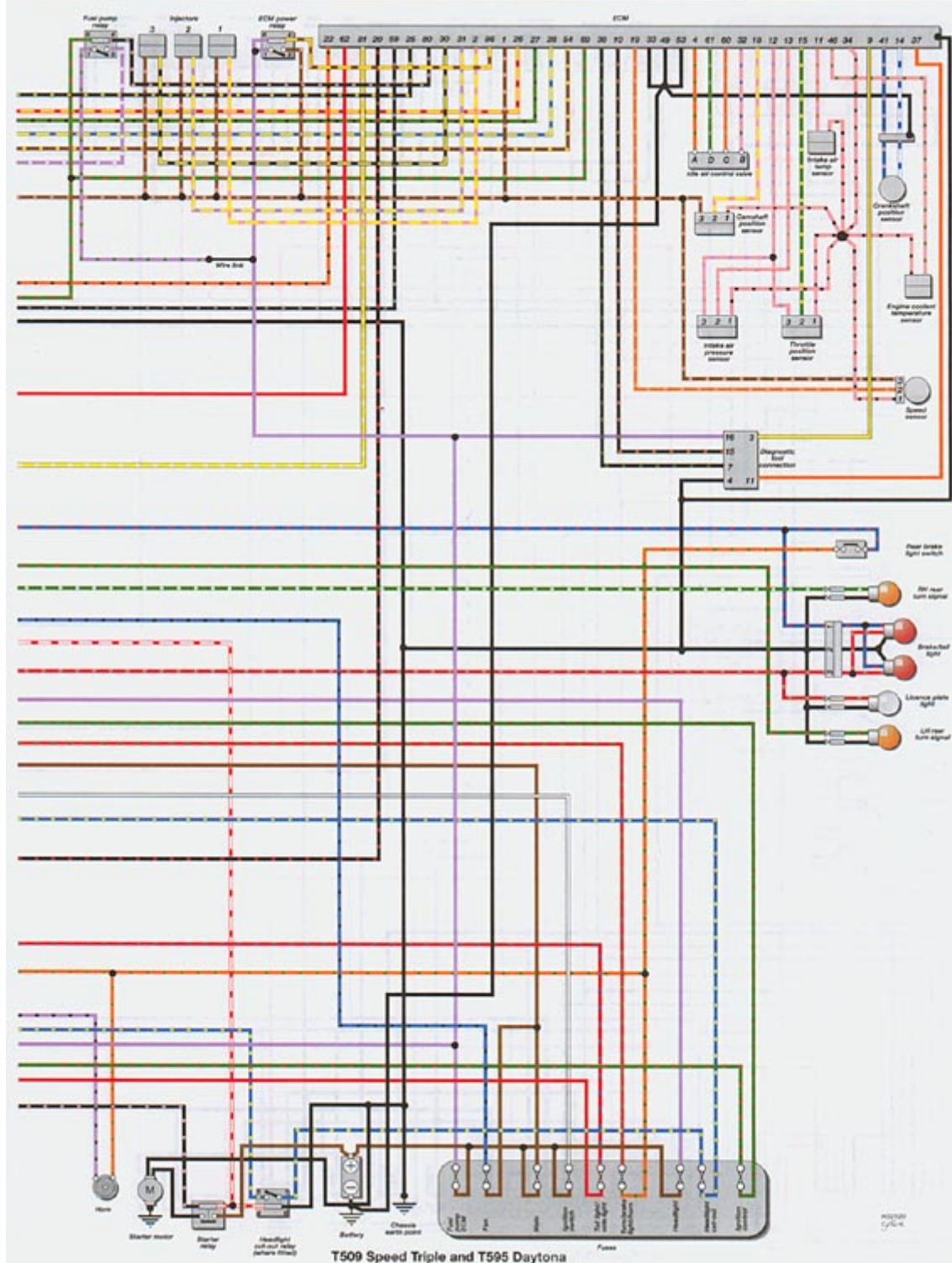
31.15 Do not forget to secure the earth lead(s) with the rear bolt

## 8•22 Electrical system

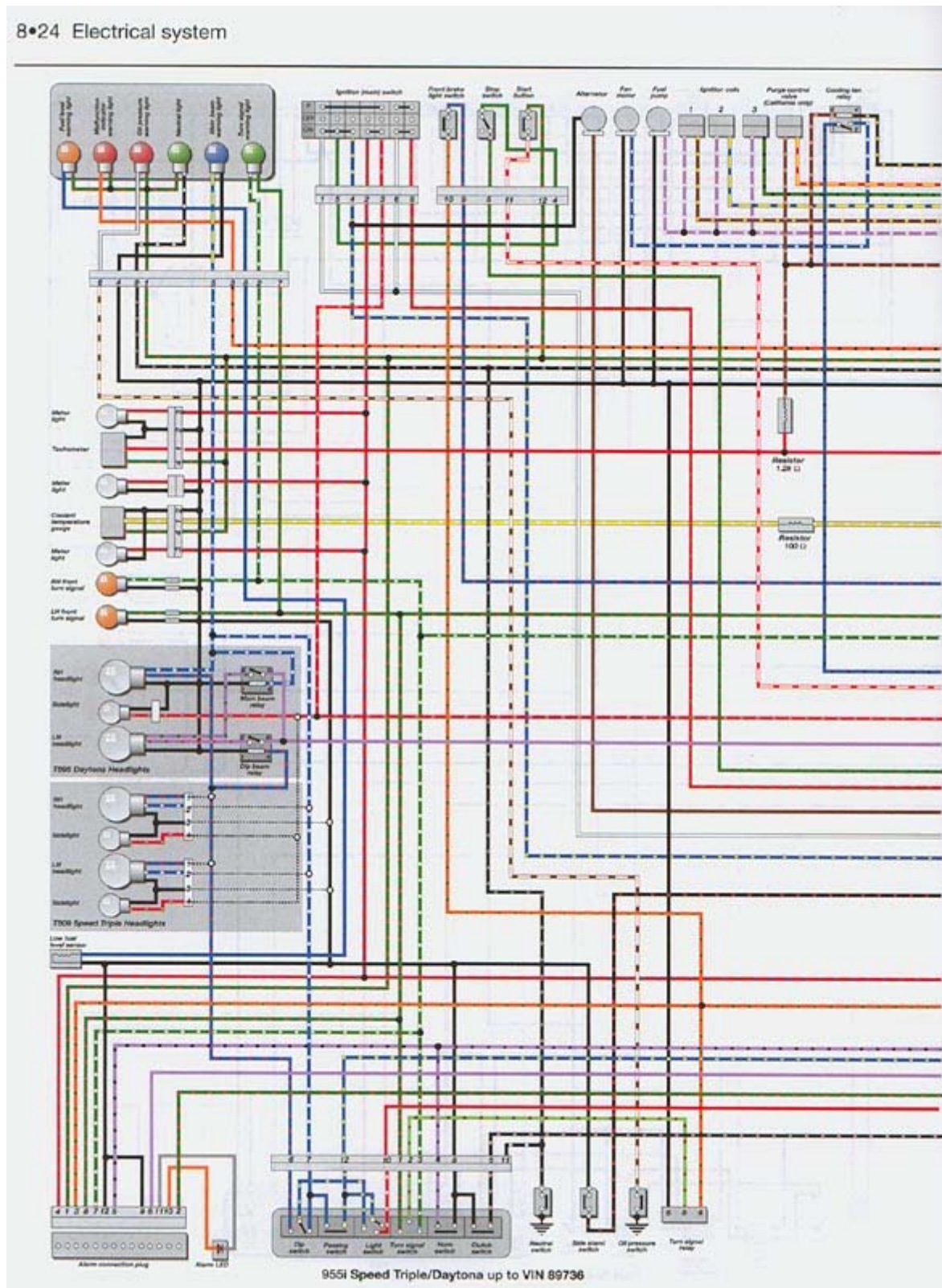


### T609 Speed Triple and T595 Daytona

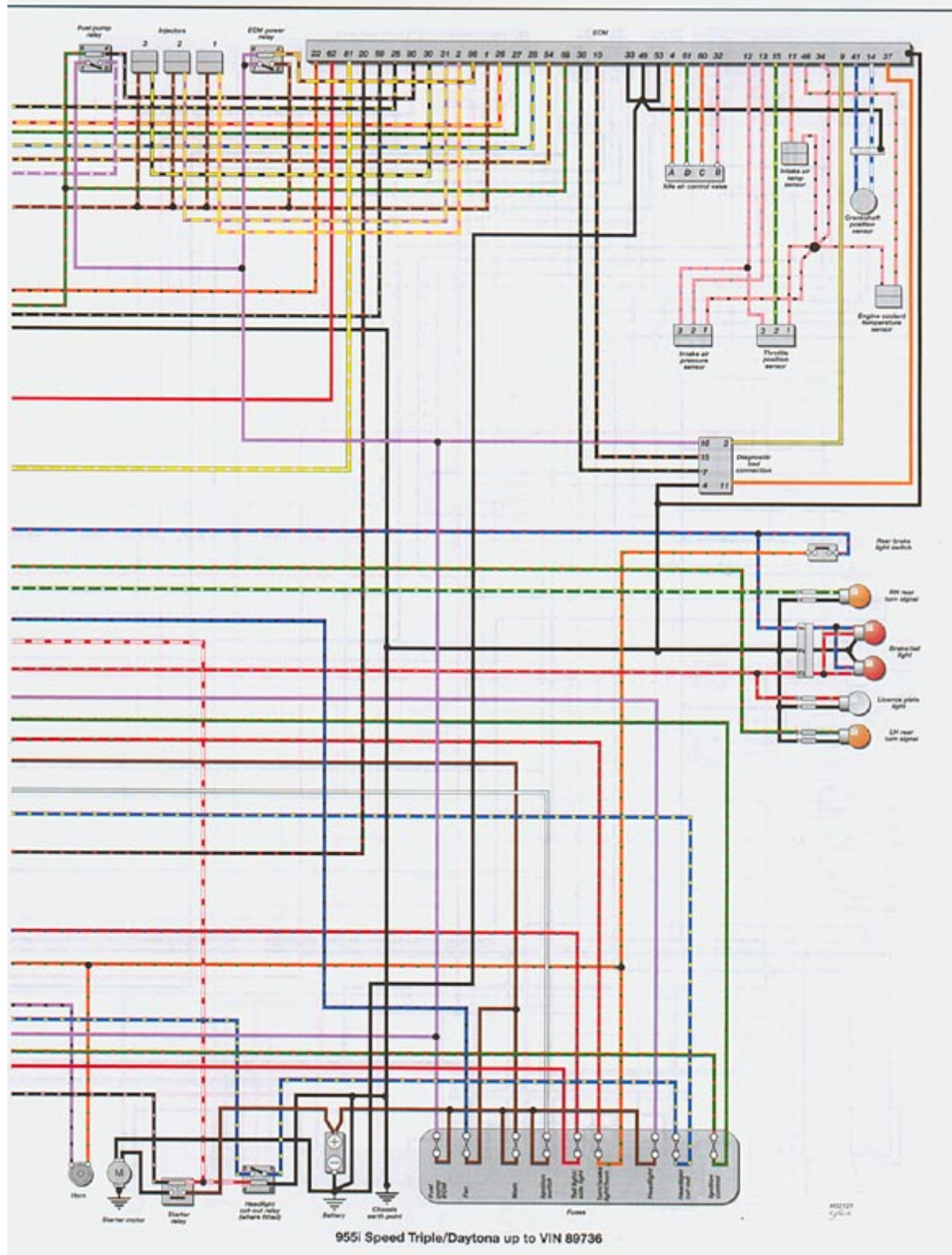




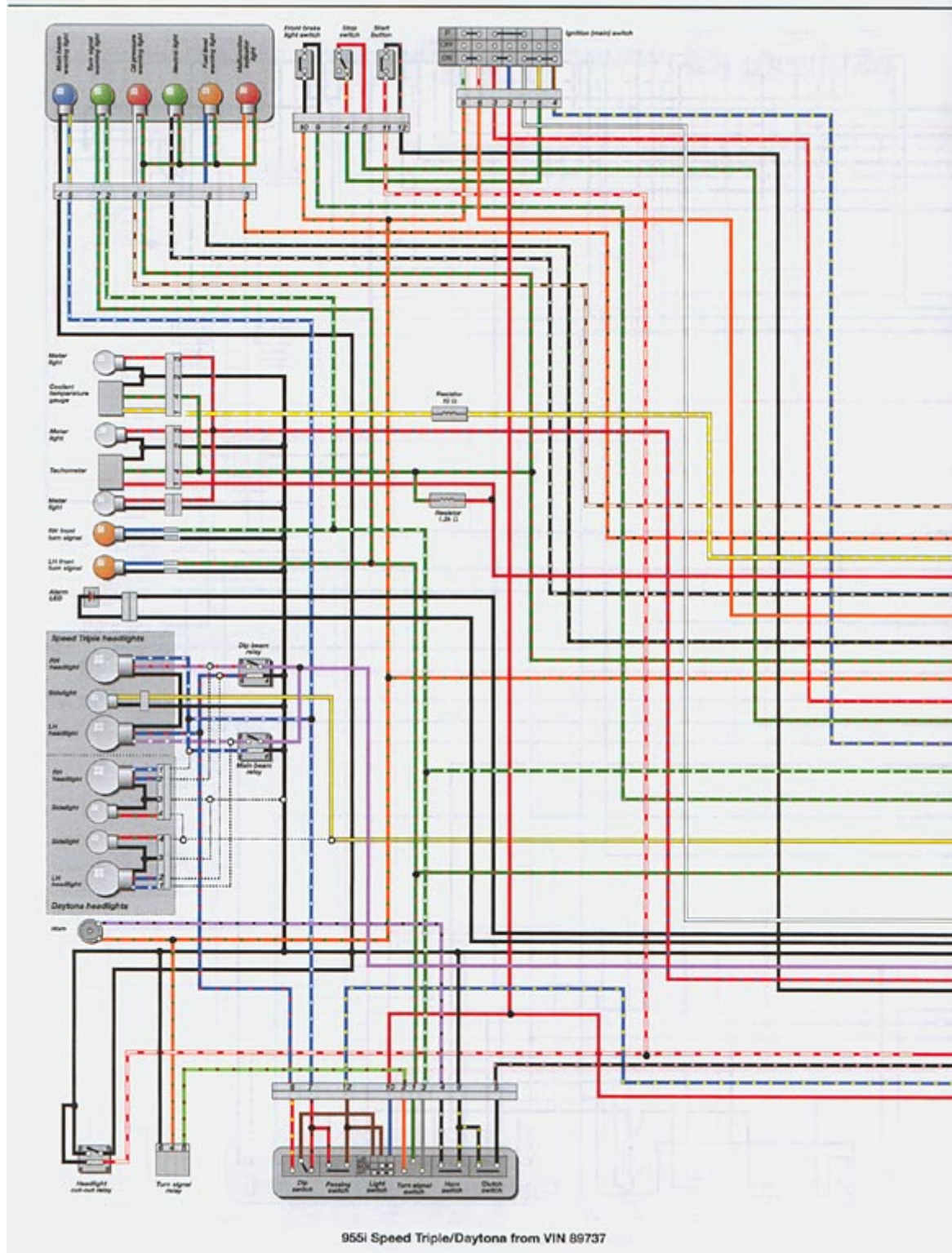
# 8•24 Electrical system



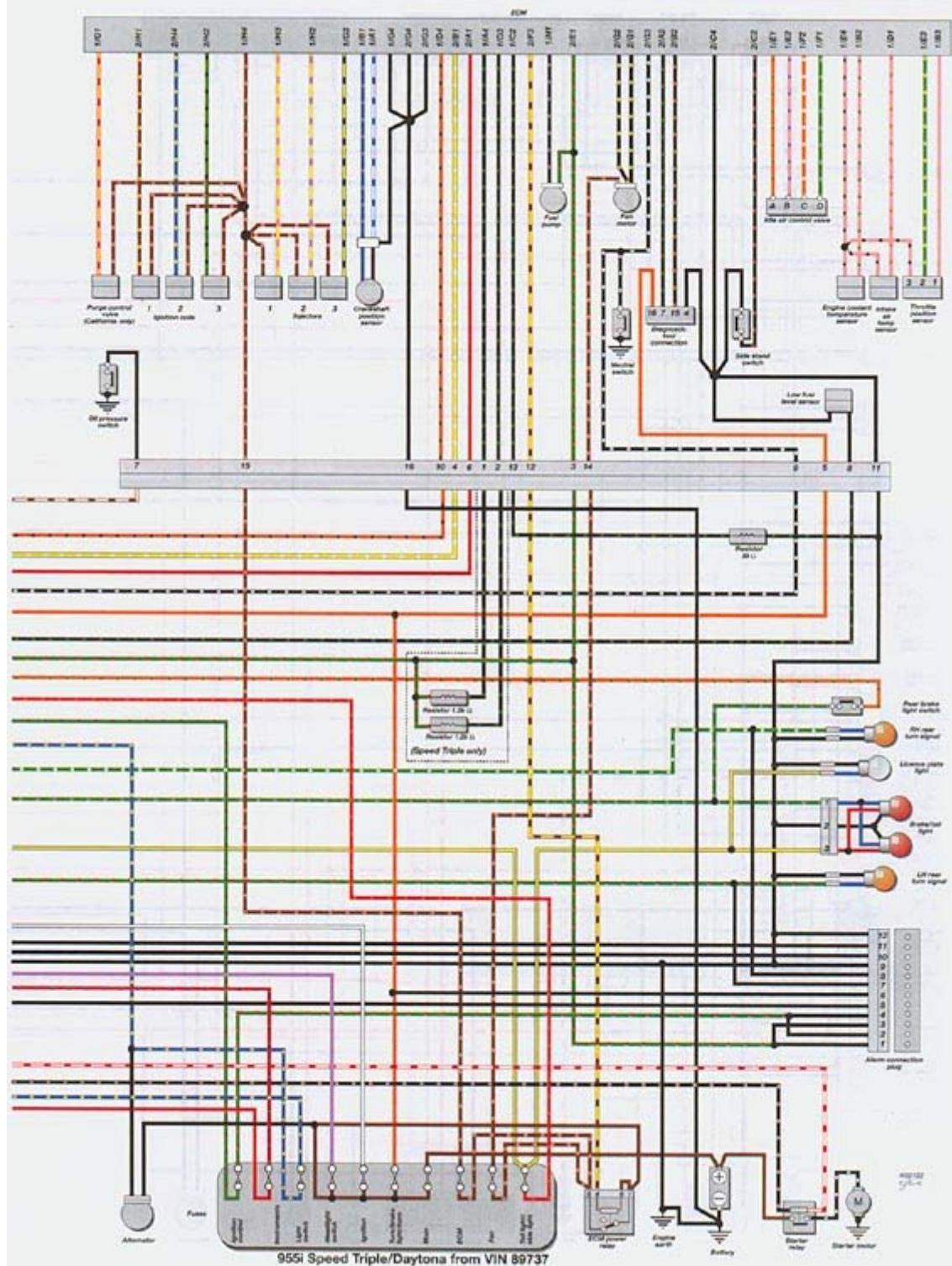




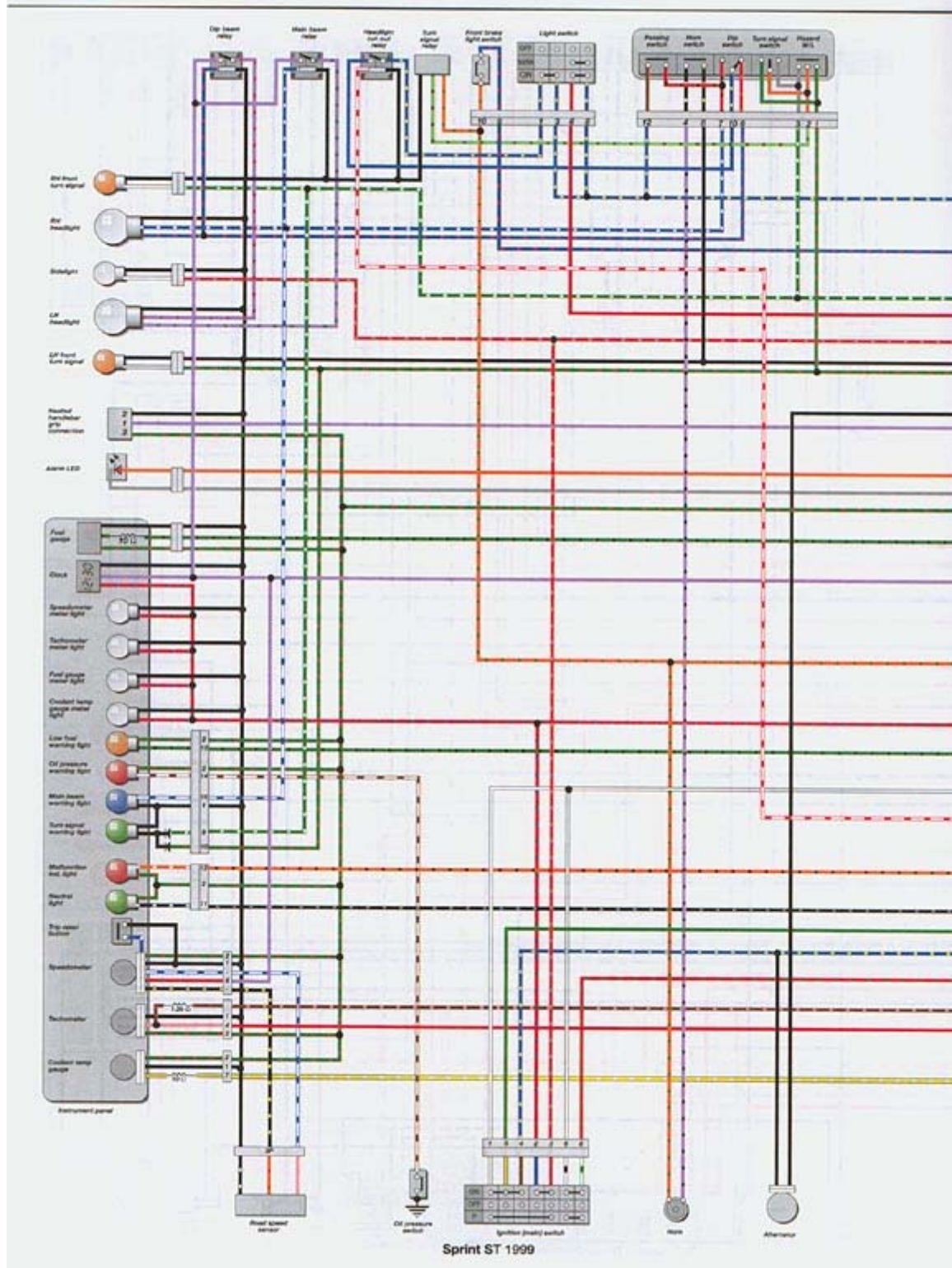
# 8•26 Electrical system



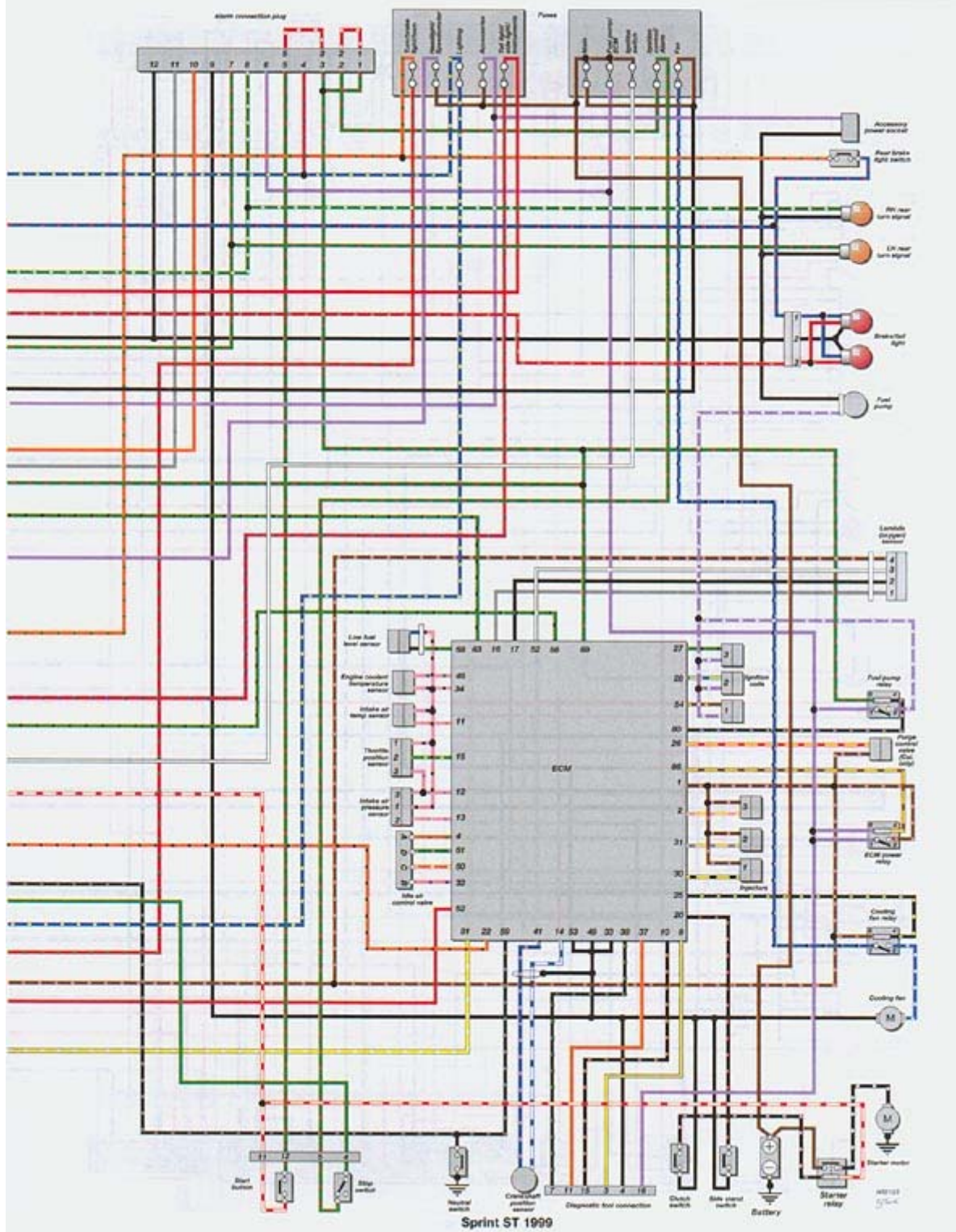




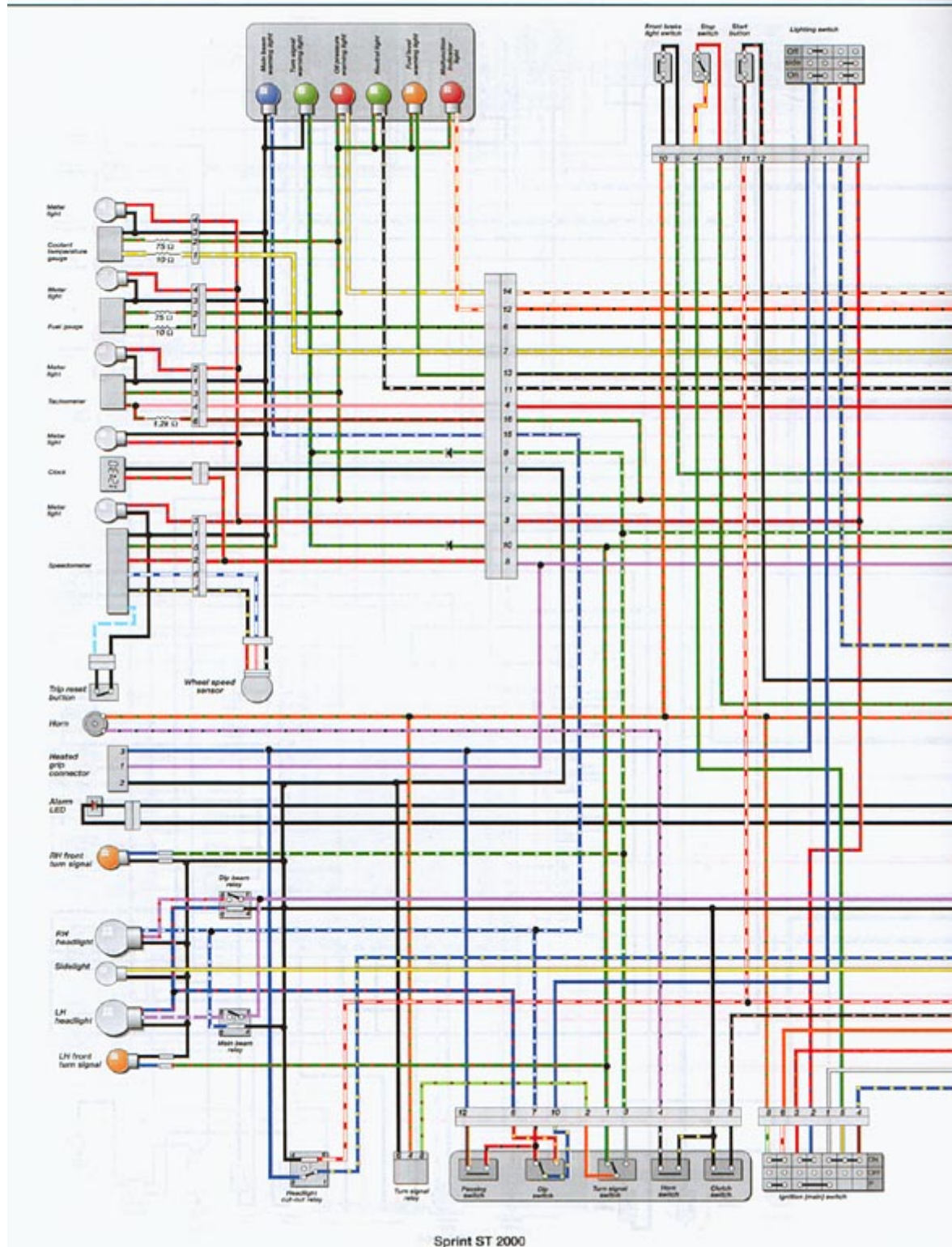
# 8•28 Electrical system



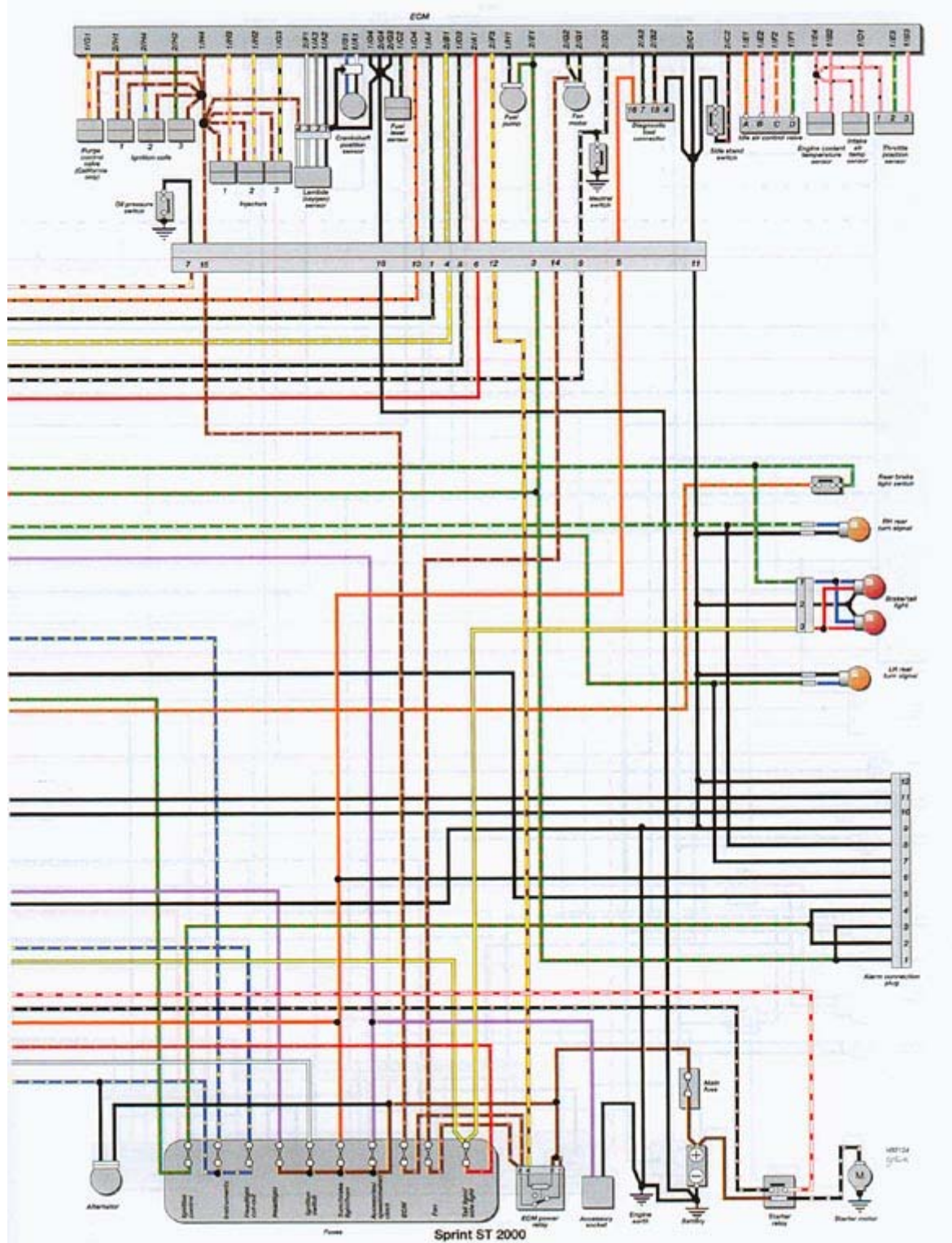




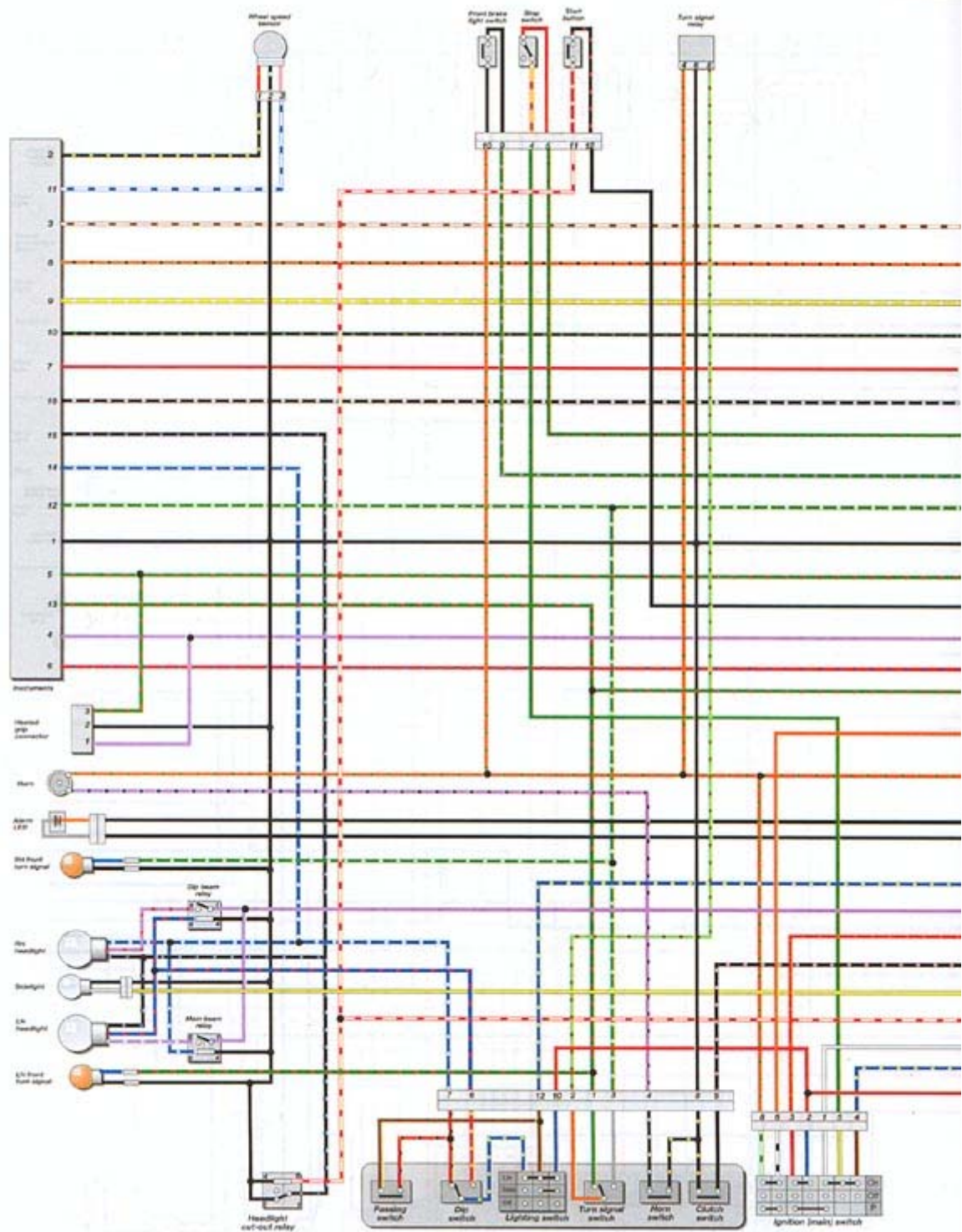
# 8•30 Electrical system





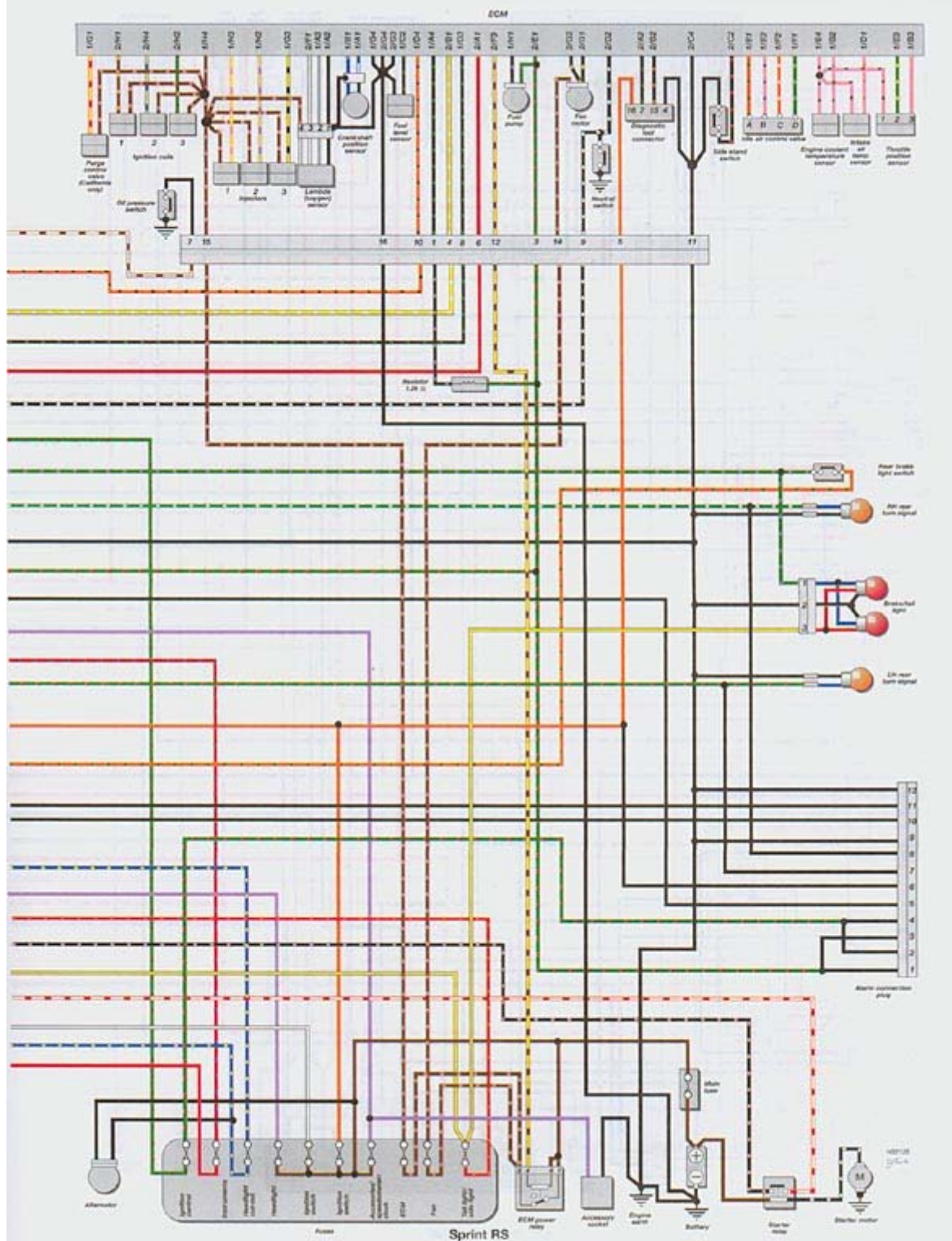


# 8•32 Electrical system

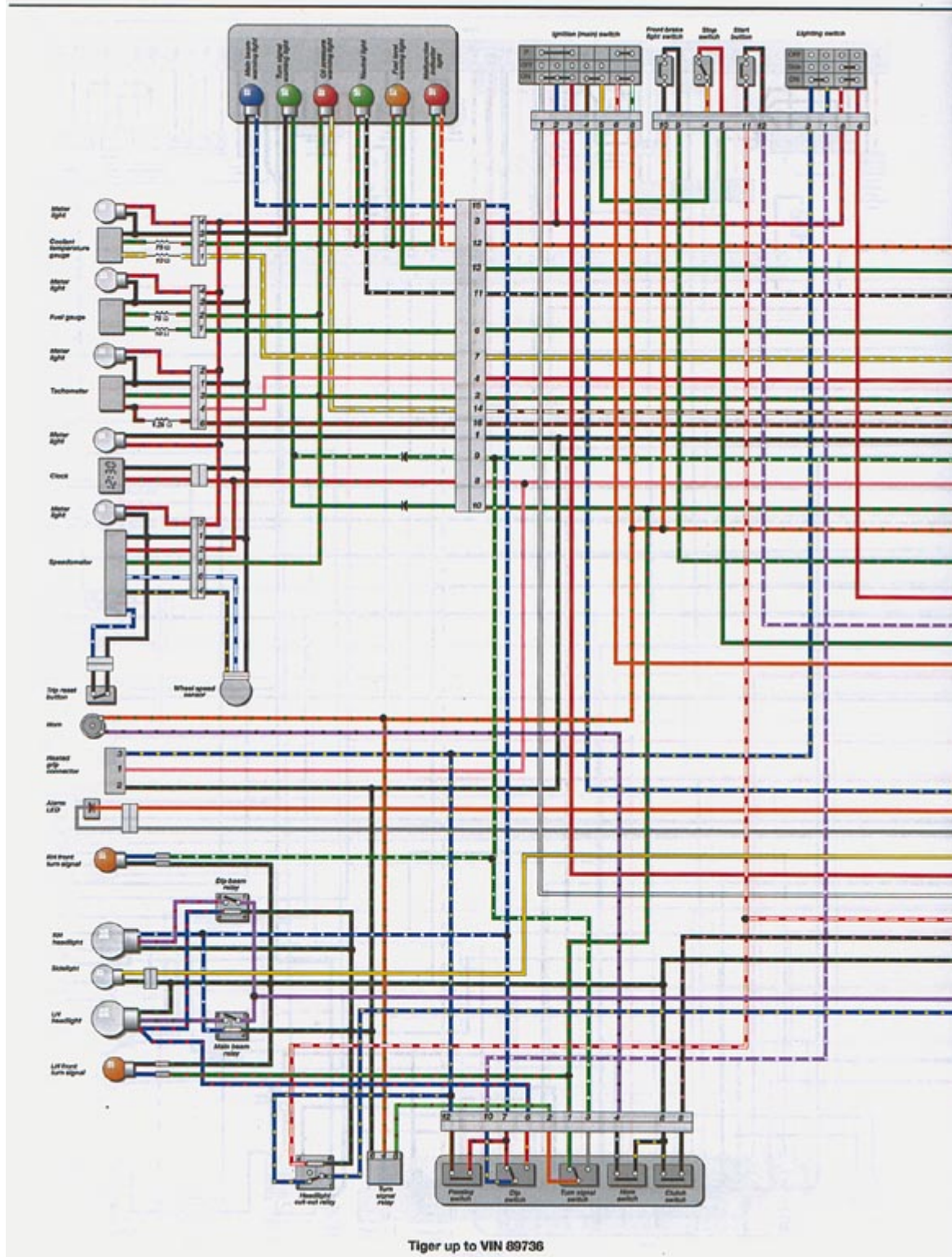


Sprint RS

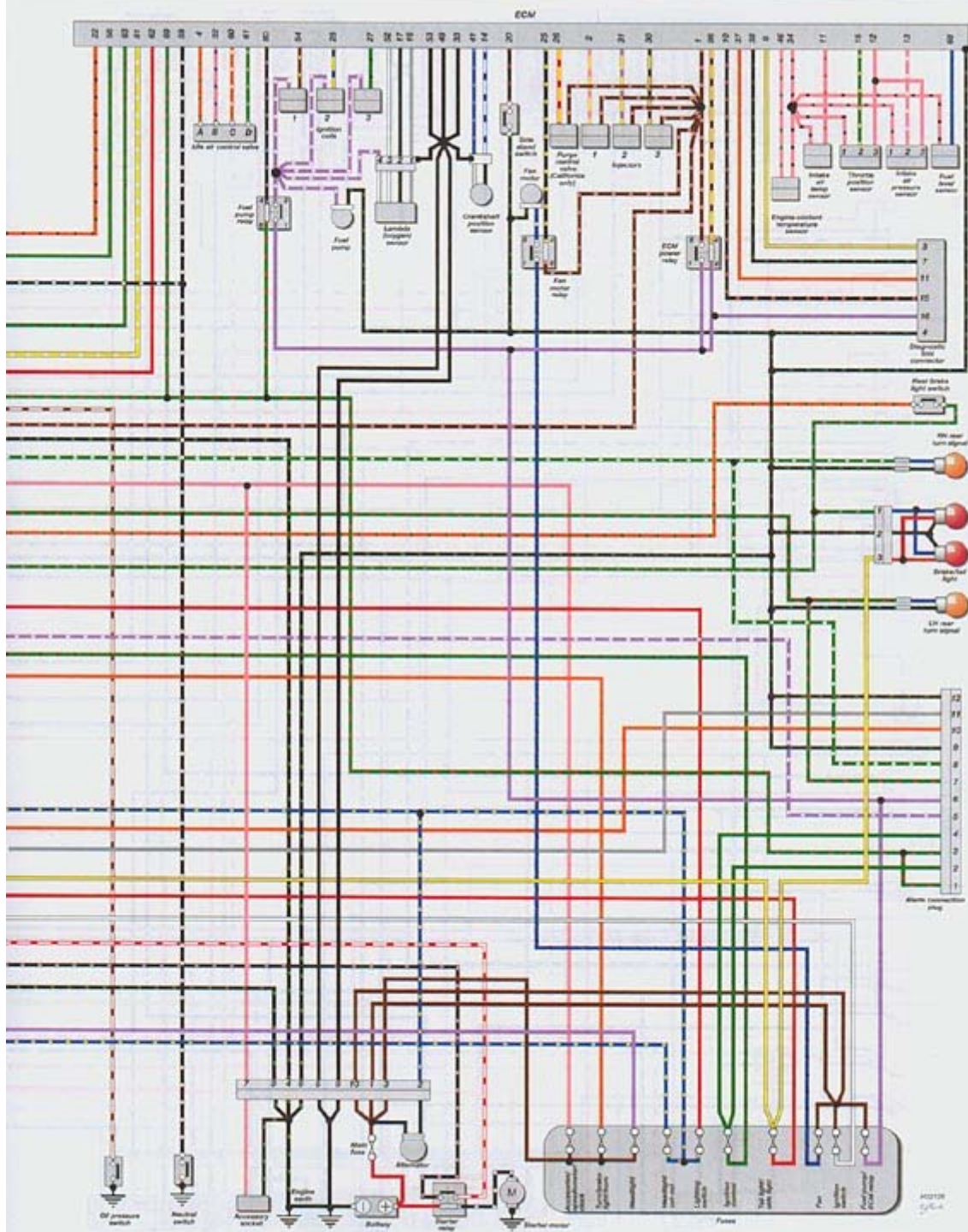




# 8•34 Electrical system

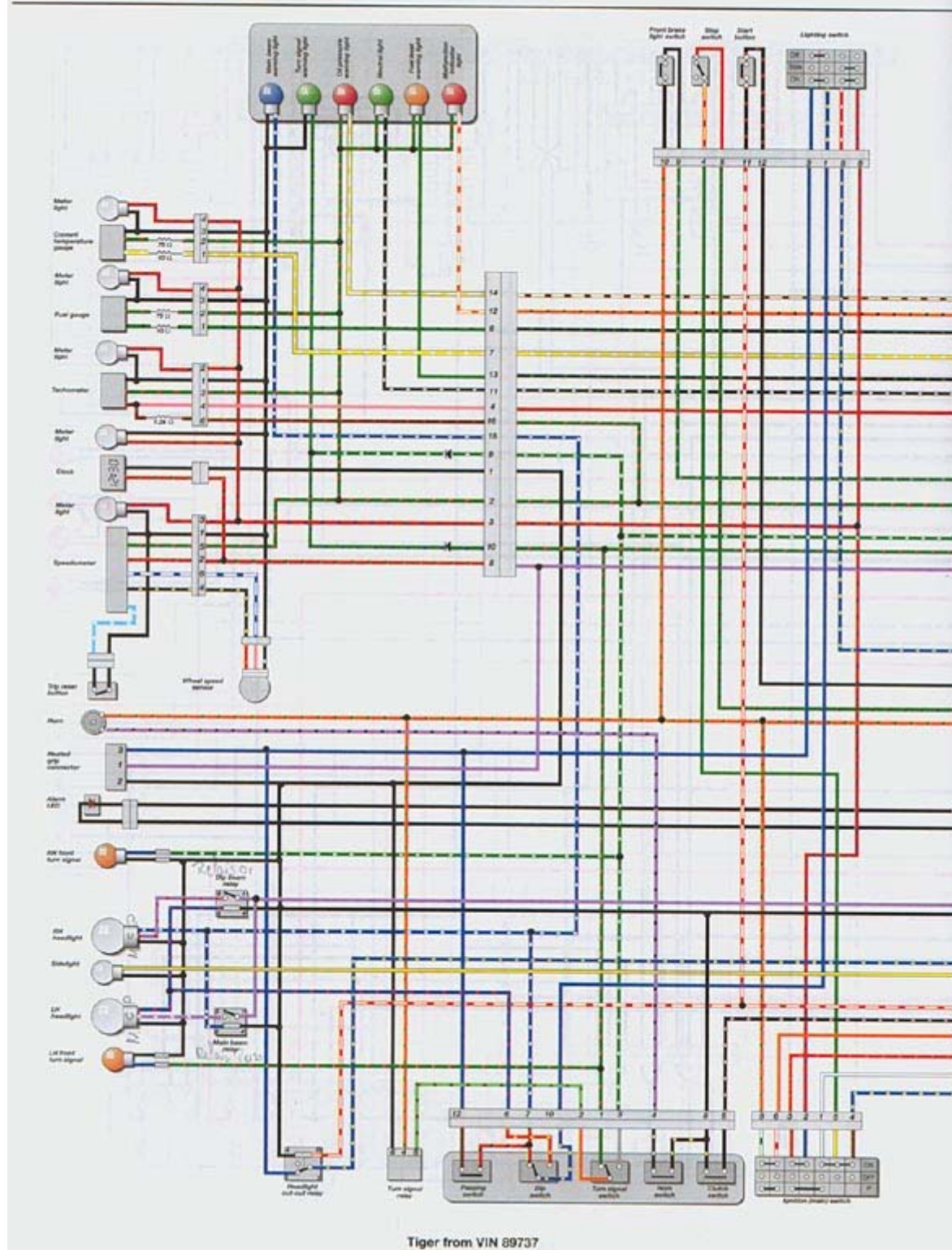






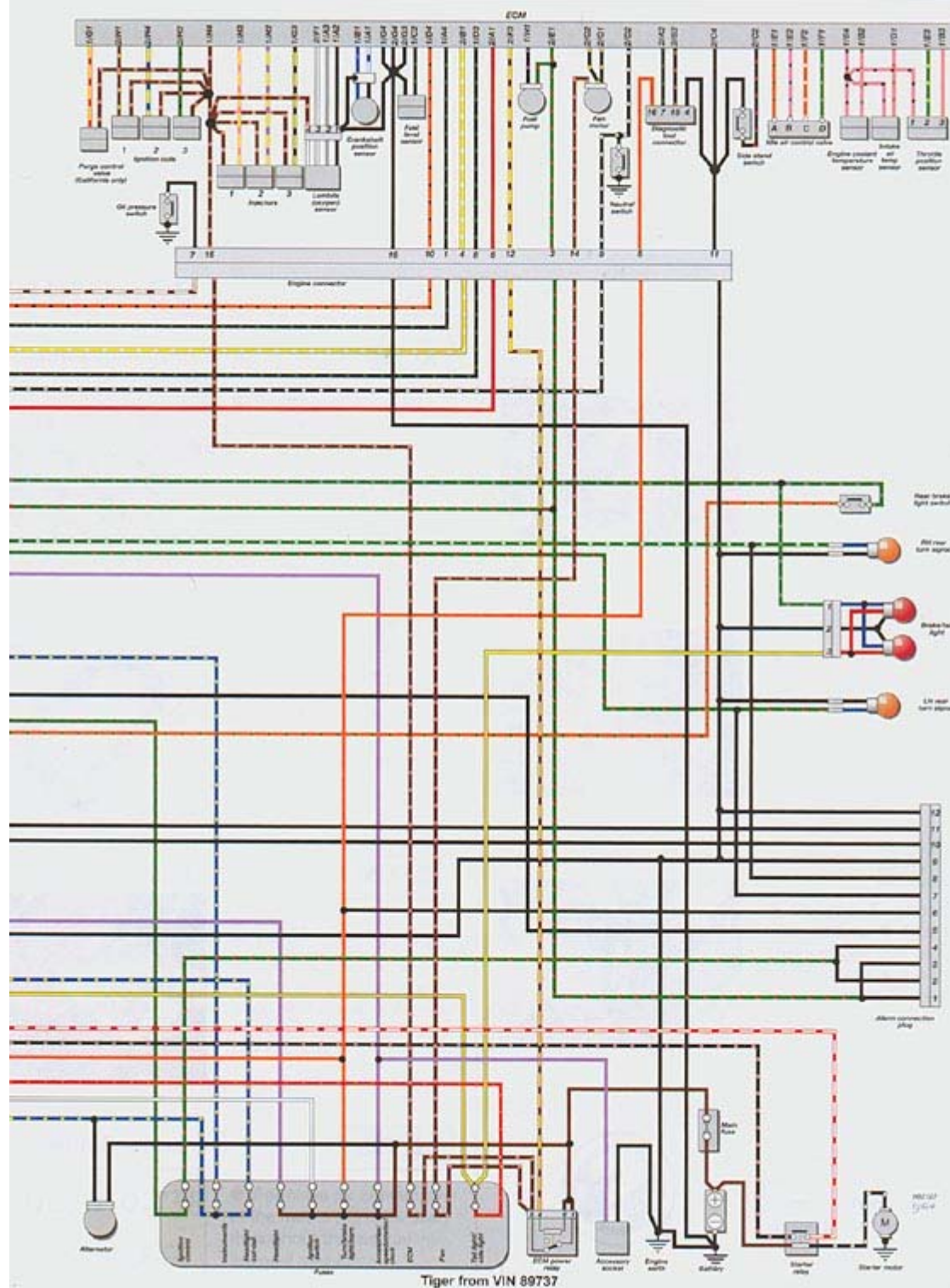
Tiger up to VIN 89736

# 8•36 Electrical system



Tiger from VIN 89737





# Dictionnaire technique

— Anglais-Français —

4-star

super plombé

## A

abdc

après point mort  
bas

ABS braking device

antiblocage des  
roues (ABR)

absorber

amortisseur

ac generator

générateur de  
courant alternatif  
(c.a.)

accelerator

accélérateur

accelerator cable

câble d'accélérateur

accelerator pedal

pédale  
d'accélérateur

accelerator pump

pompe de reprise

accumulator

accumulateur

acid

acide

acid level

niveau  
d'électrolyte  
(batterie)

acorn nut/cap nut

écrou borgne

adapter

adaptateur

adhesion

adhérence

adjust (v)

régler, ajuster (v)

adjustable spanner

clé à molette

adjuster

dispositif/vis de  
réglage

adjuster strut

bielle de  
rattrapage

adjustment bolt

vis de réglage

adjustment ferrule

virole de réglage

adjustment link

bielle de réglage

adjustment rod

tige de réglage

advance ignition

avance à

l'allumage

aerial

antenne

aerodynamic drag

coefficient de

factor

traînée

air adjusting screw

vis d'admission  
d'air

air bleed valve

vis de purge d'air

air chamber

réservoir d'air

air cleaner

filtre à air

air compressor

compresseur de  
frein

air conditioning

climatisation

air conditioning

bloc de commande

control unit

de climatisation

air control

réglage d'air

air cooling

refroidissement  
d'air

air correction jet

gicleur d'air  
d'automatisme

air deflector

défecteur d'air

air distribution

répartiteur de débit  
d'air

switch

air filter

filtre à air

air flap valve

clapet d'air

air flow sensor

sonde de débit d'air,  
débitmètre d'air

air funnel

canal d'air

|                             |                     |                             |                     |
|-----------------------------|---------------------|-----------------------------|---------------------|
| <b>air leak</b>             | prise d'air         | <b>armature winding</b>     | enroulement         |
| <b>air resistance</b>       | résistance          |                             | rotorique/d'induit  |
|                             | aérodynamique       | <b>asbestos</b>             | amiante             |
| <b>air temperature</b>      | régulateur de       | <b>atdc</b>                 | ApPMH               |
| <b>control system</b>       | température d'air   | <b>automatic adjustment</b> | mécanisme de        |
| <b>air temperature</b>      | sonde de            | <b>mechanism</b>            | raitrappage         |
| <b>sensor</b>               | température d'air   |                             | automatique         |
| <b>airbag</b>               | coussin gonflable,  | <b>automatic advance</b>    | avance variable     |
|                             | airbag              |                             | automatique,        |
| <b>airflow meter</b>        | débitmètre d'air    |                             | avance centrifuge   |
| <b>airflow sensor plate</b> | disque capteur      | <b>automatic</b>            | crépine de boîte de |
|                             | (de débit d'air)    | <b>transmission filter</b>  | vitesse             |
| <b>alcohol-based fuels</b>  | carburants à base   |                             | automatique         |
|                             | d'alcool            | <b>auxiliary air valve</b>  | électrovanne d'air  |
| <b>Allen key</b>            | clé Allen           |                             | auxiliaire          |
| <b>Allen screw</b>          | vis Allen           | <b>auxiliary shaft</b>      | arbre intermédiaire |
| <b>alloy</b>                | alliage             | <b>axle</b>                 | essieu              |
| <b>alternating current</b>  | courant alternatif  | <b>axle stands</b>          | chandelles          |
| <b>(ac)</b>                 | (c.a.)              |                             |                     |
| <b>alternator</b>           | alternateur         |                             |                     |
| <b>alternator pulley</b>    | poulie              |                             |                     |
|                             | d'alternateur       | <b>B</b>                    |                     |
| <b>ammeter</b>              | ampèremètre         | <b>backlash</b>             | jeu                 |
| <b>analogue clock</b>       | montre analogique   | <b>backplate</b>            | plaque-support      |
| <b>angle lock</b>           | angle de braquage   | <b>balance weight</b>       | contrepois          |
| <b>anhydrous</b>            | anhydre             | <b>ball bearing</b>         | roulement à billes  |
| <b>anti-clockwise</b>       | sens inverse des    | <b>ball pein hammer</b>     | marteau à panne     |
|                             | aiguilles d'une     |                             | ronde               |
|                             | montre, anti-       | <b>ball valve</b>           | clapet à bille      |
|                             | horaire             | <b>ball-bearing grease</b>  | graisse pour        |
|                             | antigel             |                             | roulement à billes  |
| <b>anti-freeze</b>          | antigel             | <b>ball-head bolt</b>       | boulon à tête       |
| <b>anti-rust</b>            | antirouille         |                             | sphérique           |
| <b>anti-leaf mesh</b>       | tamis anti-feuilles | <b>balljoint separator</b>  | séparateur de       |
| <b>anti-roll bar</b>        | barre antiroulis    |                             | rotules/            |
| <b>anti-stall</b>           | anticalage          |                             | arrache-rotules     |
| <b>anti-theft system</b>    | antivol             | <b>balljoint</b>            | rotule              |
| <b>antifreeze</b>           | antigel             | <b>barrel</b>               | barillet, cylindre  |
| <b>arbor</b>                | mandrin             | <b>base</b>                 | embase, socle       |
| <b>armature</b>             | induit              | <b>baseplate (ignition)</b> | platine             |
| <b>armature coil</b>        | bobine d'induit     |                             | (d'allumage)        |
| <b>armature spindle</b>     | axe d'induit        |                             |                     |

|                            |                     |                             |                      |
|----------------------------|---------------------|-----------------------------|----------------------|
| <b>battery</b>             | batterie            | <b>big-end cap</b>          | coupelle de tête de  |
| <b>battery-cable</b>       | cosse de batterie   |                             | bielle               |
| <b>terminal</b>            |                     | <b>binder</b>               | liant                |
| <b>bayonet joint</b>       | joint à baïonnette  | <b>blade terminal</b>       | languette            |
| <b>bayonet socket</b>      | douille à           | <b>bleed (v)</b>            | purger (v)           |
|                            | baïonnette          | <b>bleed screw</b>          | vis de purge         |
| <b>bdc</b>                 | PMB (point mort     | <b>blow back</b>            | explosion au         |
|                            | bas)                |                             | carburateur          |
| <b>bead (tyre)</b>         | talon (pneu)        | <b>blow-by</b>              | gaz contourant le    |
| <b>beam</b>                | madrier             |                             | piston               |
| <b>bearing</b>             | palier, roulement,  | <b>blower</b>               | bloc de soufflerie   |
|                            | appui               | <b>body</b>                 | carrosserie          |
| <b>bearing cap</b>         | chapeau de palier   | <b>body pillar</b>          | pilier de caisse     |
| <b>bearing half</b>        | demi-palier         | <b>bodyshell</b>            | carrosserie, caisse  |
| <b>bearing inner race</b>  | bague intérieure de | <b>bodywork</b>             | carrosserie          |
|                            | roulement           | <b>bonded brake linings</b> | garnitures de freins |
| <b>bearing journal</b>     | portée/tourillon    |                             | liées                |
| <b>bearing ladder</b>      | carter-palier       | <b>bonnet</b>               | capot                |
| <b>bearing shell</b>       | coussinet (de       | <b>booster battery</b>      | batterie d'appoint/  |
| <b>(crankshaft)</b>        | vilebrequin)        |                             | de secours           |
| <b>bearing surface</b>     | surface d'appui     | <b>boot</b>                 | coffre               |
| <b>bellows</b>             | soufflet            | <b>bore</b>                 | alésage              |
| <b>belt</b>                | courroie            | <b>bottom dead centre</b>   | point mort bas       |
| <b>belt deflection</b>     | flèche de courroie  | <b>box spanner</b>          | clé-tube, clé à pipe |
| <b>belt drive</b>          | commande à          | <b>brace</b>                | bride, attache,      |
|                            | courroie            |                             | entretoise,          |
| <b>belt tensioner</b>      | tendeur de          | <b>bracket</b>              | armature             |
|                            | courroie            |                             | patte-support,       |
| <b>bent screwdriver</b>    | tournevis coudé     | <b>braided cable</b>        | support              |
| <b>bevel pinion/</b>       | satellite, pignon   | <b>brake</b>                | câble tressé         |
| <b>differential pinion</b> | satellite           | <b>brake adjustment</b>     | frein                |
| <b>bevel ring gear/</b>    | couronne de         | <b>brake anchor plate</b>   | réglage des freins   |
| <b>differential ring</b>   | différentiel,       |                             | plaque de fixation   |
| <b>gear</b>                | grande couronne     | <b>brake bleed nipple</b>   | des freins           |
| <b>gear</b>                | chanfrein, biseau   | <b>spanner</b>              | clé à purgeurs de    |
| <b>bezel</b>               | lamelle bilame      | <b>brake bleeding kit</b>   | freins               |
| <b>bi-metallic strip</b>   | tête de bielle      |                             | trousse de purge de  |
| <b>big end (conn. rod)</b> | maneton (ou         | <b>brake caliper</b>        | frein                |
| <b>big-end bearing</b>     | coussinet de        | <b>brake disc</b>           | disque de frein      |
| <b>(crankpin)</b>          | bielle)             | <b>brake drum</b>           | tambour de frein     |
| <b>{connecting rod</b>     |                     |                             |                      |
| <b>bearing}</b>            |                     |                             |                      |

|                                        |                                                   |                                            |                                                                    |
|----------------------------------------|---------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------|
| <b>brake fluid</b>                     | liquide de frein                                  | <b>bulkhead grommet</b>                    | passé-câble du<br>tablier                                          |
| <b>brake hose clamp</b>                | pince pour<br>flexibles de frein                  | <b>bumper</b>                              | pare-chocs                                                         |
| <b>brake light</b>                     | feu stop                                          | <b>bung</b>                                | bondemini                                                          |
| <b>brake light switch</b>              | contacteur de feu<br>stop                         | <b>burrs</b>                               | bavures                                                            |
| <b>brake line</b>                      | conduite de frein,<br>canalisation<br>hydraulique | <b>bush</b>                                | douille/bague/<br>coussinet                                        |
| <b>brake lining wear<br/>indicator</b> | témoin d'usure des<br>garnitures de<br>freins     | <b>butterfly valve/<br/>throttle valve</b> | papillon des gaz                                                   |
| <b>brake linings</b>                   | garniture de frein                                | <b>buzzer</b>                              | avertisseur sonore,<br>ronfleur, vibreur                           |
| <b>brake master cylinder</b>           | maître-cylindre                                   | <b>by-pass oil cleaner</b>                 | filtre à huile en<br>dérivation                                    |
| <b>brake pad</b>                       | plaquette de frein                                | <b>bypass</b>                              | dérivation                                                         |
| <b>brake pedal</b>                     | pédale de frein                                   |                                            |                                                                    |
| <b>brake power<br/>distributor</b>     | répartiteur de<br>freinage                        | <b>C</b>                                   |                                                                    |
| <b>brake shoe</b>                      | segment de frein                                  | <b>cable</b>                               | câble                                                              |
| <b>brake spring pliers</b>             | pince à ressort de<br>frein                       | <b>cable adjuster</b>                      | barillet/vis de<br>réglage de câble                                |
| <b>braked trailer</b>                  | remorque freinée                                  | <b>cable casing</b>                        | gaine de câble                                                     |
| <b>braking system</b>                  | freinage                                          | <b>cable clamp</b>                         | pince-câble                                                        |
| <b>brazing</b>                         | soudo-brasage                                     | <b>cable grommet</b>                       | passé-fil en<br>caoutchouc,<br>œillet, obturateur<br>en caoutchouc |
| <b>breaker points</b>                  | contacts de<br>rupteur                            | <b>calibrated container</b>                | réceptacle<br>mesureur                                             |
| <b>breaker/contact<br/>breaker</b>     | rupteur                                           | <b>caliper</b>                             | étrier (de frein)                                                  |
| <b>breather</b>                        | reniflard de carter                               | <b>cam</b>                                 | came                                                               |
| <b>breather hose</b>                   | évent                                             | <b>cam follower</b>                        | poussoir d'arbre à<br>cames                                        |
| <b>broach</b>                          | broche/poinçon                                    | <b>camber</b>                              | carrossage                                                         |
| <b>brush</b>                           | balai, charbon de<br>contact                      | <b>camshaft</b>                            | arbre à cames                                                      |
| <b>brush holder</b>                    | porte-balai                                       | <b>camshaft bearing</b>                    | palier d'arbre à<br>cames                                          |
| <b>btde</b>                            | AvPMH                                             | <b>camshaft cover</b>                      | couvre-culasse/<br>couvre-soupapes                                 |
| <b>buckling</b>                        | flambage/<br>gondolage/voilage                    | <b>camshaft endfloat</b>                   | jeu longitudinal à<br>l'arbre à cames                              |
| <b>built-in</b>                        | incorporé                                         |                                            |                                                                    |
| <b>bulb</b>                            | ampoule                                           |                                            |                                                                    |
| <b>bulge</b>                           | renflement, saillie                               |                                            |                                                                    |
| <b>bulkhead</b>                        | tablier                                           |                                            |                                                                    |

|                                                   |                                           |                                     |                                                              |
|---------------------------------------------------|-------------------------------------------|-------------------------------------|--------------------------------------------------------------|
| <b>camshaft gear</b>                              | commande de<br>distribution               | <b>castellated nut</b>              | écrou crénelé                                                |
| <b>camshaft pinion</b>                            | pignon d'arbre à<br>cames                 | <b>casting</b>                      | coulée                                                       |
| <b>camshaft sprocket</b>                          | pignon d'arbre à<br>cames à chaîne        | <b>castle nut</b>                   | écrou à créneaux                                             |
| <b>canister</b>                                   | réservoir                                 | <b>castor</b>                       | chasse                                                       |
| <b>cap</b>                                        | bouchon,<br>capuchon                      | <b>catalytic converter</b>          | pot catalytique,<br>convertisseur<br>catalytique             |
| <b>cap nut</b>                                    | écrou borgne, à<br>chapeau                | <b>catch</b>                        | cliquet                                                      |
| <b>capacitative<br/>discharging<br/>capacitor</b> | décharge<br>capacitative<br>condensateur  | <b>caustic soda</b>                 | soude caustique                                              |
| <b>capless bulb</b>                               | ampoule à tige de<br>verre                | <b>caution signal</b>               | signal d'alarme                                              |
| <b>capped nut</b>                                 | écrou à chapeau                           | <b>central console</b>              | console centrale                                             |
| <b>car radio</b>                                  | autoradio                                 | <b>central locking<br/>system</b>   | verrouillage central/<br>condamnation<br>centrale des portes |
| <b>carbon brush</b>                               | plot de carbone                           | <b>centre distance</b>              | entraxe                                                      |
| <b>carbon deposit/<br/>build-up</b>               | calaminage                                | <b>centre line</b>                  | axe, ligne médiane                                           |
| <b>carbon removing</b>                            | décalaminage                              | <b>centre of gravity</b>            | centre de gravité                                            |
| <b>carborundum</b>                                | carborundum                               | <b>centre of rotation</b>           | centre de rotation                                           |
| <b>carburettor</b>                                | carburateur                               | <b>centre punch</b>                 | pointeau fin                                                 |
| <b>carburettor bowl</b>                           | corps du<br>carburateur                   | <b>chain and sprocket<br/>drive</b> | engrenage à chaîne                                           |
| <b>carburettor jet</b>                            | gicleur de<br>carburateur                 | <b>chain sprocket</b>               | pignon à chaîne                                              |
| <b>carburettor stud</b>                           | goujon de<br>carburateur                  | <b>chain tensioner</b>              | tendeur de chaîne                                            |
| <b>cardan joint</b>                               | joint de Cardan,<br>joint universel       | <b>chamber</b>                      | chambre, réservoir                                           |
| <b>cardan shaft</b>                               | arbre de<br>transmission,<br>arbre cardan | <b>chamfer</b>                      | chanfrein                                                    |
| <b>cardan spider</b>                              | croisillon de joint à<br>cardan           | <b>change-over switch</b>           | commutateur,<br>inverseur                                    |
| <b>casing</b>                                     | boîtier, logement                         | <b>change down (v)</b>              | retrograder (v)                                              |
| <b>casing lug</b>                                 | ergot de carter                           | <b>change gear (v)</b>              | changer de<br>vitesse (v)                                    |
| <b>cast</b>                                       | moulé, fondu                              | <b>change up (v)</b>                | passer la vitesse<br>supérieure (v)                          |
| <b>cast iron</b>                                  | fonte                                     | <b>changing of oil</b>              | vidange                                                      |
|                                                   |                                           | <b>charger</b>                      | chargeur                                                     |
|                                                   |                                           | <b>charging</b>                     | mise en charge                                               |
|                                                   |                                           | <b>charging control lamp</b>        | voyant de charge,<br>témoin<br>d'allumage                    |
|                                                   |                                           |                                     | témoin indicateur<br>de charge                               |



|                                         |                                                  |                                      |                                                        |
|-----------------------------------------|--------------------------------------------------|--------------------------------------|--------------------------------------------------------|
| <b>charging current</b>                 | courant de charge                                | <b>clutch facing/lining</b>          | garniture d'embrayage                                  |
| <b>charging rate</b>                    | régime/intensité de charge                       | <b>clutch hub</b>                    | moyeu                                                  |
| <b>check</b>                            | contrôle                                         | <b>clutch plate</b>                  | plateau d'embrayage                                    |
| <b>check nut</b>                        | contre-écrou                                     | <b>clutch plate alignment set</b>    | mandrin de centrage d'embrayage avec jeu d'accessoires |
| <b>check valve</b>                      | soupape d'arrêt, clapet de retenue               | <b>clutch slippage</b>               | patinage                                               |
| <b>chisel</b>                           | ciseau, burin, tranche                           | <b>clutch spring</b>                 | ressort                                                |
| <b>choke (cold start valve)</b>         | starter/volet de départ à froid                  | <b>coarse adjustment</b>             | d'embrayage réglage grossier                           |
| <b>choke linkage</b>                    | tringlerie du starter                            | <b>coil</b>                          | bobine                                                 |
| <b>choke valve gap</b>                  | entrebâillement du volet de starter              | <b>coil ignition</b>                 | allumage à bobine                                      |
| <b>chrome plated</b>                    | chromé                                           | <b>coil spring</b>                   | ressort hélicoïdal (de suspension)                     |
| <b>cigar lighter</b>                    | allume-cigares                                   | <b>coil spring compressor</b>        | compresseur de ressorts de suspension                  |
| <b>circlip</b>                          | circlip/jonc d'arrêt                             | <b>cold chisel</b>                   | ciseau à froid                                         |
| <b>circuit breaker</b>                  | disjoncteur                                      | <b>collapsible</b>                   | pliant, démontable                                     |
| <b>circuit diagram</b>                  | schéma de circuit                                | <b>collar</b>                        | collier, bague                                         |
| <b>clamp</b>                            | bride de maintien/blocage                        | <b>collar flange</b>                 | bague à bride                                          |
| <b>clamp bolt/screw</b>                 | vis de bridage/blocage                           | <b>collar screw</b>                  | vis de bague                                           |
| <b>clamp bracket screw</b>              | vis de support de bridage                        | <b>collets (cf. "split collets")</b> | pincettes de serrage (cf. demi-clavettes de soupapes)  |
| <b>clamping washer</b>                  | rondelle de serrage                              | <b>combination pliers</b>            | pince universelle, mixte                               |
| <b>clatter</b>                          | cliquetis                                        | <b>combination spanner</b>           | clé mixte                                              |
| <b>claw</b>                             | griffe                                           | <b>combustion</b>                    | combustion                                             |
| <b>clearance</b>                        | jeu                                              | <b>combustion chamber</b>            | chambre de combustion                                  |
| <b>clevis pin</b>                       | axe de chape                                     | <b>commutator</b>                    | commutateur                                            |
| <b>clicking</b>                         | claquement                                       | <b>compensating jet</b>              | gicleur de compensation                                |
| <b>clip</b>                             | attache, fixation                                | <b>compression</b>                   | compression                                            |
| <b>clockwise</b>                        | dans le sens des aiguilles d'une montre, horaire | <b>compression gauge</b>             | indicateur de compression                              |
| <b>closed-loop converter</b>            | convertisseur type réglage automatique           |                                      |                                                        |
| <b>clutch</b>                           | embrayage                                        |                                      |                                                        |
| <b>clutch disk &amp; pressure plate</b> | disque à plateau d'embrayage                     |                                      |                                                        |

|                                           |                                              |                            |                                            |
|-------------------------------------------|----------------------------------------------|----------------------------|--------------------------------------------|
| <b>compression ratio</b>                  | rapport volumétrique                         | <b>continuous current</b>  | courant continu                            |
| <b>compression ring</b>                   | segment de compression, segment d'étanchéité | <b>control</b>             | commande                                   |
| <b>compression testing gauge/cylinder</b> | composimètre                                 | <b>control unit</b>        | (calculateur de) commande                  |
| <b>compression gauge</b>                  |                                              | <b>coolant</b>             | liquide de refroidissement                 |
| <b>computer</b>                           | calculateur                                  | <b>coolant bleed screw</b> | vis de purge du circuit de refroidissement |
| <b>condenser</b>                          | condenseur                                   | <b>coolant hose</b>        | durite de refroidissement                  |
| <b>conduit</b>                            | canalisation, conduit                        | <b>coolant pump</b>        | pompe à eau                                |
| <b>cone</b>                               | cône                                         | <b>cooler</b>              | refroidisseur                              |
| <b>conical</b>                            | conique                                      | <b>cooling fan switch</b>  | thermocontact de motoventilateur           |
| <b>connect (v)</b>                        | brancher, relier (v)                         | <b>cooling fin</b>         | ailette de refroidissement                 |
| <b>connect in parallel</b>                | brancher en parallèle                        | <b>cooling system</b>      | circuit de refroidissement                 |
| <b>connect in series</b>                  | monter en série                              | <b>copper gasket</b>       | joint en cuivre                            |
| <b>connecting box</b>                     | boîte (à prise) de courant                   | <b>core plug</b>           | pastille de dessablage                     |
| <b>connecting clamp</b>                   | collier de raccordement                      | <b>(cylinder-block)</b>    | (bloc-cylindres)                           |
| <b>connecting link</b>                    | lien de raccordement                         | <b>corrosion</b>           | corrosion                                  |
| <b>connecting rod</b>                     | bielle                                       | <b>cotter</b>              | clavette transversale, goupille fendue     |
| <b>connection</b>                         | branchement, connexion, raccordement         | <b>counter balance</b>     | contrepoids                                |
| <b>connector</b>                          | raccord, connecteur                          | <b>counter clockwise</b>   | sens anti-horaire                          |
| <b>constant voltage</b>                   | tension invariable                           | <b>counterbore</b>         | mèche-fraise cylindrique                   |
| <b>constant-velocity joint</b>            | joint homocinétique                          | <b>countergear</b>         | pignon de renvoi sur arbre intermédiaire   |
| <b>contact angle</b>                      | angle de contact                             | <b>countershaft</b>        | arbre intermédiaire, train fixe            |
| <b>contact breaker</b>                    | rupteur                                      | <b>counterweight</b>       | contrepoids                                |
| <b>contact breaker points</b>             | contacts de rupteur                          | <b>coupling</b>            | accouplement                               |
| <b>contact brush</b>                      | plot de contact                              | <b>covering</b>            | recouvrement, garniture, habillage         |
| <b>continuity tester</b>                  | contrôleur de continuité                     | <b>crack</b>               | fissure, fêlure                            |

|                                        |                                              |                                |                                             |
|----------------------------------------|----------------------------------------------|--------------------------------|---------------------------------------------|
| <b>crankcase</b>                       | carter-moteur                                | <b>cubic capacity</b>          | cylindrée                                   |
| <b>crankcase bearing</b>               | palier de carter-moteur                      | <b>current consumption</b>     | consommation de courant                     |
| <b>crankcase filter</b>                | filtre de carter-moteur                      | <b>current limit relay</b>     | relais limiteur de courant                  |
| <b>crankcase ventilation hose</b>      | tuyau de reniflard du carter-moteur          | <b>curve</b>                   | courbe                                      |
| <b>cranking</b>                        | lancement                                    | <b>curved spring washer</b>    | rondelle bombée                             |
| <b>crankpin</b>                        | maneton                                      | <b>cut off</b>                 | coupure                                     |
| <b>crankshaft</b>                      | vilebrequin                                  | <b>cut-out relay</b>           | conjoncteur-disjoncteur                     |
| <b>crankshaft counter weight</b>       | contrepois de vilebrequin                    | <b>cut-outs</b>                | découpes                                    |
| <b>crankshaft main bearing journal</b> | tourillon de vilebrequin                     | <b>cylinder barrel</b>         | barillet                                    |
| <b>crankshaft pulley</b>               | poulie de vilebrequin                        | <b>cylinder block</b>          | bloc-cylindres                              |
| <b>crankshaft sprocket</b>             | pignon de vilebrequin                        | <b>cylinder bore hone</b>      | outil à rectifier les alésages de cylindres |
| <b>crimped</b>                         | serti                                        | <b>cylinder head</b>           | culasse                                     |
| <b>crimping tool</b>                   | pince à serrer, pince à encoches             | <b>cylinder head bolt</b>      | vis de culasse                              |
| <b>cross bar</b>                       | traverse, barre transversale                 | <b>cylinder head cover</b>     | couvre-culasse                              |
| <b>cross-flow radiator</b>             | radiateur à débit horizontal                 | <b>cylinder head gasket</b>    | joint de culasse                            |
| <b>cross-flow scavenging</b>           | balayage transversal                         | <b>cylinder liner (sleeve)</b> | chemise                                     |
| <b>cross-head</b>                      | tournevis à lame cruciforme                  | <b>cylindrical spring</b>      | ressort cylindrique                         |
| <b>screwdriver/Philips screwdriver</b> |                                              |                                |                                             |
| <b>crown</b>                           | couronne                                     |                                |                                             |
| <b>crown gear</b>                      | engrenage à couronne                         |                                |                                             |
| <b>cruising</b>                        | roulement à vitesse constante                |                                |                                             |
| <b>cruising speed</b>                  | vitesse de service, vitesse de croisière     |                                |                                             |
| <b>crumple zone</b>                    | zone déformable, zone à absorption d'énergie |                                |                                             |

|                                   |                                              |                                |                                                |
|-----------------------------------|----------------------------------------------|--------------------------------|------------------------------------------------|
| <b>defect</b>                     | défaut, anomalie                             | <b>die casting</b>             | coulage sous pression                          |
| <b>deflection mark</b>            | repère de flèche                             | <b>die nut</b>                 | écrou-filière                                  |
| <b>deflector</b>                  | défecteur                                    | <b>diesel</b>                  | Diesel                                         |
| <b>defuming valve</b>             | valve de dégazage                            | <b>diesel fuel</b>             | gazole                                         |
| <b>degassing chamber</b>          | boîte de dégazage                            | <b>differential</b>            | différentiel                                   |
| <b>deionised water</b>            | eau déminéralisée                            | <b>differential case</b>       | coquille/boîtier de différentiel               |
| <b>delivery</b>                   | débit                                        | <b>differential crown gear</b> | couronne de différentiel, grande couronne      |
| <b>delivery pipe</b>              | tuyauterie haute pression, tuyau d'injection | <b>differential pinion</b>     | satellite, pignon satellite                    |
| <b>delivery valve</b>             | soupape de décharge, soupape de refoulement  | <b>differential side gear</b>  | roue planétaire, planétaire, pignon planétaire |
| <b>delta connection</b>           | couplage/montage en triangle                 | <b>digital clock</b>           | montre numérique                               |
| <b>demister</b>                   | déssembuage-dégivrage                        | <b>dim (v)</b>                 | passer en code (v)                             |
| <b>dent</b>                       | déformation, bosselure, indentation          | <b>dimmer relay</b>            | inverseur code-route                           |
| <b>deposit</b>                    | dépôt                                        | <b>dimmer switch/dipswitch</b> | contacteur de feux de croisement               |
| <b>depress</b>                    | déformation, bosselure                       | <b>dip lights</b>              | feux de croisement                             |
| <b>depth gauge</b>                | jauge/calibre de profondeur                  | <b>dip switch</b>              | commutateur d'inversion route/croisement       |
| <b>detent</b>                     | détente                                      |                                |                                                |
| <b>detent ball</b>                | bille de détente                             | <b>dipped beam</b>             | faisceau/feu de croisement                     |
| <b>diagnostic connector</b>       | prise diagnostic                             | <b>dipstick</b>                | jauge                                          |
| <b>dial gauge</b>                 | comparateur à cadran                         | <b>direct drive</b>            | prise directe                                  |
| <b>dial test indicator</b>        | comparateur analogique                       | <b>direction indicator</b>     | clignotant                                     |
| <b>diaphragm</b>                  | membrane                                     | <b>disc brake</b>              | frein à disque                                 |
| <b>diaphragm accelerator pump</b> | pompe de reprise à membrane                  | <b>discharge (v)</b>           | décharger (v)                                  |
| <b>diaphragm clutch</b>           | embrayage à diaphragme                       | <b>discharged battery</b>      | batterie à plat                                |
| <b>diaphragm cover</b>            | couvercle à membrane                         | <b>disconnect (v)</b>          | débrancher (v)                                 |
| <b>diaphragm unit</b>             | chambre à diaphragme                         | <b>dished washer</b>           | rondelle plate                                 |
|                                   |                                              | <b>dismantle (v)</b>           | démonter (v)                                   |
|                                   |                                              | <b>displacement</b>            | déplacement                                    |
|                                   |                                              | <b>dissipate (v)</b>           | dissiper (v)                                   |
|                                   |                                              | <b>dissolve (v)</b>            | dissoudre (v)                                  |
|                                   |                                              | <b>distance piece/spacer</b>   | entretoise                                     |

|                                                   |                                                        |                               |                                                                    |
|---------------------------------------------------|--------------------------------------------------------|-------------------------------|--------------------------------------------------------------------|
| <b>distance plate</b>                             | plaque<br>d'espacement                                 | <b>drain plug</b>             | bouchon de<br>vidange                                              |
| <b>distribution box</b>                           | caisse/boîte de<br>distribution                        | <b>drain the battery (v)</b>  | solliciter la<br>batterie (v)                                      |
| <b>distributor</b>                                | distributeur                                           | <b>draw (elect.)</b>          | intensité (élect.)                                                 |
| <b>distributor advance</b>                        | réglage d'allumage                                     | <b>dribble</b>                | égouttement                                                        |
| <b>distributor cover/cap</b>                      | tête de distributeur                                   | <b>drift</b>                  | dérive (trajectoire);<br>poinçon (outil)                           |
| <b>distributor injector pump</b>                  | pompe d'injection<br>distributrice,<br>pompe rotative  | <b>drift-punch</b>            | chasse-pointes                                                     |
| <b>distributor shaft/spindle</b>                  | axe de distributeur                                    | <b>drill</b>                  | foret                                                              |
| <b>distributor test bench</b>                     | banc d'essai pour<br>allumeurs                         | <b>drip feed</b>              | compte-gouttes                                                     |
| <b>distributorless semiconductor ignition dog</b> | allumage<br>électronique<br>intégral<br>toc/griffe     | <b>drive dogs</b>             | tocs<br>d'entraînement                                             |
| <b>dohc (double overhead camshaft)</b>            | double arbre à<br>cames en tête                        | <b>drive end</b>              | côté entraînement                                                  |
| <b>dome head piston</b>                           | piston à calotte                                       | <b>drive fit</b>              | ajustement serré                                                   |
| <b>domed nut</b>                                  | écrou à calotte                                        | <b>drive pinion</b>           | pignon d'attaque<br>du différentiel                                |
| <b>door check straps</b>                          | arrêts de portes                                       | <b>drive wheel</b>            | roue motrice                                                       |
| <b>door light switch</b>                          | contact de feuillure                                   | <b>drivebelt</b>              | courroie<br>d'entraînement                                         |
| <b>double acting shock absorber</b>               | amortisseur à<br>double effet                          | <b>drivegear</b>              | pignon de<br>commande                                              |
| <b>double piston wheel</b>                        | cylindre de frein à<br>double effet                    | <b>driven plate assembly</b>  | plateau de friction                                                |
| <b>brake cylinder</b>                             | double circuit de<br>freinage                          | <b>driven plate lining</b>    | garniture<br>d'embrayage                                           |
| <b>double-circuit braking system</b>              | douille de centrage                                    | <b>driveplate</b>             | plateau de pression<br>(clutch) tôle<br>(plaque)<br>d'entraînement |
| <b>dowel</b>                                      | tuyau de descente                                      | <b>driveshaft</b>             | arbre de<br>transmission                                           |
| <b>down pipe</b>                                  | carburateur à tirage                                   | <b>driveshaft gaiter</b>      | soufflet d'arbre de<br>transmission                                |
| <b>downdraught carburettor</b>                    | par en bas                                             | <b>driveshaft outer joint</b> | tulipe de la<br>transmission                                       |
| <b>downstroke</b>                                 | course descendante                                     | <b>yoke</b>                   | groupe                                                             |
| <b>drag coefficient</b>                           | coefficient de<br>pénétration dans<br>l'air/de trainée | <b>drivetrain</b>             | motopropulseur                                                     |
| <b>drain</b>                                      | vidange                                                | <b>driving gear</b>           | pignon menant                                                      |
| <b>drain cock</b>                                 | robinet de vidange                                     | <b>driving pinion</b>         | pignon d'attaque/<br>d'entraînement                                |

|                              |                                         |                                    |                                                |
|------------------------------|-----------------------------------------|------------------------------------|------------------------------------------------|
| <b>drop arm</b>              | biellette pendante                      | <b>electric cooling fan</b>        | motoventilateur de<br>refroidissement          |
| <b>drum brake</b>            | frein à tambours                        | <b>electric fan</b>                | motoventilateur,<br>ventilateur<br>électrique  |
| <b>dry cell battery</b>      | batterie sèche                          | <b>electric fuel pump</b>          | pompe à essence<br>électrique                  |
| <b>dry sump lubrication</b>  | graissage à carter<br>sec               | <b>electric screen washer pump</b> | pompe électrique<br>de lave-glace              |
| <b>dual carburettor</b>      | carburateur double<br>corps             | <b>electric windows</b>            | lève-vitres<br>électriques                     |
| <b>dual master cylinder</b>  | maître-cylindre<br>tandem               | <b>electrocoating</b>              | électrophorèse                                 |
| <b>ductile</b>               | ductile, malléable                      | <b>electrode gap</b>               | écartement des<br>électrodes                   |
| <b>durability</b>            | durabilité                              | <b>electronic control unit</b>     | calculateur/<br>boîtier<br>électronique        |
| <b>dust cap/cover</b>        | capuchon pare-<br>poussière             | <b>electronic ignition system</b>  | allumage<br>électronique                       |
| <b>dust excluding boot</b>   | soufflet cache-<br>poussière            | <b>elliptic</b>                    | elliptique                                     |
| <b>dust proof</b>            | anti-poussière                          | <b>emery</b>                       | émeri                                          |
| <b>dwell</b>                 | fermeture                               | <b>emission control systems</b>    | dispositifs<br>antipollution                   |
| <b>dwell angle/cam angle</b> | angle de came,<br>angle de<br>fermeture | <b>emulsion tube</b>               | tube d'émulsion                                |
| <b>dwell time</b>            | temps de fermeture                      | <b>enamel</b>                      | émail                                          |
| <b>dynamo</b>                | dynamo                                  | <b>end float</b>                   | jeu axial                                      |
| <b>early spark</b>           | allumage avancé                         | <b>end plug</b>                    | obturateur                                     |
| <b>earth (elect.)</b>        | masse (élect.)                          | <b>end thrust</b>                  | pression axiale                                |
| <b>earth connection</b>      | connexion de<br>masse                   | <b>engine</b>                      | moteur                                         |
| <b>earth electrode</b>       | électrode de masse                      | <b>engine (rubber) mounting</b>    | silentbloc de<br>moteur/support                |
| <b>earth strap</b>           | traverse de masse                       | <b>engine bracket</b>              | support-moteur                                 |
| <b>eccentricity, ovality</b> | faux-rond                               | <b>engine oil cooler</b>           | échangeur<br>thermique eau-<br>huile du moteur |
| <b>edge raising</b>          | repliage                                | <b>engine oil level</b>            | jauge de niveau<br>d'huile moteur              |
| <b>edge to edge</b>          | bord à bord                             | <b>dipstick</b>                    | plaque moteur                                  |
| <b>effective output</b>      | puissance effective                     | <b>engine plate</b>                | régime moteur                                  |
| <b>efficiency</b>            | rendement                               | <b>engine speed</b>                | pignon moteur                                  |
| <b>elapsed time</b>          | laps de temps                           | <b>engine sprocket</b>             | distribution                                   |
| <b>elastic coupling</b>      | accouplement<br>élastique               | <b>engine timing</b>               |                                                |
| <b>elbow</b>                 | coudé                                   |                                    |                                                |

|                                           |                                    |                           |                                                                        |
|-------------------------------------------|------------------------------------|---------------------------|------------------------------------------------------------------------|
| <b>engine torque</b>                      | couple moteur                      | <b>fast idle</b>          | ralenti accéléré                                                       |
| <b>engineer's hammer</b>                  | marteau rivoir                     | <b>fasten (v)</b>         | attacher (v)                                                           |
| <b>estate car</b>                         | voiture break/familiale            | <b>fastener</b>           | attache, fixation                                                      |
| <b>excess pressure</b>                    | surpression                        | <b>fault</b>              | défaut, anomalie                                                       |
| <b>exchange engine</b>                    | moteur de remplacement             | <b>fault diagnosis</b>    | diagnostic des défauts                                                 |
| <b>excitation diode</b>                   | diode d'excitation                 | <b>feed pipe</b>          | canalisation                                                           |
| <b>exhaust</b>                            | échappement                        | <b>feed port</b>          | orifice                                                                |
| <b>exhaust expansion box</b>              | pot de détente d'échappement       | <b>feeler blade</b>       | d'alimentation                                                         |
| <b>exhaust silencer</b>                   | pot d'échappement, pot de détente  | <b>feeler gauge</b>       | cale d'épaisseur                                                       |
| <b>exhaust valve</b>                      | soupape d'échappement              | <b>felt washer</b>        | jauge/cale d'épaisseur                                                 |
| <b>exhaust valve lifter</b>               | poussoir de soupape d'échappement  | <b>female thread</b>      | rondelle en feutre                                                     |
| <b>exhaust-pollution reduction</b>        | dépollution des gaz d'échappement  | <b>fender (US)</b>        | filet de vis intérieur, taraudage                                      |
| <b>expansion tank</b>                     | vase d'expansion                   | <b>ferrule</b>            | aile                                                                   |
| <b>expansion valve (air conditioning)</b> | détendeur (climatisation)          | <b>fibre washer</b>       | virole                                                                 |
| <b>explosive mixture</b>                  | mélange explosif, mélange détonant | <b>field coil/winding</b> | rondelle en fibre                                                      |
| <b>extension piece</b>                    | rallonge                           | <b>field current</b>      | bobinage inducteur                                                     |
| <b>external coolant leakage</b>           | perte d'eau externe                | <b>field winding</b>      | courant inducteur                                                      |
| <b>extractor</b>                          | extracteur                         | <b>file</b>               | bobinage inducteur                                                     |
| <b>eye</b>                                | ocillet                            | <b>filler cap</b>         | lime                                                                   |
| <b>F</b>                                  |                                    | <b>filler tube</b>        | bouchon de remplissage                                                 |
| <b>face</b>                               | face                               | <b>filter cartridge</b>   | tube de remplissage                                                    |
| <b>facia (panel)</b>                      | planche de bord                    | <b>filter element</b>     | cartouche filtrante                                                    |
| <b>failure</b>                            | défaillance, anomalie              | <b>filter magnet</b>      | élément de filtre                                                      |
| <b>fan</b>                                | ventilateur                        | <b>final drive</b>        | aimant de sédimentation                                                |
| <b>fan belt</b>                           | courroie trapézoïdale              | <b>fine emery cloth</b>   | couple réducteur/pont                                                  |
|                                           |                                    | <b>firing order</b>       | toile émeri fine                                                       |
|                                           |                                    | <b>firing stroke</b>      | ordre d'allumage                                                       |
|                                           |                                    | <b>firing voltage</b>     | explosion-détente (essence), combustion-détente (Diesel), temps moteur |
|                                           |                                    |                           | tension d'allumage                                                     |

|                            |                                             |                               |                                             |
|----------------------------|---------------------------------------------|-------------------------------|---------------------------------------------|
| <b>fittings</b>            | aménagements/garnitures                     | <b>fresh air box</b>          | caisson de ventilation                      |
| <b>fixed jet</b>           | gicleur fixe                                | <b>friction</b>               | friction, frottement                        |
| <b>fixed pivot</b>         | pivot fixe                                  | <b>friction clutch</b>        | embrayage à friction                        |
| <b>flammable</b>           | inflammable                                 | <b>front axle</b>             | essieu avant                                |
| <b>flanging</b>            | emboutissage                                | <b>front wheel drive</b>      | traction avant                              |
| <b>flap</b>                | volet, aileron                              | <b>fuel</b>                   | carburant                                   |
| <b>flapper valve</b>       | papillon, soupape à clapet                  | <b>fuel consumption</b>       | consommation de carburant                   |
| <b>flasher relay</b>       | relais clignotants                          | <b>fuel feed pipe</b>         | durit d'alimentation                        |
| <b>flasher unit</b>        | centrale clignotants                        | <b>fuel filter</b>            | filtre à carburant                          |
| <b>flexible brake hose</b> | durit de frein                              | <b>fuel gauge sender unit</b> | jaugeur de carburant                        |
| <b>float</b>               | flotteur                                    | <b>fuel injection</b>         | injection de carburant                      |
| <b>float chamber</b>       | chambre à niveau constant                   | <b>fuel inlet hose</b>        | durit d'arrivée de carburant                |
| <b>float level</b>         | niveau de flotteur                          | <b>fuel line</b>              | tuyauterie d'alimentation                   |
| <b>float needle</b>        | pointeau                                    | <b>fuel mixture</b>           | mélange                                     |
| <b>flood (v)</b>           | noyer (v)                                   | <b>fuel pump</b>              | pompe à carburant                           |
| <b>fluid</b>               | fluide, liquide                             | <b>fuel rail</b>              | rampe                                       |
| <b>fluid coupling</b>      | embrayage hydraulique, coupleur hydraulique | <b>fuel return pipe</b>       | canalisation de retour                      |
| <b>fluid pressure</b>      | pression de liquide                         | <b>fuel supply line</b>       | canalisation d'alimentation                 |
| <b>fluid renewal</b>       | vidange                                     | <b>fuel tank</b>              | réservoir de carburant                      |
| <b>fly nut</b>             | écrou à oreilles                            | <b>fuel tank filler pipe</b>  | goulotte de remplissage de réservoir        |
| <b>flywheel</b>            | volant moteur                               | <b>fuel/feed line</b>         | d'essence tuyauterie/conduites/canalisation |
| <b>flywheel marking</b>    | marquage de volant moteur                   | <b>fulcrum</b>                | point d'appui d'un levier                   |
| <b>foglight</b>            | feu antibrouillard                          |                               |                                             |
| <b>follower</b>            | poussoir                                    |                               |                                             |
| <b>forced lubrication</b>  | graissage forcé, graissage sous pression    |                               |                                             |
| <b>fore and aft</b>        | avant et arrière                            |                               |                                             |
| <b>four-stroke process</b> | cycle à quatre temps                        |                               |                                             |
| <b>free movement</b>       | jeu libre                                   |                               |                                             |
| <b>free play</b>           | jeu                                         |                               |                                             |
| <b>free travel</b>         | course libre                                |                               |                                             |
| <b>frequency</b>           | fréquence                                   |                               |                                             |



|                                 |                                            |                                           |                                     |
|---------------------------------|--------------------------------------------|-------------------------------------------|-------------------------------------|
| <b>full throttle enrichment</b> | enrichissement à pleine charge             | <b>generator armature</b>                 | induit de générateur                |
| <b>full-flow oil filter</b>     | filtre à huile en série/à passage total    | <b>genuine part</b>                       | pièce d'origine                     |
|                                 |                                            | <b>glovebox light</b>                     | éclairage de boîte à gants          |
| <b>fully automatic</b>          | entièrement automatique                    | <b>glow plug</b>                          | bougie de préchauffage              |
| <b>funnel</b>                   | entonnoir                                  | <b>glow plug tips</b>                     | pointes de bougies                  |
| <b>fuse</b>                     | fusible                                    | <b>grease</b>                             | graisse                             |
| <b>fuse box</b>                 | boîte à fusibles                           | <b>grease gun</b>                         | pompe de graissage                  |
| <b>fusing point</b>             | point de fusion                            | <b>grease nipple</b>                      | graisseur                           |
|                                 |                                            | <b>grease retainer</b>                    | burette                             |
| <b>G</b>                        |                                            | <b>grinding-in (valve)</b>                | rodage (de soupape)                 |
| <b>gaiter</b>                   | soufflet                                   | <b>groove</b>                             | rainure                             |
| <b>gear change</b>              | passage/ changement de vitesses            | <b>gross vehicle weight</b>               | poids autorisé en charge            |
| <b>gear component</b>           | élément de pignon                          | <b>ground cable</b>                       | câble de mise à la masse/à la terre |
| <b>gear lever boot</b>          | soufflet de levier de vitesses             | <b>ground clearance</b>                   | hauteur de coque, garde au sol      |
| <b>gear lever knob</b>          | boule du levier de vitesses                | <b>ground clearance compensator</b>       | correcteur de hauteur               |
| <b>gear ratio</b>               | rapport de transmission                    | <b>ground return</b>                      | retour à la masse                   |
| <b>gear selector</b>            | sélecteur de vitesses                      | <b>ground strap</b>                       | tresse de masse                     |
| <b>gear teeth</b>               | dents d'engrenage                          | <b>grub screw (Allen screw, setscrew)</b> | vis sans tête (à tige lisse)        |
| <b>gear train</b>               | train d'engrenage                          | <b>gudgeon pin</b>                        | axe de piston                       |
| <b>gearbox</b>                  | boîte de vitesses                          | <b>guide sleeve</b>                       | manchon de guidage                  |
| <b>gearbox drain plug key</b>   | clé pour bouchon de vidange d'huile moteur |                                           |                                     |
| <b>gearbox housing</b>          | carter de boîte (de vitesses)              | <b>H</b>                                  |                                     |
| <b>gearshift lever</b>          | levier de changement de vitesse            | <b>hacksaw</b>                            | scie à métaux                       |
| <b>geartrains</b>               | trains de pignonnerie                      | <b>half-casing</b>                        | demi-coquille/ demi-carter          |
|                                 |                                            | <b>Hall sender</b>                        | émetteur Hall                       |

|                                  |                                                |                                      |                                     |
|----------------------------------|------------------------------------------------|--------------------------------------|-------------------------------------|
| <b>hand operated hand primer</b> | manuel(le) pompe d'amorçage                    | <b>heater resistor unit</b>          | boîtier de résistance de chauffage  |
| <b>handbrake</b>                 | frein à main                                   | <b>heater unit</b>                   | bloc de chauffage                   |
| <b>handbrake cable</b>           | câbles de commande de frein à main             | <b>heavy discharge meter (batt.)</b> | testeur de grande capacité (batt.)  |
|                                  |                                                | <b>helical groove</b>                | rampe hélicoïdale                   |
| <b>handle</b>                    | poignée                                        | <b>herringbone teeth</b>             | dents à chevrons                    |
| <b>hatchback</b>                 | voiture à cinq portes                          | <b>high beam (headlamps)</b>         | faisceau route (éclairage de route) |
| <b>hazard lights</b>             | feux de détresse                               | <b>high gear</b>                     | prise directe                       |
| <b>header tank</b>               | collecteur de tête                             | <b>high melting point grease</b>     | graisse à point de fusion élevé     |
| <b>headlamp lens</b>             | verre de phare                                 | <b>high tension coil</b>             | bobine haute tension                |
| <b>headlamp/headlight</b>        | phare/feu de route/projecteur                  | <b>holding down bolt</b>             | vis de fixation                     |
| <b>headlight flasher</b>         | appel de phares                                | <b>holding down spring</b>           | ressort de fixation                 |
| <b>headlight housing</b>         | boîtier de phare                               | <b>hollow axle</b>                   | essieu creux                        |
| <b>headlining</b>                | revêtement de pavillon                         | <b>hollow bolt</b>                   | vis à tige creuse                   |
| <b>heat rating</b>               | indice thermique                               | <b>horn</b>                          | avertisseur sonore                  |
| <b>heat shield</b>               | bouclier thermique                             | <b>hose</b>                          | durit, flexible, tuyau              |
| <b>heat sink</b>                 | dissipateur de chaleur                         | <b>hose clamp</b>                    | bride de tuyau/ flexible            |
| <b>heated rear window</b>        | lunette arrière chauffante/ dégivrante         | <b>hose coupling</b>                 | raccord de tuyau                    |
| <b>heater blower (unit)</b>      | bloc de soufflerie de chauffage                | <b>hot-air shroud</b>                | buse d'air chaud                    |
| <b>heater control cable</b>      | câbles de commande de chauffage                | <b>hub</b>                           | moyeu                               |
| <b>heater control panel</b>      | panneau de commande de chauffage et soufflerie | <b>hub bearing</b>                   | roulement de moyeu                  |
|                                  |                                                | <b>hub cap</b>                       | enjoleur                            |
| <b>heater hose</b>               | durit de chauffage                             | <b>hub flange</b>                    | flasque de moyeu                    |
| <b>heater matrix</b>             | Radiateur de chauffage                         | <b>Hydragas suspension</b>           | suspension Hydragas                 |
| <b>heater plug control</b>       | résistance témoin pour bougie de préchauffage  | <b>hydraulic brake servo</b>         | servofrein hydraulique              |
|                                  |                                                | <b>hydraulic brakes</b>              | freins hydrauliques                 |
|                                  |                                                | <b>hydraulic force</b>               | force hydraulique                   |
|                                  |                                                | <b>hydraulic jack</b>                | cric hydraulique                    |
|                                  |                                                | <b>hydraulic tappet</b>              | poussoir hydraulique                |

|                                                 |                                                                  |                                          |                                                      |
|-------------------------------------------------|------------------------------------------------------------------|------------------------------------------|------------------------------------------------------|
| <b>hydrocarbon hydrometer</b>                   | hydrocarbure<br>pèse-acide,<br>acidimètre                        | <b>ignition stroke</b>                   | course d'explosion<br>et de détente,<br>temps moteur |
| <b>hydropneumatic self-levelling suspension</b> | suspension<br>hydropneumatique,<br>suspension<br>oléopneumatique | <b>ignition timing</b>                   | avance à<br>l'allumage/calage<br>d'allumage          |
| <b>hypoid-gear pair</b>                         | couple/engrenage<br>hypoïde                                      | <b>impact screwdriver</b>                | tournevis à frapper                                  |
|                                                 |                                                                  | <b>impeller</b>                          | impulseur, pompe                                     |
|                                                 |                                                                  | <b>impulse</b>                           | impulsion                                            |
|                                                 |                                                                  | <b>inbuilt</b>                           | incorporé(e)                                         |
|                                                 |                                                                  | <b>inch</b>                              | pouce                                                |
|                                                 |                                                                  | <b>independent wheel suspension</b>      | suspension à roues<br>indépendantes                  |
|                                                 |                                                                  | <b>indexing</b>                          | indexage,<br>indexation                              |
| <b>I</b>                                        |                                                                  | <b>indicator</b>                         | clignotant                                           |
| <b>identification plate</b>                     | plaque<br>constructeur                                           | <b>induction</b>                         | induction (élect.)                                   |
| <b>idle adjusting screw</b>                     | vis de réglage de<br>ralenti                                     | <b>induction manifold</b>                | collecteur<br>d'admission                            |
| <b>idle cut-off valve</b>                       | étouffoir de ralenti                                             | <b>induction stroke</b>                  | course d'admission/<br>aspiration                    |
| <b>idle fuel system</b>                         | circuit de ralenti                                               | <b>induction valve</b>                   | soupape<br>d'admission                               |
| <b>idle jet</b>                                 | gicleur de ralenti                                               | <b>inductive semi-conductor ignition</b> | allumage transistoré<br>à induction                  |
| <b>idle mixture</b>                             | mélange de ralenti                                               | <b>inert</b>                             | inerte                                               |
| <b>idle speed</b>                               | régime de ralenti                                                | <b>inertia reel belt</b>                 | ceinture de sécurité<br>à enrouleur                  |
| <b>idle speed boost</b>                         | compensateur de<br>régime de ralenti                             | <b>inflammable</b>                       | inflammable                                          |
| <b>idle speed control valve</b>                 | électrovanne de<br>ralenti                                       | <b>injection</b>                         | injection                                            |
| <b>idler arm</b>                                | relais de direction<br>ralenti                                   | <b>injection jet test stand</b>          | banc d'essai<br>d'injecteurs                         |
| <b>idling</b>                                   | allumage                                                         | <b>injector</b>                          | injecteur                                            |
| <b>ignition cable</b>                           | câble d'allumage                                                 | <b>inlet manifold</b>                    | collecteur<br>d'admission                            |
| <b>ignition capacitor</b>                       | condensateur<br>d'allumage                                       | <b>inlet valve</b>                       | soupape<br>d'admission                               |
| <b>ignition coil</b>                            | bobine d'allumage                                                | <b>inlet/intake</b>                      | admission                                            |
| <b>ignition control</b>                         | commande<br>d'allumage                                           | <b>inner tube (tyre)</b>                 | chambre à air<br>(pneu)                              |
| <b>ignition delay</b>                           | délai d'allumage                                                 | <b>input shaft</b>                       | arbre d'entrée                                       |
| <b>ignition distributor</b>                     | distributeur<br>d'allumage                                       |                                          |                                                      |
| <b>ignition key</b>                             | clé de contact                                                   |                                          |                                                      |
| <b>ignition setting</b>                         | calage de (l'avance<br>à) l'allumage                             |                                          |                                                      |

|                                                |                                              |                          |                                               |
|------------------------------------------------|----------------------------------------------|--------------------------|-----------------------------------------------|
| <b>inspection pit</b>                          | fosse d'inspection                           | <b>jet needle</b>        | aiguille-pointeau,<br>aiguille de dosage,     |
| <b>instrument board</b>                        | combiné<br>d'instruments                     | <b>jingling noise</b>    | aiguille conique                              |
| <b>instrument panel</b>                        | combiné<br>d'instruments/<br>tableau de bord | <b>join</b>              | cliquetis, tintement                          |
| <b>instrument panel shroud</b>                 | coquille de tableau<br>de bord               | <b>jointing compound</b> | raccorder                                     |
| <b>insulated wire</b>                          | fil isolé                                    | <b>jointing sleeve</b>   | mastic d'étanchéité                           |
| <b>insulating tape</b>                         | chatterton                                   | <b>journals</b>          | manchon de                                    |
| <b>intake period</b>                           | période d'admission                          | <b>jump leads</b>        | jonction (élec.)                              |
| <b>integral body</b>                           | caisse monocoque                             | <b>junction box</b>      | portées/tourillons                            |
| <b>interconnected</b>                          | interconnecté                                |                          | câbles de                                     |
| <b>interference fit</b>                        | ajustement très<br>serré                     |                          | démarrage volants                             |
| <b>interference-suppression filter</b>         | filtre<br>d'antiparasitage                   |                          | boîte                                         |
| <b>interference-suppression ignition cable</b> | câble d'allumage<br>antiparasité             | <b>K</b>                 | d'accouplement                                |
| <b>interior light</b>                          | éclairage intérieur                          | <b>kerbweight</b>        |                                               |
| <b>interlocking</b>                            | verrouillage,<br>enchevêtrement              | <b>kickdown cable</b>    | poids à vide en<br>ordre de marche            |
| <b>intermittent wiper control switch</b>       | contacteur essuie-<br>glace à minuterie      | <b>kickstarter</b>       | câble de<br>rétrocommande<br>(kickdown)       |
| <b>internal thread gauge</b>                   | jauge de filetage<br>interne                 | <b>kickstarter</b>       | kickstarter, kick,<br>lanceur au pied         |
| <b>interrupter point</b>                       | interrupteur                                 | <b>king pin</b>          | axe de fusée, axe-<br>pivot de fusée          |
| <b>IO (Inlet valve Opens)</b>                  | ouverture de valve<br>d'admission            |                          | d'essieu avant,<br>pivot de l'essieu<br>avant |
| <b>J</b>                                       |                                              | <b>knee-bar</b>          | bourrelet de<br>protection des<br>genoux      |
| <b>jack</b>                                    | crie                                         | <b>knobbly tyre</b>      | pneu à crampons                               |
| <b>jacking</b>                                 | levage                                       | <b>knock sensor</b>      | détecteur de<br>cliquetis                     |
| <b>jacking point</b>                           | point de levage                              | <b>knocking</b>          |                                               |
| <b>jam nut</b>                                 | contre-écrou                                 | <b>L</b>                 |                                               |
| <b>jaw clutch</b>                              | accouplement à<br>griffes                    | <b>laden</b>             | chargé(e)                                     |
| <b>jet</b>                                     | gicleur                                      |                          |                                               |

|                                  |                                          |                                    |                                                                            |
|----------------------------------|------------------------------------------|------------------------------------|----------------------------------------------------------------------------|
| <b>laminated spring</b>          | ressort à lames                          | <b>load sensing valve</b>          | limiteur asservi à la charge, répartiteur de pression sensible à la charge |
| <b>lamp socket</b>               | douille de lampe                         |                                    |                                                                            |
| <b>latch</b>                     | loquet                                   |                                    |                                                                            |
| <b>late ignition</b>             | allumage retardé                         |                                    |                                                                            |
| <b>layshaft gear</b>             | pignon de renvoi sur arbre intermédiaire | <b>lobe (cam)</b>                  | bossage (came)                                                             |
|                                  |                                          | <b>locating clip</b>               | agrafe de positionnement                                                   |
| <b>layshaft/countershaft</b>     | arbre intermédiaire                      |                                    |                                                                            |
| <b>lead</b>                      | plomb                                    | <b>locating dowel</b>              | douille de positionnement/centrage                                         |
| <b>lead acid battery</b>         | batterie à acide                         |                                    |                                                                            |
| <b>leaded fuel</b>               | carburant plombé                         | <b>locating lug</b>                | ergot de positionnement                                                    |
| <b>leak-off pipe</b>             | canalisation de retour de fuite          |                                    |                                                                            |
|                                  |                                          | <b>lock assembly</b>               | serrure                                                                    |
| <b>leakage</b>                   | fuite                                    | <b>lock barrel (cylinder)</b>      | barillet de serrure                                                        |
| <b>lean gas mixture</b>          | mélange de gaz pauvre                    | <b>lock striker</b>                | gâche de serrure                                                           |
|                                  |                                          | <b>locking compound</b>            | liquide de blocage/produit-frein                                           |
| <b>left-hand thread</b>          | filetage à gauche                        |                                    |                                                                            |
| <b>length of stroke</b>          | longueur de course                       | <b>locking pin (cent. locking)</b> | bielle de condamnation                                                     |
| <b>level gauge</b>               | jauge de niveau                          | <b>locking rod (cent. locking)</b> | bretelle de fixation contre-écrou                                          |
| <b>level plug</b>                | bouchon de niveau                        | <b>locking strap</b>               | tôle-frein                                                                 |
|                                  |                                          | <b>locknut</b>                     | rondelle d'arrêt                                                           |
| <b>lever</b>                     | levier, manette                          | <b>locktab</b>                     | haut-parleur                                                               |
| <b>lifting bracket</b>           | patte de levage                          | <b>lockwasher</b>                  | cadre à longerons                                                          |
| <b>lifting tackle</b>            | palan                                    | <b>long-nosed pliers</b>           | haut-parleur                                                               |
| <b>light alloy</b>               | alliage léger                            | <b>longitudinal frame</b>          | faisceau de croisement                                                     |
| <b>light oil</b>                 | huile fine                               | <b>loudspeaker</b>                 | pneu à profil surbaissé/à basse section                                    |
| <b>light with extension lead</b> | baladeuse                                | <b>low beam</b>                    | section                                                                    |
| <b>line up</b>                   | alignement                               |                                    |                                                                            |
| <b>liner (cylinders)</b>         | chemise (cylindres)                      | <b>low section tyre</b>            | gicleur de petite faible                                                   |
| <b>link</b>                      | bielle                                   |                                    |                                                                            |
| <b>link pivot bolt</b>           | vis-pivot de bielle                      | <b>low speed jet</b>               | faible tension                                                             |
|                                  |                                          |                                    |                                                                            |
| <b>linkage</b>                   | tringlerie                               | <b>low tension</b>                 | lubrifiant                                                                 |
| <b>linked suspension system</b>  | suspension à trains de roues conjugués   | <b>lubricant</b>                   | circuit de graissage                                                       |
|                                  |                                          | <b>lubrication system</b>          | coffre à bagages, malle                                                    |
| <b>live axle</b>                 | arbre primaire, de commande              | <b>luggage compartment</b>         |                                                                            |
| <b>live lead</b>                 | ligne sous tension                       |                                    |                                                                            |
| <b>load</b>                      | charge                                   |                                    |                                                                            |

## M

|                                          |                                            |                                      |                                                       |
|------------------------------------------|--------------------------------------------|--------------------------------------|-------------------------------------------------------|
| <b>magnetic stand</b>                    | support magnétique                         | <b>micrometer set</b>                | micromètre/palmer avec jeu d'accessoires              |
| <b>main beam</b>                         | faisceau de route                          |                                      |                                                       |
| <b>main bearing (crankshaft journal)</b> | tourillon, palier principal                | <b>microswitch</b>                   | microcontacteur                                       |
| <b>main bearing shell</b>                | demi-coussinets supérieurs de palier       | <b>mirror</b>                        | rétroviseur                                           |
| <b>upper halves</b>                      |                                            | <b>misalignment</b>                  | mauvais alignement                                    |
|                                          |                                            | <b>misfire</b>                       | raté, défaut d'allumage                               |
| <b>main hydraulic brake</b>              | frein hydraulique principal                | <b>mixing chamber</b>                | chambre de carburation                                |
| <b>main jet</b>                          | gicleur principal                          |                                      |                                                       |
| <b>main line</b>                         | canalisation principale                    | <b>mixture adjustment</b>            | réglage de la richesse                                |
|                                          |                                            | <b>mole wrench/self-grip wrench</b>  | clé à pince réglable, pince-étau                      |
| <b>main muffler</b>                      | silencieux principal                       | <b>molybdenum disulphide</b>         | bisulfure de molybdène                                |
|                                          |                                            | <b>MoT</b>                           | contrôle technique                                    |
| <b>mainshaft</b>                         | arbre moteur, arbre principal              | <b>mounting bolt</b>                 | vis de fixation                                       |
|                                          |                                            | <b>mounting bracket</b>              | patte-support                                         |
| <b>maintenance-free battery</b>          | batterie sans entretien, à énergie scellée | <b>mounting plate</b>                | plaque de fixation                                    |
|                                          |                                            | <b>movable</b>                       | déplaçable                                            |
| <b>maladjustment</b>                     | mauvais réglage                            | <b>moving contact</b>                | contact mobile                                        |
| <b>mandrel</b>                           | mandrin                                    | <b>mud flap</b>                      | bavette                                               |
| <b>manifold</b>                          | collecteur                                 | <b>mudguard</b>                      | aile                                                  |
| <b>manifold absolute pressure (map)</b>  | pression absolue de collecteur             | <b>muffler</b>                       | pot d'échappement, silencieux                         |
| <b>manifold pressure sensor</b>          | sonde de pression                          |                                      |                                                       |
| <b>manual stop lever</b>                 | levier d'arrêt manuel                      | <b>multi-cylinder injection pump</b> | pompe d'injection à éléments en ligne, pompe en ligne |
|                                          |                                            |                                      |                                                       |
| <b>mating surfaces</b>                   | plans de joint                             | <b>multi-function indicator</b>      | ordinateur de bord                                    |
| <b>mean value</b>                        | valeur moyenne                             | <b>multiblade</b>                    | tournevis à lames interchangeables                    |
| <b>membrane</b>                          | membrane                                   | <b>screwdriver</b>                   | injecteur à plusieurs trous                           |
| <b>mesh in (v)</b>                       | engrener (v)                               | <b>multiplate clutch</b>             | embrayage multidisque                                 |
| <b>metal filings</b>                     | limailles                                  |                                      |                                                       |
| <b>metal hose</b>                        | durite métallique                          |                                      |                                                       |
| <b>metering</b>                          | éléments de dosage                         |                                      |                                                       |
| <b>components (fuel)</b>                 | (carburant)                                |                                      |                                                       |
| <b>methyated spirit</b>                  | alcool dénaturé                            |                                      |                                                       |
| <b>metric threads</b>                    | filets métriques                           |                                      |                                                       |
| <b>mica</b>                              | mica                                       |                                      |                                                       |

## N

**neck (journal) bearing** palier à collets

|                              |                               |
|------------------------------|-------------------------------|
| <b>needle bearing</b>        | roulement à aiguilles         |
| <b>needle roller</b>         | roulement à aiguilles         |
| <b>needle roller cage</b>    | cage de roulement à aiguilles |
| <b>needle valve</b>          | soupape à pointeau            |
| <b>negative camber</b>       | carrossage négatif            |
| <b>negative earth</b>        | masse négative (élect.)       |
| <b>negative lead</b>         | câble négatif                 |
| <b>negative pole</b>         | pole négatif                  |
| <b>neon timing light</b>     | lampe stroboscopique au néon  |
| <b>net weight</b>            | poids net                     |
| <b>neutral</b>               | point mort                    |
| <b>nickel plated</b>         | plaqué au nickel              |
| <b>no charge</b>             | charge nulle                  |
| <b>no delivery</b>           | débit nul                     |
| <b>no-load switch</b>        | contacteur à vide             |
| <b>nominal speed</b>         | vitesse de régime nominale    |
| <b>non-return valve</b>      | clapet anti-retour            |
| <b>non-turbo model</b>       | modèle atmosphérique          |
| <b>notch</b>                 | cran                          |
| <b>notched wheel</b>         | roue crantée                  |
| <b>nozzle</b>                | buse, nez                     |
| <b>nozzle holder</b>         | porte-injecteur               |
| <b>number of revolutions</b> | nombre de tours               |
| <b>nut</b>                   | écrou                         |

## O

|                             |                       |
|-----------------------------|-----------------------|
| <b>octane number/rating</b> | indice d'octane       |
| <b>offset piston pin</b>    | axe de piston décalé  |
| <b>offset radius</b>        | déport au sol         |
| <b>ohc (overhead cam)</b>   | arbre à cames en tête |

|                                          |                                                |
|------------------------------------------|------------------------------------------------|
| <b>ohmmeter</b>                          | ohmmètre                                       |
| <b>ohv (overhead valve)</b>              | soupapes en tête                               |
| <b>oil bath</b>                          | bain d'huile                                   |
| <b>oil can</b>                           | burette d'huile                                |
| <b>oil change</b>                        | vidange d'huile                                |
| <b>oil charge</b>                        | alimentation d'huile                           |
| <b>oil collector</b>                     | collecteur d'huile                             |
| <b>oil cooler</b>                        | refroidisseur d'huile                          |
| <b>oil deflector plate</b>               | défecteur d'huile                              |
| <b>oil dipper rod/oil level dipstick</b> | jauge de niveau d'huile                        |
| <b>oil drain plug</b>                    | bouchon de vidange d'huile                     |
| <b>oil filling plug</b>                  | bouchon de remplissage d'huile                 |
| <b>oil filter</b>                        | filtre à huile                                 |
| <b>oil filter removal tool</b>           | clé à sangle ou à chaîne (pour filtre à huile) |
| <b>oil gauge</b>                         | jauge d'huile                                  |
| <b>oil level</b>                         | niveau d'huile                                 |
| <b>oil line</b>                          | canalisation d'huile                           |
| <b>oil pressure switch</b>               | mancontact d'huile                             |
| <b>oil pump</b>                          | pompe à huile                                  |
| <b>oil pump gears</b>                    | pignons de pompe à huile                       |
| <b>oil pump strainer</b>                 | crépine d'huile                                |
| <b>oil scraper ring</b>                  | segment racleur                                |
| <b>oil seal</b>                          | bague (joint) d'étanchéité                     |
| <b>oil seal seating ring</b>             | bague d'appui de joint d'étanchéité            |
| <b>oil sludge</b>                        | cambouis                                       |
| <b>oil strainer</b>                      | filtre décanteur d'huile                       |
| <b>oil sump</b>                          | carter d'huile                                 |
| <b>oil syringe</b>                       | siringue d'huile                               |

|                                    |                                          |
|------------------------------------|------------------------------------------|
| <b>oil trap</b>                    | déshuileur, séparateur d'huile           |
| <b>oil-carbon deposit</b>          | dépôt charbonneux, dépôt de carbone      |
| <b>oilway</b>                      | canalisation d'huile                     |
| <b>one way valve</b>               | soupape une voie                         |
| <b>open circuit</b>                | circuit ouvert                           |
| <b>out of action</b>               | hors service                             |
| <b>out of balance</b>              | en déséquilibre                          |
| <b>out of round</b>                | faux-rond, ovalisation                   |
| <b>outlet grille (ventilation)</b> | grille orientable                        |
| <b>outlet valve</b>                | soupape d'échappement                    |
| <b>output</b>                      | rendement, débit                         |
| <b>output shaft</b>                | arbre de sortie                          |
| <b>overall length</b>              | longueur hors tout                       |
| <b>overall width</b>               | largeur hors tout                        |
| <b>overcharge</b>                  | surcharge                                |
| <b>overcooling</b>                 | température de moteur anormalement basse |
| <b>overdrive</b>                   | vitesse surmultipliée                    |
| <b>transmission</b>                | surmultiplication                        |
| <b>overflow</b>                    | décharge, trop-plein                     |
| <b>overflow oil line</b>           | raccord de retour                        |
| <b>connection</b>                  |                                          |
| <b>overflow pipe</b>               | conduite de décharge/ trop-plein         |
| <b>overflow valve</b>              | soupape de décharge                      |
| <b>overhaul</b>                    | révision, remise en état                 |
| <b>overhead valve engine</b>       | moteur à soupapes en tête                |
| <b>overheating</b>                 | surchauffe                               |
| <b>overinflation</b>               | surgonflage                              |
| <b>overload</b>                    | surcharge                                |

|                            |                                             |
|----------------------------|---------------------------------------------|
| <b>overload trip</b>       | disjoncteur à maximums                      |
| <b>overpressure</b>        | surpression                                 |
| <b>overrun brake</b>       | frein à inertie                             |
| <b>overrun cut-off</b>     | coupure en retenue                          |
| <b>oversize</b>            | surdimension                                |
| <b>oversteer (v)</b>       | survirer (v)                                |
| <b>overtake (v)</b>        | doubler (v)                                 |
| <b>overweight</b>          | surcharge, surpoids                         |
| <b>oxidation inhibitor</b> | additif antioxydant, inhibiteur d'oxydation |

## P

|                                                  |                                           |
|--------------------------------------------------|-------------------------------------------|
| <b>packing</b>                                   | étanchéification, étanchement             |
| <b>packing box</b>                               | boîte à garniture                         |
| <b>padding</b>                                   | rembourrage                               |
| <b>paraffin oil</b>                              | pétrole brut, huile brute                 |
| <b>parallel connection</b>                       | branchement/ couplage en parallèle        |
| <b>part</b>                                      | pièce                                     |
| <b>part throttle</b>                             | gicleur                                   |
| <b>enrichment jet/valve</b>                      | d'enrichissement d'ouverture partielle    |
| <b>partition</b>                                 | division                                  |
| <b>pawl</b>                                      | cliquet                                   |
| <b>peak power</b>                                | puissance maximale                        |
| <b>peg spanner</b>                               | clé de cheville                           |
| <b>permanent magnet</b>                          | aimant permanent                          |
| <b>petrol</b>                                    | essence                                   |
| <b>petroleum jelly = battery terminal grease</b> | graisse pour bornes de batterie/ vaseline |
| <b>pin bolt</b>                                  | vis-verrou (boulon-verrou)                |



|                               |                                           |                                  |                                                                        |
|-------------------------------|-------------------------------------------|----------------------------------|------------------------------------------------------------------------|
| <b>pin plug</b>               | fiche banane                              | <b>plate</b>                     | plaque, plateau                                                        |
| <b>pin punch</b>              | chasse-goupilles                          | <b>platinum points</b>           | points en platine                                                      |
| <b>pincers</b>                | tenailles                                 | <b>plenum chamber</b>            | réservoir à air                                                        |
| <b>pinch-bolt</b>             | boulon de bridage/serrage                 | <b>pliers</b>                    | pince                                                                  |
| <b>pinion</b>                 | pignon                                    | <b>plug (seal)</b>               | bouchon                                                                |
| <b>pinking</b>                | cliquetis                                 | <b>plug connector</b>            | connecteur enfichable                                                  |
| <b>pintle nozzle</b>          | injecteur à téton                         | <b>plug lead/spark plug lead</b> | fil de bougie                                                          |
| <b>pipe retaining clip</b>    | barrette/collier de maintien de durit     | <b>plug socket</b>               | clé à bougie                                                           |
| <b>piston</b>                 | piston                                    | <b>plunger</b>                   | piston                                                                 |
| <b>piston bush</b>            | bague de piston                           | <b>plunger pump</b>              | pompe refoulante à piston plongeur                                     |
| <b>piston clearance</b>       | jeu radial de piston                      | <b>plunger valve</b>             | soupape à piston                                                       |
| <b>piston displacement</b>    | déplacement de piston                     | <b>pop-rivet</b>                 | rivet                                                                  |
| <b>piston head</b>            | tête de piston                            | <b>positive camber</b>           | carrossage positif                                                     |
| <b>piston pin</b>             | axe de piston                             | <b>post-heating</b>              | post-démarrage                                                         |
| <b>piston pin retainer</b>    | frein d'axe de piston                     | <b>post-heating cut-off</b>      | arrêt de fin de chauffage                                              |
| <b>piston retracting tool</b> | outil à repousser les pistons             | <b>potentiometer</b>             | potentiomètre (résistance variable utilisée pour effectuer un réglage) |
| <b>piston ring</b>            | segment de piston                         | <b>power stroke</b>              | course motrice, course de détente                                      |
| <b>piston ring compressor</b> | outil à comprimer les segments de pistons | <b>power transmission</b>        | boîte de vitesse                                                       |
| <b>piston ring gap</b>        | fente de segment                          | <b>power-assisted steering</b>   | direction assistée                                                     |
| <b>piston skirt</b>           | jupe du piston                            | <b>pre-ignition</b>              | pré-allumage                                                           |
| <b>piston speed</b>           | vitesse du piston                         | <b>pre-load</b>                  | précharge                                                              |
| <b>piston stroke travel</b>   | course de piston                          | <b>premium</b>                   | eurosuper (sans plomb)                                                 |
| <b>piston top</b>             | calotte/plateau de piston                 | <b>premium/super</b>             | super                                                                  |
| <b>pivot</b>                  | pivot                                     | <b>pressure limiting valve</b>   | limiteur non asservi                                                   |
| <b>pivot bolt</b>             | vis-pivot                                 | <b>pressure line</b>             | canalisation de pression                                               |
| <b>pivot post</b>             | linguet                                   | <b>pressure loss tester</b>      | contrôleur de perte de pression                                        |
| <b>pivot-bush</b>             | bague-pivot, bague-palier                 |                                  |                                                                        |
| <b>plain bearing</b>          | palier lisse, palier-glisseur             |                                  |                                                                        |
| <b>Plastigage</b>             | jauge plastique (= Plastigage =)          |                                  |                                                                        |

|                                           |                                                          |                                 |                                                   |
|-------------------------------------------|----------------------------------------------------------|---------------------------------|---------------------------------------------------|
| <b>pressure plate</b>                     | plateau de pression, contre-plateau, plateau d'embrayage | <b>R</b>                        |                                                   |
| <b>pressure reducing valve</b>            | correcteur-réducteur                                     | <b>rack</b>                     | crémaillère                                       |
| <b>pressure regulating valve (brakes)</b> | limiteur de pression (freinage)                          | <b>rack-and-pinion steering</b> | direction à crémaillère, commande par crémaillère |
| <b>pressure relief valve</b>              | soupape de pression, soupape de sûreté, de surpression   | <b>radiator</b>                 | radiateur                                         |
| <b>pressure spring</b>                    | ressort à pression                                       | <b>radiator fan</b>             | ventilateur de radiateur                          |
| <b>pressure switch</b>                    | mancontact                                               | <b>radiator hood</b>            | écran de calandre                                 |
| <b>pressure test</b>                      | test de pression                                         | <b>radiator hose</b>            | durit de radiateur                                |
| <b>primary current</b>                    | courant primaire                                         | <b>ratchet</b>                  | cliquet                                           |
| <b>priming</b>                            | amorçage                                                 | <b>ratchet spanner</b>          | clé à cliquet (réversible)                        |
| <b>priming pump</b>                       | pompe d'amorçage                                         | <b>rated voltage</b>            | tension nominale                                  |
| <b>propeller shaft</b>                    | arbre de transmission                                    | <b>rear axle cover</b>          | couvercle de carter de pont arrière               |
| <b>protective cap</b>                     | chapeau protecteur                                       | <b>rear axle drive</b>          | traction arrière                                  |
| <b>pull rod</b>                           | tringle de liaison                                       | <b>rear axle ratio</b>          | rapport de pont arrière                           |
| <b>pull-back spring</b>                   | ressort de rappel                                        | <b>rear lights</b>              | feux arrière                                      |
| <b>puller</b>                             | extracteur                                               | <b>rear parcel shelf</b>        | plage arrière, tablette arrière                   |
| <b>pulse width</b>                        | largeur d'impulsion                                      | <b>rear window</b>              | lunette arrière                                   |
| <b>pump</b>                               | pompe                                                    | <b>reboring</b>                 | réalésage                                         |
| <b>pump vane</b>                          | palette de pompe                                         | <b>recess</b>                   | encoche                                           |
| <b>punch</b>                              | poinçon                                                  | <b>recessed head screw</b>      | vis cruciforme                                    |
| <b>purifier</b>                           | purificateur, nettoyeur                                  | <b>recharge (v)</b>             | recharger (v)                                     |
| <b>push-on connector</b>                  | connecteur à pression                                    | <b>recirculated air</b>         | air recyclé                                       |
| <b>pushbolt</b>                           | vis-poussoir                                             | <b>recoil (v)</b>               | rembobiner (v)                                    |
| <b>pushrod</b>                            | tige de poussée, tige-poussoir, poussoir                 | <b>recondition (v)</b>          | remettre en état (v)                              |
| <b>quarter-pillar (doors)</b>             | montant (de porte)                                       | <b>reduction gearing</b>        | engrenage réducteur/démultiplicateur              |
|                                           |                                                          | <b>reduction ratio</b>          | rapport réducteur                                 |
|                                           |                                                          | <b>refitting</b>                | repose                                            |
|                                           |                                                          | <b>refrigerant pipes</b>        | canalisations de réfrigérant                      |
|                                           |                                                          | <b>relay</b>                    | relais                                            |
|                                           |                                                          | <b>relay link (seatbelt)</b>    | boucle de renvoi                                  |
|                                           |                                                          | <b>relay plate</b>              | planche à relais                                  |

|                                   |                                                               |                                        |                                                           |
|-----------------------------------|---------------------------------------------------------------|----------------------------------------|-----------------------------------------------------------|
| <b>release bearing (cup)</b>      | butée de débrayage                                            | <b>ring gear</b>                       | couronne                                                  |
| <b>release mechanism (clutch)</b> | débrayage                                                     | <b>ring nut</b>                        | écrou annulaire                                           |
| <b>reliable</b>                   | fiable                                                        | <b>ring terminal</b>                   | cosse ronde, cosse à oeillet                              |
| <b>relief valve</b>               | clapet de sûreté                                              | <b>ring-to-groove clearance</b>        | jeu segment de piston-gorge                               |
| <b>removal</b>                    | dépose                                                        | <b>road clearance/ground clearance</b> | hauteur de coque/ garde au sol                            |
| <b>repair part</b>                | pièce de rechange                                             | <b>road holding</b>                    | tenue de route                                            |
| <b>replacement engine</b>         | moteur de rechange                                            | <b>road test</b>                       | essai sur route                                           |
| <b>rest position</b>              | position de repos                                             | <b>rocker arm/rocker</b>               | culbuteur                                                 |
| <b>restrictor</b>                 | régulateur (refroidissement)                                  | <b>rocker box/cover</b>                | couvre-culasse                                            |
| <b>retainer</b>                   | agrafe de retenue                                             | <b>rocker finger</b>                   | doigt culbuteur                                           |
| <b>retaining plate</b>            | plaquette d'arrêt                                             | <b>rocker inspection cover</b>         | cache-culbuteurs                                          |
| <b>retaining screw</b>            | vis de maintien                                               | <b>rocker shaft</b>                    | axe de culbuteur                                          |
| <b>retaining straps</b>           | bretelles/sangles de retenue                                  | <b>roll</b>                            | roulis                                                    |
| <b>retard the ignition (v)</b>    | retarder l'allumage (v)                                       | <b>roll pin</b>                        | goupille                                                  |
| <b>retracting headline</b>        | phare escamotable                                             | <b>roller bearing</b>                  | roulement à rouleaux                                      |
| <b>return line</b>                | canalisation de rappel                                        | <b>roller cage</b>                     | cage de rouleaux                                          |
| <b>return pump</b>                | pompe de refoulement                                          | <b>roof luggage rack</b>               | galerie                                                   |
| <b>return spring</b>              | ressort de rappel                                             | <b>roof rack load</b>                  | charge sur galerie de toit                                |
| <b>reverse gear</b>               | marche arrière                                                | <b>rotational speed sensor</b>         | capteur de régime                                         |
| <b>reverse gear shaft</b>         | arbre de pignon de marche arrière                             | <b>rotor</b>                           | rotor                                                     |
| <b>reverse order</b>              | ordre inverse                                                 | <b>rotor arm</b>                       | doigt de distributeur                                     |
| <b>reversible ratchet drive</b>   | entraîneur à cliquet réversible                               | <b>rotor winding</b>                   | enroulement/ bobine de rotor                              |
| <b>reversing light</b>            | feu de recul                                                  | <b>roughness</b>                       | à-coups                                                   |
| <b>revolution</b>                 | tour                                                          | <b>round nose pliers</b>               | pince ronde                                               |
| <b>revolution counter</b>         | compte-tours                                                  | <b>round off</b>                       | arrondissement                                            |
| <b>ribbed radiator</b>            | radiateur à ailettes                                          | <b>routine maintenance</b>             | entretien courant                                         |
| <b>rich mixture</b>               | mélange riche                                                 | <b>routing</b>                         | acheminement                                              |
| <b>ride height</b>                | hauteur d'assiette, hauteur sous coque (caisse), garde au sol | <b>rpm (revs per minute)</b>           | tours par minute (tr/min)                                 |
| <b>right-hand wing valance</b>    | passage de roue droit                                         | <b>rubber grommet</b>                  | passe-fil en caoutchouc, oeillet/obturateur en caoutchouc |

|                                |                                          |                                        |                                            |
|--------------------------------|------------------------------------------|----------------------------------------|--------------------------------------------|
| <b>run-in oil</b>              | huile de rodage                          | <b>self-adjusting</b>                  | auto-réglable, à ajustage automatique      |
| <b>run-out</b>                 | excentricité, faux-rond                  | <b>self-adjusting brake</b>            | frein à rattrapage automatique de jeu      |
| <b>run-out (camshaft)</b>      | voile                                    | <b>self-adjusting clutch</b>           | embrayage à rattrapage d'usure automatique |
| <b>running in</b>              | rodage                                   | <b>self-grip wrench</b>                | pince-étai                                 |
| <b>rust-preventive primer</b>  | apprêt antirouille                       | <b>self-locking nut</b>                | écrou indesserrable                        |
| <b>S</b>                       |                                          | <b>self-locking pliers/wrench</b>      | pince-étai                                 |
| <b>saloon</b>                  | berline, 4 portes                        | <b>self-tapping screw</b>              | vis Parker/vis à tête                      |
| <b>scavenge pump</b>           | pompe de balayage                        | <b>semi-automatic</b>                  | semi-automatique                           |
| <b>score</b>                   | rayure, grippage                         | <b>sender unit</b>                     | émetteur, sonde                            |
| <b>scraper</b>                 | grattoir                                 | <b>separator</b>                       | séparateur                                 |
| <b>scraper ring</b>            | bague gratte-huile                       | <b>series connection</b>               | branchement en série                       |
| <b>screw pitch</b>             | pas de vis                               | <b>servo-brake</b>                     | servofrein                                 |
| <b>screwdriver</b>             | tournevis                                | <b>servo-wiring connector</b>          | servo-connecteur                           |
| <b>scriber</b>                 | pointe à marquer                         | <b>set (v)</b>                         | fixer, régler (v)                          |
| <b>scuttle</b>                 | auvent                                   | <b>set collar</b>                      | bague d'arrêt                              |
| <b>scuttle bulkhead cover</b>  | carter d'auvent                          | <b>set of screw taps</b>               | jeu de tarauds                             |
| <b>seal</b>                    | joint, bague                             | <b>shaft drive</b>                     | commande par arbre                         |
| <b>sealant bead</b>            | cordon de pâte d'étanchéité              | <b>shank</b>                           | tige                                       |
| <b>sealing groove</b>          | rainure d'étanchéité                     | <b>shank (connec. rod)</b>             | corps de bielle                            |
| <b>sealing washer</b>          | rondelle d'étanchéité                    | <b>shank (of a twist drill)</b>        | tige (d'une mèche)                         |
| <b>seat angle</b>              | angle de portée                          | <b>shift element (central locking)</b> | élément d'actionnement (verr. central)     |
| <b>seat belt mounting</b>      | ancrage de ceintures de sécurité         | <b>shift lever</b>                     | levier de passage (des vitesses)           |
| <b>seat runner &amp; cover</b> | glissière et couvre-glissière de siège   | <b>shift rod</b>                       | barre de commande                          |
| <b>seat width (valve)</b>      | largeur de portée                        | <b>shim</b>                            | cale/rondelle d'épaisseur                  |
| <b>securing clip</b>           | attache                                  | <b>shock absorber</b>                  | amortisseur                                |
| <b>seepage</b>                 | infiltration, suintements                | <b>short circuit</b>                   | court-circuit                              |
| <b>selector fork</b>           | fourchette de sélection                  |                                        |                                            |
| <b>selector rod</b>            | barre de sélection/ tringle de sélection |                                        |                                            |

|                                           |                                                 |                                 |                                      |
|-------------------------------------------|-------------------------------------------------|---------------------------------|--------------------------------------|
| <b>shoulder</b>                           | épaulement                                      | <b>soft-faced mallet</b>        | marteau à tête tendre                |
| <b>shunt</b>                              | dérivation                                      | <b>solder (v)</b>               | braser (v)                           |
| <b>shut off</b>                           | coupure                                         | <b>solenoid blade</b>           | borne à lamelle du solénoïde         |
| <b>side runout</b>                        | voile latéral                                   | <b>terminal</b>                 | piston de solénoïde                  |
| <b>side valve</b>                         | soupape latérale                                | <b>solenoid plunger</b>         | électrovanne                         |
| <b>sidelights</b>                         | feux de position (avant)                        | <b>solenoid-operated valve</b>  |                                      |
| <b>silencer</b>                           | silencieux                                      | <b>solid bolt</b>               | vis à tige pleine                    |
| <b>single tube shock absorber</b>         | amortisseur monotube                            | <b>source of current</b>        | source de courant                    |
| <b>single-acting wheel brake cylinder</b> | cylindre de frein à simple effet                | <b>spacer</b>                   | rondelle/entretoise                  |
| <b>single-point fuel injection</b>        | injection monopoint                             | <b>spanner</b>                  | clé d'espacement                     |
| <b>skew bevel gear</b>                    | engrenage hypocyloïde, roue conique hélicoïdale | <b>spare parts</b>              | pièces de rechange                   |
|                                           |                                                 | <b>spare wheel</b>              | roue de secours                      |
| <b>skimming</b>                           | surfaçage léger, rectification                  | <b>spark plug</b>               | bougie                               |
| <b>slack</b>                              | mou                                             | <b>spark plug body</b>          | culot de bougie                      |
| <b>slave battery</b>                      | batterie d'appoint                              | <b>spark plug cover</b>         | cache de bougie                      |
| <b>slave cylinder</b>                     | cylindre                                        | <b>spark plug gap</b>           | écartement des électrodes de bougies |
|                                           | récepteur                                       | <b>spark plug socket wrench</b> | clé à tube pour bougies              |
| <b>slide caliper</b>                      | pied à coulisse                                 | <b>spark plug spanner</b>       | clé à bougies                        |
| <b>slide way</b>                          | glissière                                       | <b>speed limiter</b>            | limiteur régime                      |
| <b>slip joint</b>                         | joint coulissant                                | <b>speedometer</b>              | compteur, tachymètre                 |
| <b>slip ring</b>                          | bague collectrice                               | <b>splash guard</b>             | coquille pare-boue                   |
| <b>slot</b>                               | ouïe, fente                                     | <b>spline bit set</b>           | jeu d'embouts avec douille pour vis  |
| <b>slotted nut</b>                        | écrou à fente                                   |                                 | 12 pans creux                        |
| <b>slotted pin</b>                        | goupille fendue                                 | <b>spline key set</b>           | jeu de clés pour vis                 |
| <b>slow running jet</b>                   | gicleur de ralenti                              |                                 | 12 pans creux                        |
| <b>small end (conn. rod)</b>              | pied de bielle                                  | <b>splined shaft</b>            | arbre cannelé                        |
| <b>snap hook</b>                          | anneau d'arrêt à crochets                       | <b>splined washer</b>           | rondelle cannelée                    |
| <b>snap-ring</b>                          | joint à ergots, circlip extérieur               | <b>split collet</b>             | demi-clavette de soupape             |
| <b>snugly fitting</b>                     | effleuré                                        | <b>split cotter</b>             | clavette fendue                      |
| <b>socket</b>                             | douille                                         | <b>split pin</b>                | goupille fendue                      |
| <b>socket type coupling</b>               | accouplement à emboîtement                      | <b>spring</b>                   | ressort                              |
| <b>socket-headed screw</b>                | vis à tête creuse                               |                                 |                                      |

|                              |                                                     |                                     |                                  |
|------------------------------|-----------------------------------------------------|-------------------------------------|----------------------------------|
| <b>spring balance</b>        | peson à ressort                                     | <b>steering rack gaiter</b>         | protecteur de crémaillère        |
| <b>spring bolt</b>           | corps de boulon de ressort, étoquiau                |                                     | soufflet de direction            |
| <b>spring cup</b>            | couvette de ressort                                 | <b>steering wheel stem</b>          | volant                           |
| <b>spring washer</b>         | rondelle à ressort                                  | <b>step bearing</b>                 | queue                            |
| <b>sprocket</b>              | pignon                                              | <b>stop by step</b>                 | palier inférieur                 |
| <b>sprung mass</b>           | masse suspendue                                     | <b>stop screw</b>                   | étape par étape                  |
| <b>spurgear</b>              | renvoi à engrenage droit, réducteur à roues droites | <b>stop-light</b>                   | vis de butée                     |
|                              | freiner/mater                                       | <b>stopping ability</b>             | feu stop                         |
| <b>stake</b>                 | relais de blocage du démarreur                      | <b>strainer</b>                     | capacité de freinage             |
| <b>start-locking relay</b>   | démarreur                                           | <b>strangler</b>                    | filtre, tamis                    |
| <b>starter</b>               | douille de démarreur                                |                                     | étrangleur, starter, volet d'air |
| <b>starter bush</b>          | glicleur de démarreur                               | <b>strengthening bar</b>            | barre de renfort                 |
| <b>starter jet</b>           | démarreur                                           | <b>strengthening bracket</b>        | patte de renfort                 |
| <b>starter motor</b>         | démarreur                                           | <b>stroboscopic timing light</b>    | lampe stroboscopique             |
| <b>starter ring gear</b>     | couronne de démarreur/lancement                     | <b>stroke</b>                       | course                           |
|                              | arbre d'induit, de démarreur                        | <b>stroke-bore ratio</b>            | rapport course-alésage           |
| <b>stay</b>                  | montant, support                                    |                                     | fusée d'essieu                   |
| <b>stay-bolt</b>             | vis d'ancrage traversante                           | <b>stub axle (steering knuckle)</b> |                                  |
| <b>stay bracket</b>          | renfort                                             | <b>stub axle spindle</b>            | pivot de fusée                   |
| <b>steel</b>                 | acier                                               | <b>stud</b>                         | goujon                           |
| <b>steering</b>              | direction                                           | <b>stud extractor</b>               | extracteur de goujons            |
| <b>steering column</b>       | colonne de direction                                | <b>subframe</b>                     | berceau-moteur                   |
| <b>steering damper</b>       | amortisseur de direction                            | <b>suction line</b>                 | canalisation d'aspiration        |
| <b>steering gear</b>         | boîtier (mécanisme) de direction                    | <b>sump</b>                         | carter inférieur                 |
| <b>steering linkage</b>      | timonerie/tringlerie de direction                   | <b>sump drain plug</b>              | bouchon de vidange d'huile       |
| <b>steering lock</b>         | antivol de direction                                | <b>sunroof</b>                      | toit ouvrant                     |
| <b>steering on full lock</b> | braquage à fond                                     | <b>sunroof guide rail</b>           | glissière de toit ouvrant        |
| <b>steering rack</b>         | crémaillère                                         | <b>super</b>                        | super (sans plomb)               |
|                              |                                                     | <b>supercharger</b>                 | compresseur à suralimentation    |
|                              |                                                     | <b>supercharging</b>                | suralimentation                  |

|                          |                                                   |
|--------------------------|---------------------------------------------------|
| support beam             | madrier                                           |
| support strut (tailgate) | béquilles (hayon)                                 |
| supporting bearing       | palier d'appui                                    |
| suppression connector    | connecteur de déparasitage                        |
| suppressor               | éliminateur de brouillage, supprimeur (électron.) |
| surplus                  | excédent, surplus                                 |
| suspension               | suspension                                        |
| suspension strut         | jambe de suspension                               |
| suspension turret        | tourelle d'amortisseur                            |
| swept volume             | cylindrique                                       |
| swinging arm             | bras pivotant, bras de balayage                   |
| swirl chamber            | chambre de tourbillonnement/turbulence            |
| switch                   | contacteur/commutateur                            |
| swivel                   | pivot                                             |
| synchro hub & sleeve     | moyeu et baladeur de synchro                      |
| synchronizer ring        | bague de synchroniseur                            |
| synchronizer sleeve      | manchon extérieur de synchroniseur                |
| <b>T</b>                 |                                                   |
| tachometer               | compte-tours                                      |
| tail light               | feu (de position) arrière                         |
| tailgate                 | hayon                                             |
| tamperproof cap          | bouchon d'inviolabilité                           |

|                      |                                        |
|----------------------|----------------------------------------|
| tap (thread cutter)  | taraud                                 |
| tap and die set      | jeu de tarauds et de filières          |
| taper pin            | goupille conique                       |
| taper-roller bearing | roulement à rouleaux coniques          |
| tapered journal      | portée/tourillon conique               |
| tapered ring         | anneau conique                         |
| tapered seat plug    | bougie d'allumage à épaulement conique |
| tappet               | poussoir                               |
| tappet clearance     | jeu aux soupapes                       |
| tappet guide         | guide de poussoir de soupape           |
| tarpaulin            | prélat, bâche imperméable              |
| TDC                  | PMH (point mort haut)                  |
| temperature gauge    | thermomètre d'eau                      |
| temperature sender   | sonde de température                   |
| temperature switch   | thermocontact                          |
| tensioner link       | bielle de tension                      |
| tensioner pulley     | galet tendeur                          |
| tensioner slipper    | patin de tension                       |
| terminal             | borne                                  |
| test box             | mallette de contrôle                   |
| test lamp            | lampe-témoin                           |
| test meter           | compteur d'essai                       |
| thermostat           | thermostat                             |
| thermostat housing   | boîtier de thermostat                  |
| thermotime switch    | contacteur thermostat                  |
| throttle             | thermotemps                            |
| throttle cable       | papillon                               |
| throttle plate       | câble de papillon papillon             |
|                      | anti-retour                            |

|                        |                                                |
|------------------------|------------------------------------------------|
| throttle valve (plate) | papillon                                       |
| through-bolt           | vis traversante                                |
| through-hole           | trou de passage                                |
| thrust                 | poussée                                        |
| thrust ball-bearing    | palier de butée à billes, butée à billes       |
| thrust collar          | cône de serrage                                |
| thrust plate           | plaquette de calage                            |
| thrust rod             | tige de butée                                  |
| thrust washer          | rondelle de butée                              |
| tie-bar                | tirant                                         |
| tie-rod                | bielle/bare d'accouplement                     |
| time-lag relay         | relais temporisé, relais à retardement         |
| timer                  | temporisateur                                  |
| timing belt            | courroie de distribution                       |
| timing belt cover      | carter de courroie de distribution             |
| timing chain           | tendeur de chaîne de distribution              |
| tensioner              | carter de distribution                         |
| timing gear case       | distributeur                                   |
| timing gears           | distributeur                                   |
| timing light           | lampe stroboscopique                           |
| timing mark            | repère de calage                               |
| toe-in                 | pincement (des roues avant)                    |
| toe-out                | ouverture                                      |
| toe-setting            | parallélisme                                   |
| toothed belt           | courroie crantée/dentée                        |
| top piston ring        | segment de feu, segment « coup de feu »        |
| top up (v)             | faire l'appoint (v)                            |
| torque                 | couple                                         |
| torque converter       | convertisseur de couple                        |
| torque stabiliser      | barre de stabilisation                         |
| torque wrench          | clé dynamométrique                             |
| torque wrench setting  | couple de serrage                              |
| torx key               | clé cannelée Torx                              |
| toughness              | résistance                                     |
| tow bar                | barre de remorquage                            |
| towing                 | remorquage                                     |
| towing eye             | oeillet de remorquage                          |
| towing weight          | poids remorquable                              |
| track width            | voie                                           |
| track-rod arm          | levier d'accouplement, levier de fusée         |
| track-rod end          | bras de direction queue de bielle de direction |
| tracking               | alignement des essieux                         |
| trailing link          | bras oscillant longitudinal                    |
| trailing shoe          | segment secondaire                             |
| train of gears         | train d'engrenage                              |
| transfer port          | lumière de transfert                           |
| transistorised         | allumage transistorisé                         |
| ignition system        | transistorisé                                  |
| transmission           | transmission                                   |
| transverse engine      | moteur transversal                             |
| tread                  | chape, bande de roulement (pneu)               |
| tread wear indicator   | témoin d'usure                                 |
| trigger box            | module/boîtier électronique                    |
| trim cover             | enjoliveur                                     |



|                        |                                           |                     |                                                  |
|------------------------|-------------------------------------------|---------------------|--------------------------------------------------|
| trim panel             | panneau de garniture                      | universal joint     | joint universel/ joint de cardan;                |
| trip mileage indicator | totalisateur partiel, compteur journalier | unleaded            | sans plomb                                       |
| trolley jack           | crie rouleur                              | upper beam          | faisceau de route                                |
| trouble shooting       | dépistage d'anomalies/ défauts            | upstroke            | course ascendante                                |
| trunnion               | pivot, tourillon                          | <b>V</b>            |                                                  |
| tubular drift          | mandrin tubulaire                         | v-belt              | courroie trapézoïdale                            |
| tuning                 | réglage-moteur, mise au point             | v-engine            | moteur en V                                      |
| turbocharger           | turbocompresseur                          | vacuum              | dépression, vide                                 |
| turning circle         | diamètre de braquage                      | vacuum advance      | avance à dépression                              |
| twin-line brake        | frein à deux conduites                    | vacuum gauge        | dépressiomètre, déprimomètre, indicateur de vide |
| twist drill            | foret hélicoïdal                          | vacuum hose         | tuyau de dépression                              |
| two-stroke engine      | moteur deux temps                         | vacuum pump         | pompe à vide                                     |
| tyre                   | pneumatique                               | vacuum servo brake  | servofrein à dépression                          |
| tyre pump              | pompe pour pneus                          | vacuum servo unit   | servo à dépression                               |
| tyre rotation          | permutation des roues                     | vacuum unit         | capsule à dépression                             |
| <b>U</b>               |                                           | vacuum valve        | clapet à dépression                              |
| under size             | sous cote                                 | valve               | soupape                                          |
| underbody              | soubassement                              | valve cap (tyre)    | capuchon de valve (pneu)                         |
| underinflation         | sous-gonflage                             | valve clearance     | jeu aux soupapes                                 |
| undershield            | carénage inférieur                        | valve core          | obus de valve                                    |
| understeer (v)         | sous-virer (v)                            | valve cover         | couvre-culasse                                   |
| union                  | raccord                                   | valve cover bracket | patte d'ancrage du couvre-culasse                |
| union nut              | écrou de raccord                          | valve gear          | commande de soupape                              |
| universal coupling     | accouplement cardan                       | valve grinder       | ventouse                                         |
| universal electrical   | multimètre électrique                     | valve grinding      | rodage pour soupapes                             |
| multimeter             | universel                                 | valve grinding tool | rodoir de soupape                                |

|                                      |                                                  |                         |                                                                                             |
|--------------------------------------|--------------------------------------------------|-------------------------|---------------------------------------------------------------------------------------------|
| valve guide                          | guide de soupape                                 | vernier calipers        | pied à coulisse                                                                             |
| valve inner spring                   | ressort intérieur de soupape                     | vice                    | étau                                                                                        |
| valve lap                            | ouverture simultanée, chevauchement des soupapes | vin plate               | plaque d'identification                                                                     |
| valve mating surface                 | portée de soupape                                | voltage                 | tension                                                                                     |
| valve refacer                        | rectifieuse de soupapes                          | voltage regulator       | régulateur de tension                                                                       |
| valve reseating                      | rectification de siège de soupape                | voltmeter               | voltmètre                                                                                   |
| valve seat                           | siège/portée de soupape                          | <b>W</b>                |                                                                                             |
| valve seat insert                    | siège de soupape rapporté                        | warm-up valve           | électrovanne de réchauffage                                                                 |
| valve split cotter                   | clavette fendue de soupape                       | warning light           | témoin d'alerte                                                                             |
| valve spring                         | compresseur de ressort de soupape                | warning signal          | signal d'alerte                                                                             |
| compressor                           | cuvette, coupelle                                | warning triangle        | triangle de présignalisation                                                                |
| valve spring                         | siège de ressort de soupape                      | warp                    | gondolage, gauchissement, voilement                                                         |
| retainer                             | tige de soupape                                  | washer                  | rondelle                                                                                    |
| valve spring seat                    | poussoir                                         | washer jet              | gicleur de lave-glace(s)                                                                    |
| valve stem                           | diagramme/calage de distribution                 | water galleries/jacket  | chemise d'eau                                                                               |
| valve tappet                         | bille de soupape                                 | water pump              | pompe à eau                                                                                 |
| valve timing                         | modèle utilitaire/ commercial                    | water temperature gauge | jauge de température d'eau                                                                  |
| valve ball                           | carburateur à diffuseur variable                 | water-cooled            | refroidi par l'eau                                                                          |
| van model                            | numéros d'identification du véhicule             | water-tight             | étanche                                                                                     |
| variable-venturi                     | métal de caisse                                  | wattage                 | consommation en watt                                                                        |
| carburettor                          | durité d'évent                                   | wax-type thermostat     | thermostat à cire/à papillon                                                                |
| vehicle identification numbers (vin) | bloc de ventilation                              | wear                    | usure                                                                                       |
| vent pipe                            | venturi/diffuseur                                | weatherstrip            | bourrelet, joint d'étanchéité, joint de portière, joint de coulisseau de vitre, lèche-vitre |
| ventilation unit                     |                                                  | wedge                   | cale, clavette                                                                              |
| venturi                              |                                                  |                         |                                                                                             |

|                               |                                    |                              |                                                                   |
|-------------------------------|------------------------------------|------------------------------|-------------------------------------------------------------------|
| <b>welding transformer</b>    | transformateur de soudage          | <b>wiring diagram</b>        | schéma électrique                                                 |
| <b>wheel alignment</b>        | parallélisme des roues             | <b>wiring grommet</b>        | anneau passe-fils                                                 |
| <b>wheel balance</b>          | équilibre des roues                | <b>wiring harness/loom</b>   | faisceau électrique                                               |
| <b>wheel base</b>             | empattement                        | <b>wiring plug</b>           | fiche de connexion électrique                                     |
| <b>wheel hub</b>              | moyeu de roue                      | <b>woodruff key</b>          | clé Woodruff/clé demi-lune                                        |
| <b>wheel lock-up</b>          | blocage des roues                  | <b>worm</b>                  | vis sans fin                                                      |
| <b>wheel rim</b>              | jante                              | <b>worm and nut steering</b> | direction à vis et écrou                                          |
| <b>wheel slip</b>             | patinage                           | <b>worm-drive hose clip</b>  | collier de serrage à vis sans fin                                 |
| <b>winding</b>                | bobinage, enroulement              | <b>worn out</b>              | usé                                                               |
| <b>window crank mechanism</b> | lève-glace                         | <b>wrist pin</b>             | axe de piston, tourillon de pied de bielle; axe de pied de bielle |
| <b>window regulator</b>       | lève-vitre(s)                      |                              |                                                                   |
| <b>windscreen</b>             | pare-brise                         |                              |                                                                   |
| <b>windscreen washers</b>     | lave-glaces (de pare-brise)        |                              |                                                                   |
| <b>windscreen wipers</b>      | essuie-glaces (de pare-brise)      |                              |                                                                   |
| <b>wing nut</b>               | écrou à oreilles                   |                              |                                                                   |
| <b>wiper</b>                  | essuie-glace                       |                              |                                                                   |
| <b>wiper motor</b>            | moteur d'essuie-glaces             |                              |                                                                   |
| <b>wire brush</b>             | brosse métallique                  |                              |                                                                   |
| <b>wire gauge</b>             | jauge à fils calibrés              |                              |                                                                   |
| <b>wire retaining ring</b>    | jonc d'arrêt                       |                              |                                                                   |
| <b>wiring bracket</b>         | patte de maintien/ support de fils |                              |                                                                   |
|                               |                                    | <b>X</b>                     |                                                                   |
|                               |                                    | <b>x-cross member</b>        | traverse en X                                                     |
|                               |                                    | <b>x-frame</b>               | cadre en X                                                        |
|                               |                                    | <b>Y</b>                     |                                                                   |
|                               |                                    | <b>y-alloy</b>               | alliage en Y                                                      |