

o.8 Safety first!

Professional mechanics are trained in safe working procedures. However enthusiastic you may be about getting on with the job at hand, take the time to ensure that your safety is not put at risk. A moment's lack of attention can result in an accident, as can failure to observe simple precautions.

There will always be new ways of having accidents, and the following is not a comprehensive list of all dangers; it is intended rather to make you aware of the risks and to encourage a safe approach to all work you carry out on your bike.

Asbestos

- Certain friction, insulating, sealing and other products - such as brake pads, clutch linings, gaskets, etc. - contain asbestos. Extreme care must be taken to avoid inhalation of dust from such products since it is hazardous to health. If in doubt, assume that they do contain asbestos.

Fire

- Remember at all times that petrol is highly flammable. Never smoke or have any kind of naked flame around, when working on the vehicle. But the risk does not end there - a spark caused by an electrical short-circuit, by two metal surfaces contacting each other, by careless use of tools, or even by static electricity built up in your body under certain conditions, can ignite petrol vapour, which in a confined space is highly explosive. Never use petrol as a cleaning solvent. Use an approved safety solvent.

- Always disconnect the battery earth terminal before working on any part of the fuel or electrical system, and never risk spilling fuel on to a hot engine or exhaust.

- It is recommended that a fire extinguisher of a type suitable for fuel and electrical fires is kept handy in the garage or workplace at all times. Never try to extinguish a fuel or electrical fire with water.

Fumes

- Certain fumes are highly toxic and can quickly cause unconsciousness and even death if inhaled to any extent. Petrol vapour comes into this category, as do the vapours from certain solvents such as trichloro-ethylene. Any draining or pouring of such volatile fluids should be done in a well ventilated area.

- When using cleaning fluids and solvents, read the instructions carefully. Never use materials from unmarked containers - they may give off poisonous vapours.

- Never run the engine of a motor vehicle in an enclosed space such as a garage. Exhaust fumes contain carbon monoxide which is extremely poisonous; if you need to run the engine, always do so in the open air or at least have the rear of the vehicle outside the workplace.

The battery

- Never cause a spark, or allow a naked light near the vehicle's battery. It will normally be giving off a certain amount of hydrogen gas, which is highly explosive.

- Always disconnect the battery ground (earth) terminal before working on the fuel or electrical systems (except where noted).

- If possible, loosen the filler plugs or cover when charging the battery from an external source. Do not charge at an excessive rate or the battery may burst.

- Take care when topping up, cleaning or carrying the battery. The acid electrolyte, even when diluted, is very corrosive and should not be allowed to contact the eyes or skin. Always wear rubber gloves and goggles or a face shield. If you ever need to prepare electrolyte yourself, always add the acid slowly to the water; never add the water to the acid.

Electricity

- When using an electric power tool, inspection light etc., always ensure that the appliance is correctly connected to its plug and that, where necessary, it is properly grounded (earthed). Do not use such appliances in damp conditions and, again, beware of creating a spark or applying excessive heat in the vicinity of fuel or fuel vapour. Also ensure that the appliances meet national safety standards.

- A severe electric shock can result from touching certain parts of the electrical system, such as the spark plug wires (HT leads), when the engine is running or being cranked, particularly if components are damp or the insulation is defective. Where an electronic ignition system is used, the secondary (HT) voltage is much higher and could prove fatal.

Remember...

X Don't start the engine without first ascertaining that the transmission is in neutral. **X Don't** suddenly remove the pressure cap from a hot cooling system - cover it with a cloth and release the pressure gradually first, or you may get scalded by escaping coolant. **X Don't** attempt to drain oil until you are sure it has cooled sufficiently to avoid scalding you.

X Don't grasp any part of the engine or exhaust system without first ascertaining that it is cool enough not to burn you. **X Don't** allow brake fluid or antifreeze to contact the machine's paintwork or plastic components.

X Don't siphon toxic liquids such as fuel, hydraulic fluid or antifreeze by mouth, or allow them to remain on your skin. **X Don't** inhale dust - it may be injurious to health (see Asbestos heading). **X Don't** allow any spilled oil or grease to remain on the floor - wipe it up right away, before someone slips on it. **X Don't** use ill-fitting spanners or other tools which may slip and cause injury. **X Don't** lift a heavy component which may be beyond your capability - get assistance.

X Don't rush to finish a job or take unverified short cuts.

X Don't allow children or animals in or around an unattended vehicle.

X Don't inflate a tyre above the recommended pressure. Apart from overstressing the carcass, in extreme cases the tyre may blow off forcibly.

• **Do** ensure that the machine is supported securely at all times. This is especially important when the machine is blocked up to aid wheel or fork removal.

</ **Do** take care when attempting to loosen a stubborn nut or bolt. It is generally better to pull on a spanner, rather than push, so that if you slip, you fall away from the machine rather than onto it.

• **Do** wear eye protection when using power tools such as drill, sander, bench grinder etc.

• **Do** use a barrier cream on your hands prior to undertaking dirty jobs - it will protect your skin from infection as well as making the dirt easier to remove afterwards; but make sure your hands aren't left slippery. Note that long-term contact with used engine oil can be a health hazard.

• **Do** keep loose clothing (cuffs, ties etc. and long hair) well out of the way of moving mechanical parts.

• **Do** remove rings, wristwatch etc., before working on the vehicle - especially the electrical system.

• **Do** keep your work area tidy - it is only too easy to fall over articles left lying around.

• **Do** exercise caution when compressing springs for removal or installation. Ensure that the tension is applied and released in a controlled manner, using suitable tools which preclude the possibility of the spring escaping violently.

• **Do** ensure that any lifting tackle used has a safe working load rating adequate for the job.

• **Do** get someone to check periodically that all is well, when working alone on the vehicle.

• **Do** carry out work in a logical sequence and check that everything is correctly assembled and tightened afterwards.

• **Do** remember that your vehicle's safety affects that of yourself and others. If in doubt on any point, get professional advice. • If in spite of following these precautions, you are unfortunate enough to injure yourself, seek medical attention as soon as possible.

Identification numbers 09

Frame and engine numbers

The frame serial number is stamped into the right side of the steering head. The engine number is stamped into the top of the crankcase on the right-hand side of the engine. Both of these numbers should be recorded and kept in a safe place so they can be furnished to law enforcement officials in the event of a theft. There is also a carburettor identification number on the intake side of each carburettor body, and a colour code label on the top of the rear fender under the passenger seat. The colour code label may also contain the bike's production year and model code.

The frame serial number, engine serial number, carburettor identification number and colour code should also be kept in a handy place (such as with your driver's licence) so they are always available when purchasing or ordering parts for your machine.

The procedures in this manual identify the bikes by model type (eg TDM) and if necessary by production year. Note that the production year does not necessarily correspond with the year of sale or registration.

The model code number is very useful when ordering parts for your bike and is linked to the production year as shown in the accompanying table. There should be a sticker on the bike's rear frame section (usually visible once the seat is lifted) which gives the model code number (eg 4TX4, meaning a 1999 TDM), the Yamaha production code number, and a letter indicating the colour code. The frame and engine numbers can also be used to establish the production year and model code, although these are not available for post-1995 models. The accompanying table gives model identification data for models available in the UK market.

Model type	ProdYr	Model code	Frame No.	Engine No.
TDM850	1991	3VD1	000101 on	000101 on
	1992	3VD4	022101 on	022101 on
	1993	3VD5	040101 on	040101 on
	1994	3VD7	060101 on	060101 on
	1995	3VD9	079101 on	079101 on
	1996	4TX1	not available	
	1997	4TX2	not available	
	1998	4TX3	not available	
	1999	4TX4	not available	
	TRX850	1996	4UN1	000101 on
1997		4UN3	not available	
1998/9		4UN4	not available	
XTZ750	1989	3LD1	000101 on	000101 on
	1990	3UD3	032101 on	032101 on
	1991	3LD4	048101 on	048101 on
	1992	3LD5	063101 on	063101 on
	1993	3LD6	079101 on	079101 on
	1994	3LD7	092101 on	092101 on
	1995	3LD8	100101 on	100101 on



The engine number is stamped into the top of the crankcase on the right-hand side of the engine.



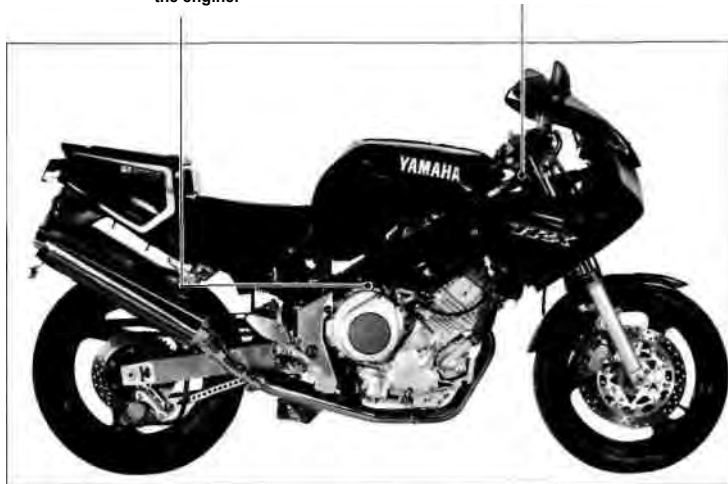
The frame number is stamped on the right-hand side of the steering head

Buying spare parts

Once you have found all the identification numbers, record them for reference when buying parts. Since the manufacturers change specifications, parts and vendors (companies that manufacture various components on the machine), providing the ID numbers is the only way to be reasonably sure that you are buying the correct parts.

Whenever possible, take the worn part to the dealer so direct comparison with the new component can be made. Along the trail from the manufacturer to the parts shelf, there are numerous places that the part can end up with the wrong number or be listed incorrectly.

The two places to purchase new parts for your motorcycle - the accessory store and the franchised dealer - differ in the type of parts they carry. While dealers can obtain virtually every part for your motorcycle, the accessory dealer is usually limited to normal high wear items such as shock absorbers, tune-up parts, various engine gaskets, cables, chains,



brake parts, etc. Rarely will an accessory outlet have major suspension components, cylinders, transmission gears, or cases.

Used parts can be obtained for roughly half the price of new ones, but you can't always be sure of what you're getting. Once again, take

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ard for direct comparison.

Whether buying new, used or rebuilt parts, the best course is to deal directly with someone who specialises in parts for your particular make.

o.io Daily (pre-ride) checks

Note: The daily (pre-ride) checks outlined in the owner's manual covers those items which should be inspected on a daily basis.

1 Engine/transmission oil level check

Level check procedure

- Position the bike upright (not on its sidestand) on a level surface.
- On 1991 to 1995 TDM models, remove the seat (see Chapter 8). On XTZ models, remove the right-hand side cover (see Chapter 8).
- Check the oil level as shown in the appropriate photo sequence and top up if necessary.
- Now start the engine and warm it up to normal operating temperature.

Caution: Do not run the engine in an enclosed space such as a garage or workshop.

- With the bike still in an upright position, let it idle for a further 10 seconds then stop the engine.

- Taking care to avoid scalding your hands, recheck the oil level and top up if necessary.

The correct oil

- Modern, high-revving engines place great demands on their oil. It is very important that the correct oil for your bike is used.
- Always top up with a good quality oil of the specified type and viscosity and do not overfill the oil tank.

Caution: Yamaha advise against using chemical oil additives, or oils with a grade of SH/CD or higher, or oils labelled ENERGY CONSERVING II. Such additives or oils could cause clutch slip.

Oil type	API grade SE, SF or SG
Oil viscosity	SAE10W30or10W40

Bike care:

- If you have to add oil frequently, you should check whether you have any oil leaks. If there is no sign of oil leakage from the joints and gaskets the engine could be burning oil (see *Fault Finding*).

TDM850 (1991 to 1995) and XTZ750 models



On TDM models, remove the seat (see Chapter 8) to access the oil filler cap (arrowed).



On XTZ models, remove the right-hand side cover (see Chapter 8) to access the oil filler cap (arrowed).



Unscrew the oil filler cap from the oil tank. The dipstick is integral with the oil filler cap, and is used to check the engine oil level. Check the condition of the cap O-ring and renew it if damaged or deteriorated.



4 Using a clean rag or paper towel, wipe all oil from the dipstick. Insert the clean dipstick back into the tank, but do not screw it in.



Remove the dipstick and observe the level of the oil, which should be somewhere in between the F (full) and E (empty) level lines (arrowed).

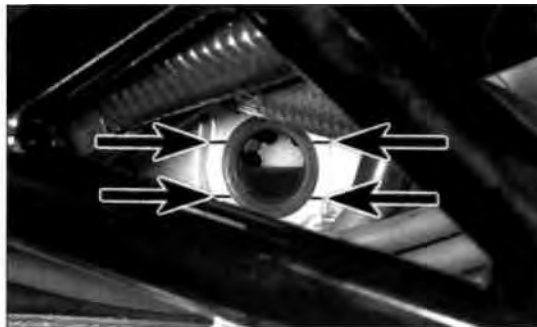


If the level is below the E line, top the oil tank up with the recommended grade and type of oil, to bring the level up to the F line on the dipstick. Do not overfill.

TDM850 (1996-on) and TRX models



Wipe the oil level window (arrowed) in the oil tank so that it is clean.



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With the motorcycle held vertical, the oil level should lie between the upper and lower level lines marked on the oil tank (arrowed).



9 If the level is below the lower line, remove the filler cap (arrowed) from the top of the oil tank.



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Top the tank up with the recommended grade and type of oil, to bring the level up to the upper line on the window.

0.12 Daily (pre-ride) checks

2 Brake fluid level checks

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Warning: Brake hydraulic fluid can harm your eyes and damage painted surfaces, so use extreme caution when handling and pouring it and cover surrounding surfaces with rag. Do not use fluid that has been standing open for some time, as it absorbs moisture from the air which can cause a dangerous loss of braking effectiveness.

Before you start:

- Support the motorcycle in an upright position, using an auxiliary stand if required.
- When checking the front brake fluid level turn the handlebars until the top of the master cylinder is as level as possible.
- On XTZ models remove the right-hand side cover to view the rear brake fluid level (see Chapter 8).
- Make sure you have the correct hydraulic fluid. DOT 4 is recommended.
- Wrap a rag around the reservoir being worked on to ensure that any spillage does not come into contact with painted surfaces.

Bike care:

- The fluid in the front and rear brake master cylinder reservoirs will drop slightly as the brake pads wear down.
- If any fluid reservoir requires repeated topping-up this is an indication of an hydraulic leak somewhere in the system, which should be investigated immediately.
- Check for signs of fluid leakage from the hydraulic hoses and components - if found, rectify immediately.
- Check the operation of both brakes before taking the machine on the road; if there is evidence of air in the system (spongy feel to lever or pedal), it must be bled as described in Chapter 7.

Front brake fluid level



1 On TDM and XTZ models, the front brake fluid level is visible through the window in the reservoir body - it must be above the LOWER level line (arrowed).



2 On TRX models, the front brake fluid level is visible through the reservoir body - it must be between the UPPER and LOWER level lines (arrowed).

On TRX models, if the level is below the LOWER



3 On TDM and XTZ models, if the level is below the LOWER level line, remove the two reservoir cover screws and remove the cover and the diaphragm.



4 On TRX models, if the level is below the LOWER level line, remove the reservoir cap clamp screw (arrowed), then unscrew the cap and remove the plate and the diaphragm.

5 Top up with new clean hydraulic fluid of the

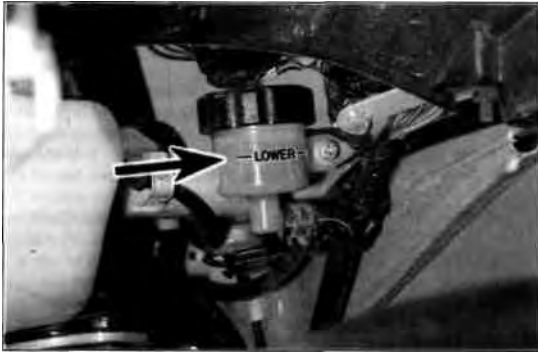


recommended type, until the level is above the LOWER level line. Take care to avoid spills (see **Warning** above).



6 Ensure that the diaphragm is correctly seated before installing the plate (TRX models) and cover or cap.

Rear brake fluid level



7 On TDM models, the rear brake fluid level is visible by looking up under the seat from the left-hand side of the rear wheel - it must be above LOWER level line (arrowed).



8 On TRX models, the rear brake fluid level is visible through the reservoir body - it must be above LOWER level line (arrowed).



9 On XTZ models, remove the right-hand side cover (see Chapter 8) - the rear brake fluid level is visible through the reservoir body - it must be above LOWER level line (arrowed).



10 If topping up is required, on TDM models remove the seat and on TRX models remove the side covers (see Chapter 8). On TRX and XTZ models, remove the cap clamp, then on TRX models support the reservoir or refit the screw. Unscrew the reservoir cap (arrowed) and remove the plate and diaphragm.



11 Top up with new clean hydraulic fluid of the recommended DOT 4 type, until the level is above the lower mark. Take care to avoid spills (see Warning above).



12 Ensure that the diaphragm is correctly seated before installing the plate and cap. Tighten the cap securely. On TRX and XTZ models, fit the cap clamp.

0*14 Daily (pre-ride) checks

3 Coolant level check

A **Warning:** *DO NOT remove the radiator pressure cap to add coolant. Topping up is done via the coolant reservoir tank filler. DO NOT leave open containers of coolant about, as it is poisonous.*

Before you start:

- Make sure you have a supply of coolant available - a mixture of 50% distilled water and 50% corrosion inhibited ethylene glycol anti-freeze is needed. **Note:** *Yamaha specify that soft tap water can be used, but NOT hard*

water. If in doubt, boil the water first or use only distilled water.

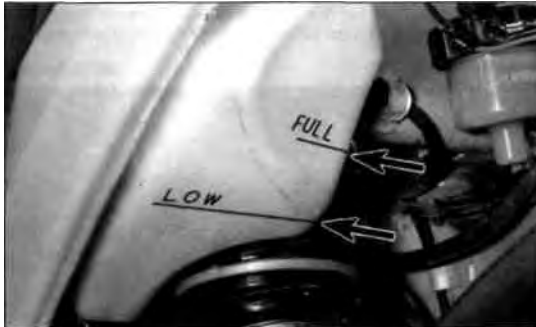
- Always check the coolant level when the engine is cold.
- Support the motorcycle in an upright position, using an auxiliary stand if required, whilst checking the level. Make sure the motorcycle is on level ground.

Bike care:

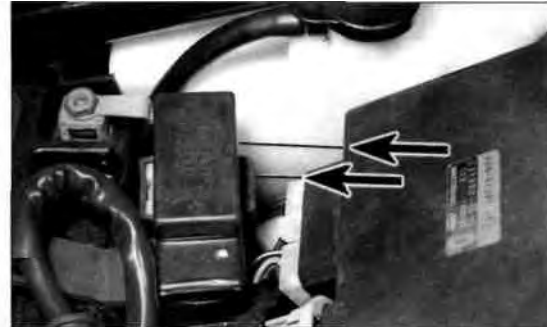
- Use only the specified coolant mixture. It is important that anti-freeze is used in the system all year round, and not just in the

winter. Do not top the system up using only water, as the system will become too diluted.

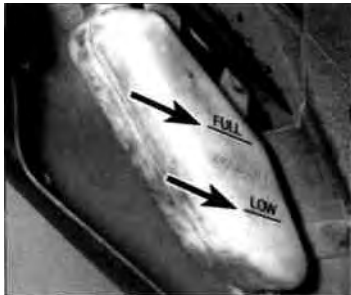
- Do not overfill the reservoir tank. If the coolant is significantly above the UPPER level line at any time, the surplus should be siphoned or drained off to prevent the possibility of it being expelled out of the breather hose.
- If the coolant level falls steadily, check the system for leaks (see Chapter 1). If no leaks are found and the level continues to fall, it is recommended that the machine is taken to a Yamaha dealer for a pressure test.



On TDM models, the coolant reservoir FULL and LOW level lines are visible by looking up under the seat from the left-hand side of the rear wheel. The coolant level lines (arrowed) are marked on the reservoir.



On TRX models, remove the seat (see Chapter 8). The coolant FULL and LOW level lines (arrowed) are marked on the inside of the reservoir.



3 On XTZ models, the coolant reservoir FULL and LOW level lines are visible by looking up under the mudguard from the right-hand side of the rear wheel. The coolant level lines (arrowed) are marked on the reservoir.



4 If the coolant level is not between the UPPER and LOWER markings, on TDM models remove the seat and on XTZ models the left-hand side cover (see Chapter 8). Remove the reservoir filler cap.



5 Top the coolant level up with the recommended coolant mixture. Fit the cap securely, then install the seat, and on XTZ models the side cover (see Chapter 8).

Daily (pre-ride) checks 0.15

4 Tyre checks

The correct pressures:

- The tyres, must be checked when **cold**, not immediately after riding. Note that low tyre pressures may cause the tyre to slip on the rim or come off. High tyre pressures will cause abnormal tread wear and unsafe handling.
- Use an accurate pressure gauge.
- Proper air pressure will increase tyre life and provide maximum stability and ride comfort.

Tyre care:

- Check the tyres carefully for cuts, tears, embedded nails or other sharp objects and excessive wear. Operation of the motorcycle with excessively worn tyres is extremely hazardous, as traction and handling are directly affected.
- Check the condition of the tyre valve and ensure the dust cap is in place.
- Pick out any stones or nails which may have become embedded in the tyre tread. If left, they will eventually penetrate through the casing and cause a puncture.
- If tyre damage is apparent, or unexplained loss of pressure is experienced, seek the advice of a tyre fitting specialist without delay.

Loading/speed	Front	Rear
1991 to 1995 TDM models Rider only Rider and passenger, or high speed	28 psi (2.0 Bar) 28 psi (2.0 Bar)	33 psi (2.25 Bar) 36 psi (2.50 Bar)
1996-on TDM models All loads/speeds	33 psi (2.25 Bar)	40 psi (2.75 Bar)
TRX models Rider only Rider and passenger, or high speed	33 psi (2.25 Bar) 36 psi (2.50 Bar)	36 psi (2.50 Bar) 41 psi (2.80 Bar)
XTZ models Rider only Rider and passenger, or high speed	33 psi (2.25 Bar) 33 psi (2.25 Bar)	33 psi (2.25 Bar) 36 psi (2.50 Bar)

Tyre tread depth:

- At the time of writing UK law requires that tread depth must be at least 1 mm over 3/4 of the tread breadth all the way around the tyre, with no bald tyre sidewall to locate the indicator bar and patches. Many riders, however, consider a minimum of 2 mm tread depth to be a safer limit. Yamaha recommend a minimum of 1.5 mm on the front and 2 mm on the rear.
- Many tyres now incorporate wear indicators in the tread. Identify the triangular pointer on the tread. replace the tyre if the tread has worn down to the

1 Check the tyre pressures when the tyres are cold and keep them properly inflated.



2 Measure tread depth at the centre of the tyre using a tread depth gauge.



3 Tyre tread wear indicator bar location marking (usually either an arrow, a triangle or the letters TWI) on the sidewall (arrowed).

Chapter 1

Routine maintenance and Servicing

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Degrees of difficulty

Easy , suitable for novice with little experience	kk	Fairly easy , suitable for beginner with some experience	ljs	Fairly difficult , suitable for competent DIY mechanic	kk	Difficult , suitable for experienced DIY mechanic	^, 3Q	.&	Very difficult, suitable for expert DIY or professional	2S
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1.2 Routine maintenance

Specifications

Engine

Cylinder identification.....	No. 1 (left-hand), no. 2 (right-hand)
Spark plugs	
Type	NGK DPR8EA-9 or Nippondenso X24EPR-U9
Electrode gap	0.8 to 0.9 mm
Engine idle speed	
TDM 1991 to 1995 models.....	1000 to 1200 rpm
TDM 1996-on models and all TRX models	1050 to 1250 rpm
XTZ models	1100 to 1200 rpm
Carburettor synchronisation - intake vacuum	
TDM 1991 to 1995 models.....	250 to 270 mm Hg
TDM 1996-on models	270 to 290 mm Hg
TRX and XTZ models	240 to 260 mm Hg
Carburettor synchronisation - max. difference between carburettors	
TDM 1991 to 1995 models and all XTZ models	10 mm Hg
TDM 1996-on models and all TRX models	5 mm Hg
Valve clearances (COLD engine)	
Inlet valves	0.15 to 0.20 mm
Exhaust valves	0.25 to 0.30 mm
Cylinder compression TDM	
1991 to 1995 models	
Standard	152 psi (10.5 Bar)
Maximum	158 psi (10.9 Bar)
Minimum	146 psi (10.1 Bar)
Max. difference between cylinders	14.5 psi (1.0 Bar)
TDM 1996-on models and all TRX models	
Standard	175 psi (12.0 Bar)
Maximum	182 psi (12.5 Bar)
Minimum	145 psi (10.0 Bar)
Maximum difference between cylinders	14.5 psi (1.0 Bar)
XTZ models	
Standard	138 psi (9.5 Bar)
Maximum	144 psi (9.9 Bar)
Minimum	132 psi (9.1 Bar)
Maximum difference between cylinders	14.5 psi (1.0 Bar)

Cycle parts

Drive chain slack	
TDM models	40 to 50 mm
TRX models	20 to 30 mm
XTZ models	25 to 35 mm
Front brake lever freeplay (XTZ models)	2 to 5 mm
Rear brake pedal height (see text)	
TDM 1991 to 1995 models.....	17 to 41 mm 29
TDM 1996-on models	mm 57 mm 5 to
TRX models	25 mm
XTZ models	
Brake pad friction material wear limit	0.5 mm 1.5
TDM and TRX models	mm
XTZ models	
Clutch cable freeplay	8 to 12 mm
TDM 1991 to 1995 models.....	10 to 15 mm
All other models	
Throttle cable freeplay	3 to 7 mm
TRX models	3 to 5 mm
All other models	see <i>Daily (pre-ride) checks</i>
Tyre pressures (cold) and minimum tread depth	
Swingarm - XTZ models	0.4 to 0.7 mm 90.95 to
Side clearance	91.10mm 80.95 to
Bearing spacer length (right-hand)	81.10 mm 1.9 to 2.0
Bearing spacer length (left-hand).....	mm
Washer thickness	

Torque settings

Rear axle nut	
TDM 1991 to 1995 models	105 Nm

Routine maintenance 1.3**Recommended lubricants and fluids**

Engine/transmission oil type.....	API grade SE, SF or SG motor oil*
Engine/transmission oil viscosity	SAE 10W30 or 10W40
Engine/transmission oil capacity TDM 1991 to 1995 models and all XTZ models	
Oil change	3.8 litres
Oil and filter change	3.9 litres
Following engine overhaul - dry engine, new filter	4.2 litres
TDM 1996-on models and all TRX models	
Oil change	3.5 litres
Oil and filter change	3.6 litres
Following engine overhaul - dry engine, new filter	4.2 litres
Coolant type	50% distilled water, 50% corrosion-inhibited ethylene glycol anti freeze. Note: <i>Yamaha specify that soft tap water can be used, but NOT hard water. If in doubt, boil the water first or use only distilled water.</i>
Coolant capacity	
Radiator and engine	1.7 litres
Reservoir	
XTZ models.....	0.45 litre
All other models	0.3 litre
Brakefluid	DOT4
Front fork oil type, capacity and level	see Chapter 6 Specifications
Drive chain	SAE 30 to 50W engine oil or chain lubricant suitable for O-ring chains
Steering head bearings	Lithium-based multi-purpose grease
Swingarm pivot bearings - TDM and TRX models.....	Molybdenum disulphide grease
Swingarm pivot bearings - XTZ models.....	Lithium-based multi-purpose grease
Suspension linkage bearings - TRX models	Molybdenum disulphide grease
Suspension linkage bearings - XTZ models	Lithium-based multi-purpose grease
Wheel bearings and grease seal lips.....	Lithium-based multi-purpose grease
Gearchange lever/clutch lever/front brake lever/rear brake pedal/sidestand pivots.....	10W30 motor oil
Cables.....	10W30 motor oil
Throttle grip	Multi-purpose grease or dry film lubricant

**Yamaha advise against using chemical oil additives, or oils with a grade of SH/CD or higher, or oils labelled ENERGY CONSERVING II. Such additives or oils could cause clutch slip.*

TDM 1996-on models.....	107 Nm
TRX models.....	117 Nm
XTZ models	90 Nm
Rear brake caliper bracket bolt (TDM models).....	35 Nm
Crankcase oil drain plug.....	35 Nm
Oil filter housing drain plug.....	30 Nm
Oil filter cover bolts.....	10 Nm
Steering head bearing adjuster nut (using service tool) 1991 to 1995 TDM models	
Initial setting	52 Nm
Final setting	3 Nm
1996-on TDM models and all TRX models	
Initial setting	48 Nm
Final setting	16 Nm
XTZ models	
Initial setting	38 Nm
Final setting	6 Nm
Steering stem nut	
1991 to 1995 TDM models.....	110 Nm
1996-on TDM models	108 Nm
TRX models.....	110 Nm
Steering stem bolt (XTZ models)	80 Nm
Fork clamp bolts (top yoke)	23 Nm
Cooling system drain plugs	10Nm
Oil gallery bolt.....	10 Nm

1.4 Component locations



TDM

- 1 Rear brake fluid reservoir
- 2 Oil level window (1996-on)
- 3 Oil filler cap (1996-on)
- 4 Front brake fluid reservoir
- 5 Throttle cable upper adjuster
- 6 Radiator pressure cap
- 7 Coolant drain plug on water pump
- 8 Clutch cable lower adjuster
- 9 Oil filter and filter housing drain plug
- 10 Battery (1996-on)



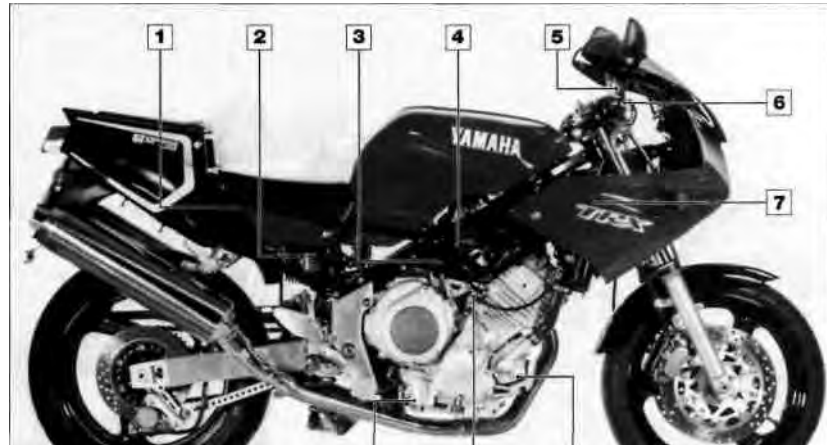
TDM

- 1 Steering head bearings
- 2 Clutch cable upper adjuster
- 3 Air filter
- 4 Battery (1991 to 1995)
- 5 Oil filler cap/dipstick (1991 to 1995)
- 6 Coolant reservoir
- 7 Drive chain adjuster
- 8 Idle speed adjuster
- 9 Oil drain plug

Component locations 1.5

TRX

- 1 Coolant reservoir
- 2 Rear brake fluid reservoir
- 3 Oil level window
- 4 Oil filler cap
- 5 Front brake fluid reservoir
- 6 Throttle cable upper adjuster
- 7 Radiator pressure cap
- 8 Coolant drain plug on water pump
- 9 Clutch cable lower adjuster
- 10 Oil filter and filter housing drain plug

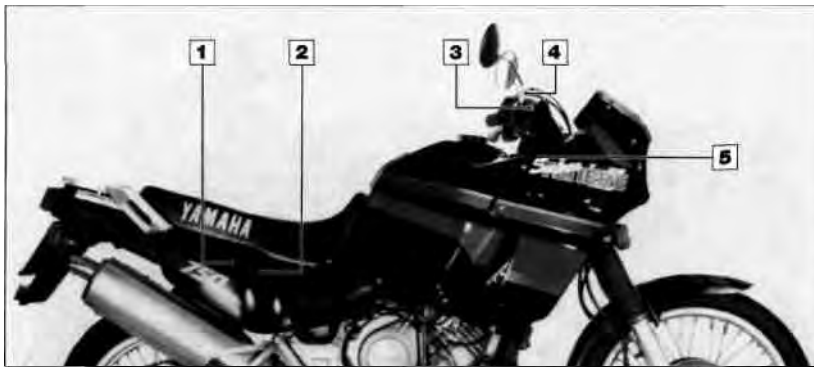


TRX

- 1 Clutch cable upper adjuster
- 2 Steering head bearing adjuster
- 3 Air filter
- 4 Idle speed adjuster
- 5 Battery
- 6 Drive chain adjuster
- 7 Oil drain plug



.6 Component locations



XTZ

- 1 Rear brake fluid reservoir
 - 2 Oil filler cap/dipstick
 - 3 Throttle cable upper adjuster
 - 4 Front brake fluid reservoir
 - 5 Steering head bearing adjuster
 - 6 Coolant drain plug on water pump
 - 7 Clutch cable lower adjuster
 - 8 Oil filter and filter housing drain plug
- Radiator pressure cap
Clutch cable upper adjuster
Air filter
Battery
Coolant reservoir



XTZ

- 1 Drive chain adjuster
- 2 Oil drain plug
- 3
- 4
- 5
- 6
- 7

Maintenance schedule w

Note: The daily (pre-ride) checks outlined in the owner's manual covers those items which should be inspected on a daily basis. Always perform the pre-ride inspection at every maintenance interval (in addition to the procedures listed). The intervals listed below are the intervals recommended by the manufacturer for each particular operation during the model years covered in this manual. Your owner's manual may have different intervals for your model.

Daily (pre-ride)

- See 'Daily (pre-ride) checks' at the beginning of this

After the initial 600 miles (1000 km)

Note: This check is usually performed by a Yamaha dealer after the first 600 miles (1000 km) from new. Thereafter, maintenance is carried out according to the following intervals of the schedule.

Every 300 miles (500 km)

- Check, adjust and lubricate the drive chain (Section 1)

Every 4000 miles (6000 km) or 6 months (whichever comes sooner)

- Check the spark plug gaps and plug condition (Section 2)
- Check and adjust the idle speed (Section 3)
- D Check/adjust the carburettor synchronisation (Section 4)
- Clean and check the air filter element (Section 5)
- Check the fuel system and hoses (Section 6) D
- Change the engine oil (Section 7)
- 0 Check the brake pads (Section 8)
- Check the brake system and brake light switch operation (Section 9)
- Check and adjust the clutch (Section 10)
- Check the battery (Section 11)
- D Check the condition of the wheels and tyres (Section 12)
- Check the wheel bearings (Section 13)
- Check the sidestand (Section 14)
- Check the tightness of all nuts, bolts and fasteners (Section 15)
- Check the cooling system (Section 16)
- Check and adjust the throttle and choke cables (Section 17)
- D Lubricate the clutch/gearshift/brake lever/brake pedal/sidestand pivots and the throttle/choke/clutch cables (Section 18)

Every 4000 miles (6000 km) or 6 months (whichever comes sooner) (continued)

- Re-grease the swingarm and suspension linkage bearings (XTZ models) (Section 19).
- Check the suspension (Section 20)
- Check and adjust the steering head bearings (Section 21)

Every 8000 miles (12,000 km) or 12 months (whichever comes sooner)

Carry out all the items under the 4000 mile (6000 km) check, plus the following:

- Change the engine oil and filter (Section 22)
- Renew the fuel filter (1999 TDM models) (Section 23)

Every 16,000 miles (24,000 km) or two years (whichever comes sooner)

Carry out all the items under the 8000 mile (12,000 km) check, plus the following:

- Re-grease the swingarm and suspension linkage bearings (TDM and TRX models) (Section 24).
- Re-grease the steering head bearings (Section 25).
- D Change the brake fluid and renew the brake master cylinder and caliper seals (see Section 26)
- Renew the coolant (Section 27)

Every 28,000 miles (42,000 km)

Carry out all the items under the 4000 mile (6000 km) check, plus the following:

- Check and adjust the valve clearances (Section 28)

Every four years

- Renew the brake hoses (Section 29)

Non-scheduled maintenance

- Check and adjust the headlight aim (Section 30)
- Check the cylinder compression (Section 31)
- Check the engine oil pressure (see Section 32)
- Renew the fuel hoses (Section 33)
- Change the front fork oil (Section 34)

1.8 Introduction

1 This Chapter is designed to help the home mechanic maintain his/her motorcycle for safety, economy, long life and peak performance.

2 Deciding where to start or plug into the routine maintenance schedule depends on several factors. If the warranty period on your motorcycle has just expired, and if it has been maintained according to the warranty standards, you may want to pick up routine maintenance as it coincides with the next mileage or calendar interval. If you have owned the machine for some time but have

never performed any maintenance on it, then you may want to start at the nearest interval and include some additional procedures to ensure that nothing important is overlooked. If you have just had a major engine overhaul, then you may want to start the maintenance routine from the beginning. If you have a used machine and have no knowledge of its history or maintenance record, you may desire to combine all the checks into one large service initially and then settle into the maintenance schedule prescribed. 3 Before beginning any maintenance or

repair, the machine should be cleaned thoroughly, especially around the oil filter, spark plugs, valve cover, side panels, carburetors, etc. Cleaning will help ensure that dirt does not contaminate the engine and will allow you to detect wear and damage that could otherwise easily go unnoticed.

4 Certain maintenance information is sometimes printed on decals attached to the motorcycle. If the information on the decals differs from that included here, use the information on the decal.

Every 300 miles (500 km)

1 Drive chain and sprockets - check, adjustment and lubrication

Check

1 A neglected drive chain won't last long and can quickly damage the sprockets. Routine chain adjustment and lubrication isn't difficult and will ensure maximum chain and sprocket life.

2 To check the chain, place the bike on its sidestand and shift the transmission into neutral.

3 Push up on the bottom run of the chain and measure the slack midway between the two sprockets, then compare your measurement

to that listed in this Chapter's Specifications (see illustration). As the chain stretches with wear, adjustment will periodically be necessary (see below). Since the chain will rarely wear evenly, roll the bike forwards so that another section of chain can be checked; do this several times to check the entire length of chain and position the tightest spot midway between the sprockets on the bottom run of the chain.

4 In some cases where lubrication has been neglected, corrosion and galling may cause the links to bind and kink, which effectively shortens the chain's length. Such links should be thoroughly cleaned and worked free. If the chain is tight between the sprockets, rusty or kinked, it's time to renew it. If you find a tight area, mark it with felt pen or paint, and repeat

the measurement after the bike has been ridden. If the chain's still tight in the same area, it may be damaged or worn. Because a tight or kinked chain can damage the transmission countershaft bearing, it's a good idea to renew it.

5 Check the entire length of the chain for damaged rollers, loose links and pins, and missing O-rings and renew it if damage is found.

Note: Never install a new chain on old sprockets, and never use the old chain if you install new sprockets - renew the chain and sprockets as a set.

6 If you suspect that the chain may be worn out, you can measure a 10-link length and compare it with the wear limit. This requires the chain to be removed from the bike and first cleaned (see Chapter 6).

7 Remove the front sprocket cover (see Chapter 6). Check the teeth on the engine sprocket and the rear wheel sprocket for wear (see illustration).

8 Inspect the drive chain slider on the swingarm for excessive wear and renew it if worn (see Chapter 6).

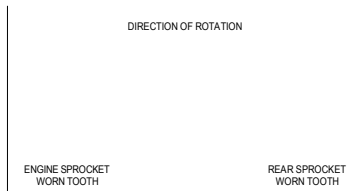
Adjustment

9 Rotate the rear wheel until the chain is positioned with the tightest point at the centre of its bottom run, then place the machine on its sidestand. On TDM models, slacken the brake calliper bracket bolt on the top of the swingarm (see illustration).

10 Where fitted, remove the split pin from the rear axle nut. Slacken the nut (see illustrations).



1.3 Push up on the chain and measure the slack



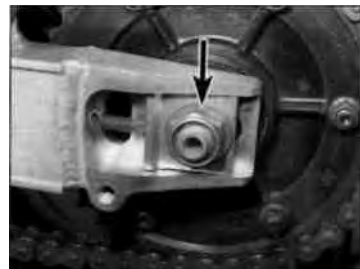
1.7 Check the sprockets in the areas indicated to see if they are worn excessively



1.9 On TDM models, slacken the bolt (arrowed)



1.10a Rear axle nut (arrowed) - TDM models



1.10b Rear axle nut (arrowed) - TRX models

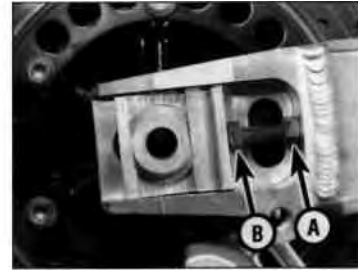
Every 300 miles (500 km) 1.9



1.11a On TDM and XTZ models, slacken the locknut (arrowed)...



1.11b ... and turn the adjuster as required



1.11c On TRX models, slacken the locknut (A) and turn the adjuster (B) as required

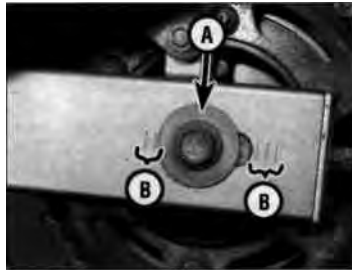
11 Slacken the adjuster locknut on each side of the swingarm, then turn the adjusters evenly until the amount of freeplay specified at the beginning of the Chapter is obtained at the centre of the bottom run of the chain (see illustrations). Following chain adjustment, check that each chain adjustment marker is in the same position in relation to the marks on the swingarm (see illustrations). It is important each adjuster aligns with the same notch; if not, the rear wheel will be out of alignment with the front. **Note:** If you need to check wheel alignment refer to Chapter 7.

12 If there is a discrepancy in the chain adjuster positions, adjust one of them so that its position is exactly the same as the other. Check the chain freeplay as described above and readjust if necessary.

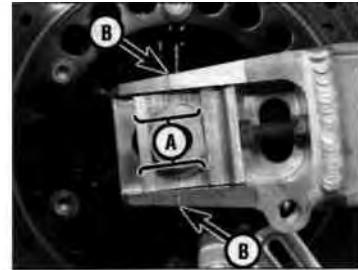
13 Tighten the axle nut to the torque setting specified at the beginning of the Chapter, then tighten the adjuster locknuts securely (see illustration). Where removed, fit a new split pin onto the axle nut (see illustration). On TDM models, tighten the brake caliper bracket bolt to the specified torque (see illustration 1.9). **Caution:** On models with a split pin securing the axle nut, if the groove in the nut does not align with the hole in the axle after the specified torque has been reached, tighten the nut to align it - DO NOT loosen it.

Lubrication

14 If required, wash the chain in paraffin



1.11d On TDM and XTZ models, check the relative position of the marker (A) and the notches (B) on each side



1.110 On TRX models, check the relative position of the marker (A) and the notches in the swingarm (B) on each side

(kerosene), then wipe it off and allow it to dry, using compressed air if available. If the chain is excessively dirty it should be removed from the machine and allowed to soak in the paraffin (see Chapter 6). **Caution:** Don't use petrol, solvent or other cleaning fluids which might damage the internal sealing properties of the chain. Don't use high-pressure water. The entire process shouldn't take longer than ten minutes - if it does, the O-rings in the chain rollers could be damaged. 15 For routine lubrication, the best time to lubricate the chain is after the motorcycle has been ridden. When the chain is warm, the lubricant will penetrate the joints between the

side plates better than when cold. **Note:** Yamaha specifies SAE 30 to 50W engine oil; you can use an aerosol chain lube, but make sure that it is suitable for O-ring chains. Apply the oil to the area where the side plates overlap - not the middle of the rollers (see illustration). centrifugal force will work the oil into the chain when the bike is moving.

JJOTJT31 ~ PPLY the oil to the top of UhhJMKI the lower chain run, so

HINT

After applying the lubricant, let it soak in a few minutes before wiping off any excess.



1.13a Tighten the axle nut to the specified torque



1.13b Use a new split pin, where appropriate



1.15 Apply the oil to the overlap in the side plates

i.io Every 4000 miles (6000 km) or 6 months

Every 4000 miles (6000 km) or 6 months

2 Spark plugs - check and adjustment

1

- 1 Make sure your spark plug socket is the correct size (18 mm) before attempting to remove the plugs - a suitable one is supplied in the motorcycle's tool kit which is stored under the seat.
- 2 On XTZ models, remove the fuel tank and the air filter housing (see Chapter 4).
- 3 Using compressed air if available, clean the area around the base of the spark plugs to prevent any dirt falling into the engine when the plugs are removed.
- 4 Check that the cylinder location is marked on each plug lead, then pull the spark plug cap off each spark plug (see illustration). Using either the plug tool supplied in the bike's toolkit or a deep socket type wrench, unscrew the plugs from the cylinder head (see illustration). Lay each plug out in relation to its cylinder; if either plug shows up a problem it will then be easy to identify the troublesome cylinder.
- 5 Inspect the electrodes for wear. Both the centre and side electrodes should have square edges and the side electrodes should be of uniform thickness. Look for excessive deposits and evidence of a cracked or chipped insulator

around the centre electrode. Compare your spark plugs to the colour spark plug reading chart at the end of this manual. Check the threads, the washer and the ceramic insulator body for cracks and other damage.

6 If the electrodes are not excessively worn, and if the deposits can be easily removed with a wire brush, the plugs can be re-gapped and re-used (if no cracks or chips are visible in the insulator). If in doubt concerning the condition of the plugs, renew them, as the expense is minimal. Yamaha do not specify a renewal interval, but leave it to the discretion of the owner.

7 Cleaning spark plugs by sandblasting is permitted, provided you clean the plugs with a high flash-point solvent afterwards.

8 Before installing the plugs, make sure they are the correct type and heat range and check the gap between the electrodes (see illustrations). Compare the gap to that specified and adjust as necessary. If the gap must be adjusted, bend the side electrode only and be very careful not to chip or crack the insulator nose (see illustration). Make sure the washer is in place on the plug before installing it.

9 Since the cylinder head is made of aluminium, which is soft and easily damaged, thread the plugs into the heads turning the tool by hand (see illustration). Once the

plugs are finger-tight, the job can be finished with a spanner on the tool supplied or a socket drive (see illustration 1.4b). If a torque wrench can be applied, tighten the spark plugs to the specified torque setting. Otherwise tighten them by 1/4 to 1/2 turn after they have been fully hand-tightened and have seated. Do not over-tighten them.

recessed, you can slip a

TTTTT33 -As the plugs are quite

HINT

short length of hose over the end of the plug to use as a tool to thread it into place. The hose will grip the plug well enough to turn it, but will start to slip if the plug begins to cross-thread in the hole - this will prevent damaged threads.

10 Reconnect the spark plug caps, making sure they are securely connected to the correct cylinder. Install all other components previously removed.

PIJHJS Stripped plug threads in the HUIUSJ cylinder head can be

repaired with a Heli-Coil® insert - see Tools and Workshop Tips® in the Reference section.

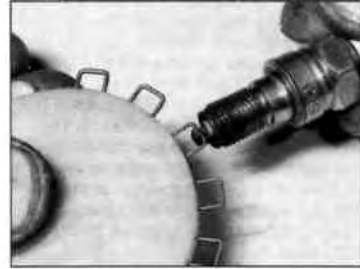
HiMT



2.4a Remove the spark plug cap...



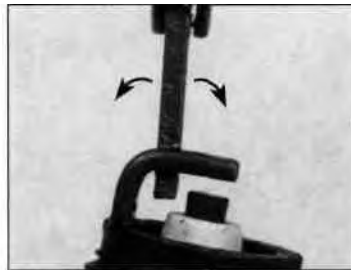
2.4b ... then unscrew the spark plug



2.8a Using a wire type gauge to measure the spark plug electrode gap



2.8b Using a feeler gauge to measure the spark plug electrode gap



2.8c Adjust the electrode gap by bending the side electrode only



2.9 Thread the plug in as far as possible by turning the tool by hand

Every 4000 miles (6000 km) or 6 months 1.1.1



3.3a Idle speed adjuster screw (arrowed) - TDM models



3.3b Idle speed adjuster screw (arrowed) - TRX models

3 Idle speed - check and adjustment

1 The idle speed should be checked and adjusted before and after the carburetors are synchronised (balanced) and when it is obviously too high or too low. Before adjusting the idle speed, make sure the valve clearances and spark plug gaps are correct. Also, turn the handlebars back-and-forth and see if the idle speed changes as this is done. If it does, the throttle cable may not be adjusted or routed correctly, or may be worn out. This is a dangerous condition that can cause loss of control of the bike. Be sure to correct this problem before proceeding.

2 The engine should be at normal operating temperature, which is usually reached after 10 to 15 minutes of stop-and-go riding. Make sure the transmission is in neutral, and place the motorcycle on its sidestand.

3 On TDM and TRX models, the idle speed adjuster is located on the left-hand side (see illustrations). On XTZ models, the adjuster is located at the back of the carburetors between the float chambers. With the engine idling, adjust the idle speed by turning the adjuster screw until the idle speed listed in this Chapter's Specifications is obtained. Turn the screw clockwise to increase idle speed, and anti-clockwise to decrease it.

4 Snap the throttle open and shut a few times, then recheck the idle speed. If necessary, repeat the adjustment procedure.

5 If a smooth, steady idle can't be achieved, the fuel/air mixture may be incorrect (check the pilot screw settings - see Chapter 4) or the carburetors may need synchronising (see Section 4). Also check the inlet manifold rubbers for cracks which will cause an air leak, resulting in a weak mixture.

4 Carburetors - synchronisation

A **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.**



Warning: Take great care not to burn your hand on the hot engine unit when accessing the

gauge take-off points on the intake manifolds. Do not allow exhaust gases to build up in the work area; either perform the check outside or use an exhaust gas extraction system.

1 Carburettor synchronisation is simply the process of adjusting the carburetors so they pass the same amount of fuel/air mixture to each cylinder. This is done by measuring the vacuum produced in each cylinder. Carburetors that are out of synchronisation will result in decreased fuel mileage, increased engine temperature, less than ideal throttle response and higher vibration levels. Before synchronising the carburetors, make sure the valve clearances and idle speed are properly set.

2 To properly synchronise the carburetors you will need a pair of vacuum gauges or a manometer; these instruments measure engine vacuum and can be obtained from motorcycle dealers or mail order parts suppliers. If you don't have access to either of these instruments entrust the work to a dealer.

3 Start the engine and let it run until it reaches normal operating temperature, then shut it off.

4 Remove the fuel tank (see Chapter 4).

5 On 1991 to 1998 TDM models, release the clamp securing the No. 1 cylinder vacuum hose to the fuel pump and detach the hose, then pull the blanking plug out of the end of the No. 2 cylinder vacuum hose (see illustrations). If in doubt, trace each hose from the take-off stub on the top of each inlet manifold between the carburettor and the cylinder head to make sure you have the correct one. On 1999 TDM models, pull the blanking plug out of both vacuum hoses situated down the right-hand side of the engine; if in doubt about their location, trace the hoses from their take-off stubs on the inlet manifolds.

6 On TRX models, release the clamp securing the No. 2 cylinder hose to the fuel pump and detach the hose (see illustration). The No. 1 cylinder vacuum hose has already been detached from the fuel tap when removing the fuel tank. If in doubt, trace each hose from the take-off stub on the top of each intake



4.5a On TDM models, detach the No. 1 vacuum hose (arrowed) from the fuel pump...

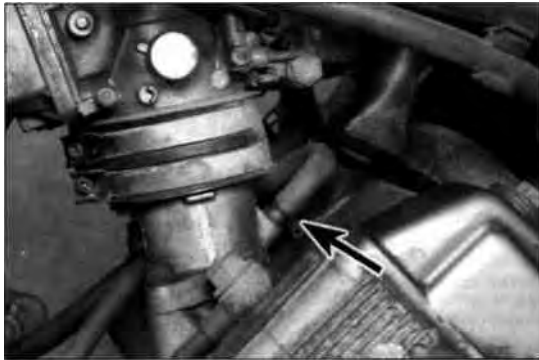


4.5b ... and remove the blanking plug (arrowed) from the No. 2 hose

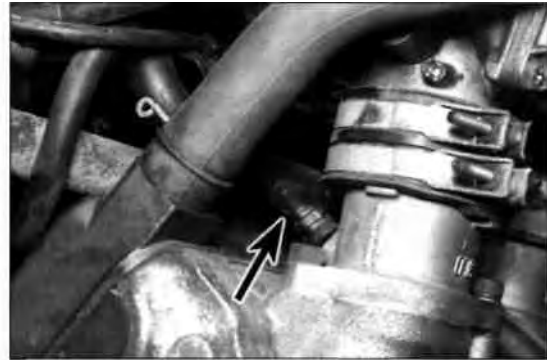


4.6 On TRX models, detach the No. 2 vacuum hose (arrowed) from the fuel pump

1.12 Every 4000 miles (6000 km) or 6 months



4.7a On XTZ models, detach the vacuum hose (arrowed).



4.7b ... and remove the blanking plug (arrowed)



4.12 Carburettor synchronisation screw (arrowed) - air filter housing removed for clarity

manifold between the carburettor and the cylinder head to make sure you have the correct one. If access is not too restricted, the hoses can be detached from the intake manifolds themselves.

7 On XTZ models, release the clamps securing the vacuum hose and the blanking plug to the take-off stubs on the inlet manifolds between the carburettor and the cylinder head and detach the hose and plug (see illustrations).

8 On TDM and TRX models, connect the gauges to the vacuum hose ends. On XTZ

models, connect the gauge hoses to the takeoff stubs on the inlet manifolds. Make sure there are no air leaks as false readings will result.

9 Arrange a temporary fuel supply, either by using a small temporary tank or by using extra long fuel pipes to the now remote fuel tank. Alternatively, position the tank on a suitable base on the motorcycle, taking care not to scratch any paintwork, and making sure that the tank is safely and securely supported. If using the main tank, switch the tap to ON or RES on TDM and XTZ models, and to PRI on TRX models.

10 Start the engine and let it idle. If the gauges are fitted with damping adjustment, set this so that the needle flutter is just eliminated but so that they can still respond to small changes in pressure.

11 The vacuum readings for both cylinders should be the same. If the vacuum readings differ, proceed as follows.

12 The carburettors are adjusted by turning the synchronising screw situated in-between the carburettors, in the throttle linkage (see illustration). **Note:** Do not press down on the screw whilst adjusting it, otherwise a false reading will be obtained. When the carburettors are synchronised, open and close the throttle quickly a few times to settle

the linkage, and recheck the gauge readings, readjusting if necessary.

13 When the adjustment is complete, recheck the vacuum readings, then adjust the idle speed (see Section 3) until the speed listed in this Chapter's Specifications is obtained. Detach the temporary fuel supply, then remove the gauges. Refit the vacuum hoses and/or blanking plugs as required by your model (see Steps 9, 10 and 11).

14 Install the fuel tank (see Chapter 4).

5 Air filter - cleaning

1 Remove the fuel tank (see Chapter 4). On XTZ models, also remove the air filter housing (see Chapter 4); it is possible to remove the covers and elements with the housing in situ but access to the screws is restricted and the screws are easily dropped.

2 On TDM and TRX models remove the screws securing the air filter cover to the filter housing, then remove the cover and withdraw the filter element from the housing (see illustrations).

3 On XTZ models, there are two filter elements, each fitted integral with its cover on the front of the housing (see illustrations).



5.2a Remove the screws (arrowed) and lift off the cover...



5.2b .. then withdraw the element (TDM shown)



5.3a Remove the screws (arrowed)...



5.3b ... and remove the cover and element together



5.4 Clean the element using compressed air if available



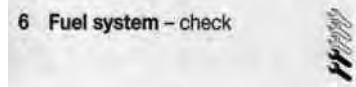
5.6 Make sure the element is correctly seated

4 Tap the element on a hard surface to dislodge any large particles of dirt, then if compressed air is available, use it to clean the element, directing the air from the inside out (see illustration).

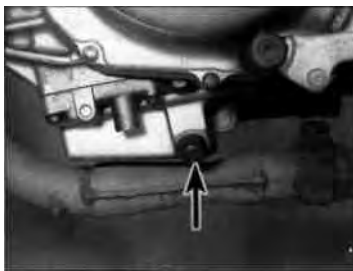
5 Check the element for signs of damage. If the element is torn or cannot be cleaned, or is obviously beyond further use, renew it.

6 Install the filter element, making sure it is properly seated, and install the fuel tank (see Chapter 4).

Caution: If the machine is ridden in dusty conditions, the filter should be cleaned more frequently.



A **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.



7.4a Unscrew the crankcase oil drain plug (arrowed)...

Check

1 Remove the fuel tank (see Chapter 4) and check the tank, the fuel tap, the fuel pump and the fuel and vacuum hoses for signs of leakage, deterioration or damage; in particular check that there is no leakage from the fuel hoses. Renew any hoses which are cracked or deteriorated.

2 If the fuel tap is leaking, tighten the assembly screws (see Chapter 4). If leakage persists remove the screws and disassemble the tap, noting how the components fit. Inspect all components and renew any that are worn or damaged. Some components are available individually, though it may be necessary to renew the whole tap, depending on your model.

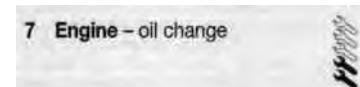
3 If the carburettor gaskets are leaking, the carburettors should be disassembled and rebuilt using new gaskets and seals (see Chapter 4).

Filter cleaning

4 Cleaning or renewal of the fuel filter is advised after a particularly high mileage has been covered. It is also necessary if fuel starvation is suspected.

5 On TRX, XTZ and 1991 to 1998 TDM models, the fuel filters are mounted in the tank. On TDM models, the filters are integral with the fuel outlet assembly from the tank. On TRX and XTZ models, the filters are integral with the fuel tap. On XTZ models, each fuel tap has its own filter. Remove the

fuel tank and the fuel tap(s) (see Chapter 4). Clean the gauze filter to remove all traces of dirt and fuel sediment. Check the gauze for holes. If any are found, a new filter should be fitted (check for availability - it may be necessary to renew the whole tap). Check the condition of the O-ring and renew it if it is in any way damaged or deteriorated. 6 On 1999 TDM models and in-line fuel filter is fitted between the fuel tap and fuel pump. Refer to Section 23 for details.



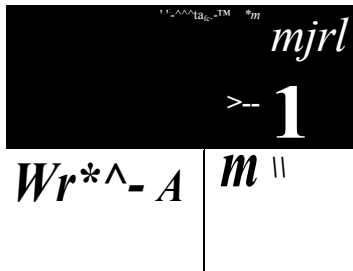
A **Warning:** Be careful when draining the oil, as the exhaust pipes, the engine, and the oil itself can cause severe burns.

1 Consistent routine oil and filter changes are the single most important maintenance procedure you can perform on a motorcycle. The oil not only lubricates the internal parts of 4 the engine, transmission and clutch, but it also acts as a coolant, a cleaner, a sealant, and a protectant. Because of these demands, the oil takes a terrific amount of abuse and should be changed often with new oil of the recommended grade and type. Saving a little money on the difference in cost between a good oil and a cheap oil won't pay off if the engine is damaged. The oil filter should be changed with every second oil change.

2 Before changing the oil, warm up the engine so the oil will drain easily.

3 Put the motorcycle on its sidestand, and position a clean drain tray below the engine. On 1991 to 1995 TDM models remove the seat, and on XTZ models remove the right-hand side cover (see Chapter 8). Unscrew the oil filler cap from the oil tank to vent it and to act as a reminder that there is no oil in the engine (see Daily (pre-ride) checks).

4 First unscrew the oil drain plug from the crankcase and allow the oil to flow into the drain tray (see illustrations). Next unscrew the oil drain plug from the oil filter housing and



7.4b ... and allow the oil to drain

1.14 Every 4000 miles (6000 km) or 6 months



8 Brake pads – wear check

1 Each brake pad has wear indicators that can be viewed without removing the pads from the caliper.

2 On TDM and TRX models, the turned-in corners of the brake pad backing material form the wear indicators - when they are almost contacting the disc itself the pads must be renewed. The indicators are visible by looking at the bottom corner of the pads (see illustration).

Caution: Do not allow the pads to wear to the extent that the indicators contact the disc itself as the disc will be damaged.

3 On XTZ models, the indicators are in the form of grooves in the brake pad friction material - when the pads are worn so that the grooves are only just visible the pads must be renewed (see illustration).

4 If the pads are worn to or beyond the indicators, they must be renewed. If the pads are dirty or if you are in doubt as to the amount of friction material remaining, remove them and measure the amount of friction material (see Chapter 7). **Note: Some after-market pads may use different indicators to those on the original equipment as shown.**

5 Refer to Chapter 7 for details of pad renewal.

6 Bikes used in the UK and anywhere where salt is used on the roads are referred to Chapter 7, Section 2, Step 9 for details of brake pad and caliper lubrication to prevent

7.4c Unscrew the oil filter housing drain plug (arrowed)...

allow the oil to flow into the drain tray (see illustrations). Check the condition of the sealing washers on the drain plugs and discard them if they are in any way damaged or worn. On 1996-on TDM and TRX models, Yamaha specify using new ones as a matter of course.

5 When the oil has completely drained, fit the plugs to the crankcase and oil filter housing, using new sealing washers if required, and tighten them to the torque settings specified at the beginning of the Chapter. Avoid overtightening, as damage to the crankcase will result.

6 Refill the oil tank to the proper level using the recommended type and amount of oil (see *Daily (pre-ride) checks* and this chapter's specifications). With the motorcycle vertical, the oil level should lie between the maximum and minimum level lines on the dipstick or inspection window (according to model) (see *Daily (pre-ride) checks*). Install the filler cap. Start the engine and let it run for two or three minutes. It is advisable to perform an oil pressure check (see Section 32). Stop the engine, wait a few minutes, then check the oil level. If necessary, add more oil to bring the level up to the maximum level line on the dipstick or window. Check around the drain plugs for leaks.

7 The old oil drained from the engine cannot

7.4d

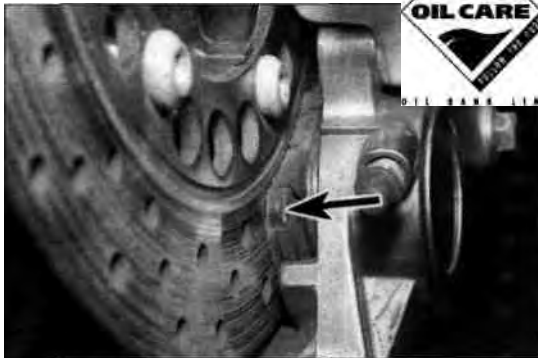
Warning! Check the old oil carefully - if it is very metallic coloured,

then the engine is experiencing wear from break-in (new engine) or from insufficient lubrication. If there are flakes or chips of metal in the oil, then something is drastically wrong internally and the engine will have to be disassembled for inspection and repair. If there are pieces of fibre-like material in the oil, the clutch is experiencing excessive wear and should be checked.

Note: It is antisocial and illegal to dump oil down the drain. To find the location of your local oil recycling bank, call this number free.

9 Brake system – check

1 A routine general check of the brake system will ensure that any problems are discovered and remedied before the rider's safety is jeopardised.



8.2 Brake pad wear indicator (arrowed) - TDM and TRX models (TRX shown)



8.3 Brake pad wear indicator groove (arrowed) - XTZ models

Every 4000 miles (6000 km) or 6 months LIS



9.3 Flex the brake hoses and check for cracks, bulges and leaking fluid



9.5a Rear brake light switch ■ TDM models



9.5b Rear brake light switch - TRX models

2 Check the brake lever and pedal for loose connections, improper or rough action, excessive play, bends, and other damage. Renew any damaged parts (see Chapter 7). Clean and lubricate the lever and pedal pivots if their action is stiff or rough (see Section 18).

3 Make sure all brake fasteners are tight. Check the brake pads for wear (see Section 8) and make sure the fluid level in the reservoirs is correct (see *Daily (pre-ride) checks*). Look for leaks at the hose and pipe connections and check for cracks in the hoses and pipes themselves (see illustration). If the lever or pedal is spongy when applied, bleed the brakes (see Chapter 7).

4 Make sure the brake light operates when the front brake lever is pulled in. The front brake light switch, mounted on the underside of the master cylinder, is not adjustable. If it fails to operate properly, check it (see Chapter 9).

5 Make sure the brake light is activated just before the rear brake takes effect. If adjustment is necessary, hold the switch and turn the adjuster ring on the switch body until the brake light is activated when required (see illustrations). If the brake light comes on too late, turn the ring clockwise. If the brake light comes on too soon or is permanently on, turn the ring anti-clockwise. If the switch doesn't operate the brake light, check it (see Chapter 9).



9.5c Rear brake light switch - XTZ models



9.6a Front brake lever span adjuster -TDM models

6 On TDM and TRX models, the front brake lever has a span adjuster which alters the distance of the lever from the handlebar (see illustrations). Each setting is identified by a number on the adjuster which aligns with the arrow on the lever bracket. Pull the lever away from the handlebar and turn the adjuster ring until the setting which best suits the rider is obtained. There are four settings.

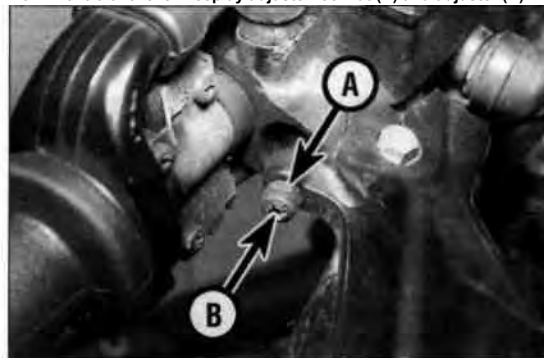
7 On XTZ models, the front brake lever has a freeplay adjuster which alters the amount of play in the lever before the brake takes effect. Check the amount of freeplay by measuring the distance the ball end of the

lever travels before the brake comes on and compare it to the amount specified at the beginning of the Chapter. To adjust the freeplay, slacken the adjuster locknut and turn the adjuster as required until the specified amount of freeplay is achieved (see illustration). Turn the adjuster clockwise to decrease freeplay and anti-clockwise to increase it.

Caution: Make sure that the correct amount of freeplay is set. Insufficient freeplay could cause the brakes to bind and excessive freeplay may not allow them to operate to their full potential.

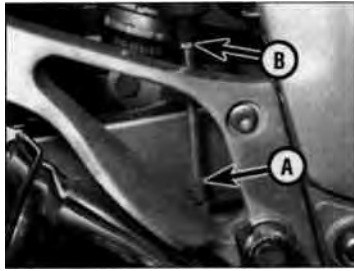


9.6b Front brake lever span adjuster - TRX models



9.7 Front brake lever freeplay adjuster locknut (A) and adjuster (B) - XTZ models

Lie Every 4000 miles (6000 km) or 6 months



9.8a Slacken the locknut (A) and turn the pushrod using the hex (B)...

8 Check the position of the brake pedal. Yamaha recommend the distance between the top of the end of the brake pedal and the top of the rider's footrest should be as specified at the beginning of the Chapter. If the pedal height is incorrect, or if the rider's preference is different, slacken the clevis locknut on the master cylinder pushrod, then turn the pushrod using a spanner on the hex at the top of the rod until the pedal is at the correct or desired height (see illustration). After adjustment check that the pushrod end is visible in the hole in the clevis (TDM and TRX models) (see illustration) or below the clevis nut (XTZ models). On completion tighten the locknut securely. Adjust the rear brake light switch after adjusting the pedal height (see Step 5).



9.8b ... making sure the rod end is still visible in the hole (arrowed) (TDM and TRX models)

10 Clutch - check and adjustment

1 Check that the clutch cable operates smoothly and easily.
 2 If the clutch lever operation is heavy or stiff, remove the cable (see Chapter 2) and lubricate it (see Section 18). If the cable is still stiff, renew it. Install the lubricated or new cable (see Chapter 2).
 3 With the cable operating smoothly, check that the clutch lever is correctly adjusted. Periodic adjustment is necessary to compensate for wear in the clutch plates and stretch of the cable. Check that the amount of

freeplay at the clutch lever end is within the specifications listed at the beginning of the Chapter (see illustration).

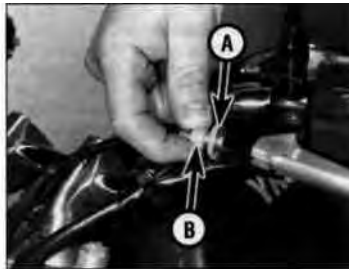
4 If adjustment is required, loosen the adjuster locking at the top of the cable and turn the adjuster in or out until the required amount of freeplay is obtained (see illustration). To increase freeplay, turn the adjuster clockwise. To reduce freeplay, turn the adjuster anti-clockwise. Tighten the locking ring securely.

5 On TRX, XTZ and 1996-on TDM models, if all the adjustment has been taken up at the lever, reset the adjuster to give a large amount of freeplay, then set the correct amount of freeplay using the adjuster nuts on each end of the threaded section in the cable bracket on the right-hand side of the engine. On TRX models, first remove the adjuster cover (see illustration). To reduce freeplay, slacken the rear nut and tighten the front nut until the freeplay is as specified, then tighten the rear nut (see illustrations). Subsequent adjustments can now be made using the lever adjuster only.

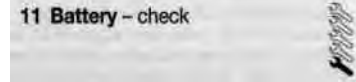
6 On 1991 to 1995 TDM models, if all the adjustment has been taken up at the lever, set the correct amount of freeplay using the adjuster in the cable - the adjuster is positioned a short way down the cable from the lever (see illustration). Slacken the locknut and turn the adjuster as required until the correct amount of freeplay is obtained.



10.3 Measuring clutch cable freeplay



10.4 Slacken the lockring (A) and turn the adjuster (B) as required



11 Battery - check

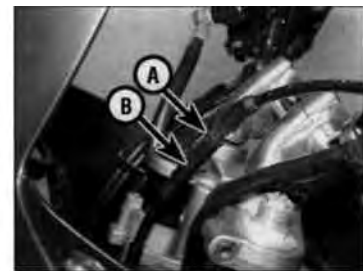
1 TDM and TRX models are fitted with a sealed (maintenance-free) battery, and therefore require no maintenance. **Note:** Do not attempt to remove the battery caps to check the electrolyte level or battery specific gravity. Removal will damage the caps, resulting in electrolyte leakage and battery damage. All that should be done is to check that its terminals are clean and tight and that the casing is not damaged or leaking. See Chapter 9 for further details.



10.5a On TRX models, remove the cover and adjust the cable as described using the nuts (arrowed)



10.5b Cable adjuster nuts (arrowed) - models



10.6 Slacken the locknut (A) and turn the adjuster (B) as required

Every 4000 miles (6000 km) or 6 months 1.17



11.2 Check that the electrolyte level is between the UPPER and LOWER level lines (arrowed)



13.2 Checking for play in the wheel bearings

2 XTZ models are fitted with a standard battery which requires regular checks of the electrolyte level. Remove the left-hand side cover for access to the battery (see Chapter 8). The electrolyte level is visible through the translucent battery case - it should be between the UPPER and LOWER level marks (see illustration). If the electrolyte is low, remove the battery (see Chapter 9), then remove the cell caps and fill each cell to the upper level mark with distilled water. Do not use tap water (except in an emergency), and do not overfill. The cell holes are quite small, so it may help to use a clean plastic squeeze bottle with a small spout to add the water. Install the battery cell caps, tightening them securely, then install the battery.

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.

3 If the machine is not in regular use, disconnect the battery and give it a refresher charge every month to six weeks (see Chapter 9).

12 Wheels and tyres - general check

Cast alloy wheels

1 The cast alloy wheels fitted to TDM and TRX models are virtually maintenance free, but they should be kept clean and checked periodically for cracks and other damage. Also check the wheel runout and alignment (see Chapter 7). Never attempt to repair damaged cast wheels; they must be renewed. Check the valve rubber for signs of damage or deterioration and have it renewed by a motorcycle tyre specialist if necessary. Also, make sure the valve stem cap is in place and tight.

Spoked wheels

2 On XTZ models, visually check the spokes for damage, breakage or corrosion. A broken or bent spoke must be renewed immediately because the load taken by it will be transferred to adjacent spokes which may in turn fail.

3 If you suspect that any of the spokes are incorrectly tensioned, tap each one lightly with a screwdriver and note the sound produced. Properly tensioned spokes will make a sharp ping sound, loose ones will produce a lower pitch and overtightened ones will be higher pitched. A spoke wrench will be needed if any of the spokes require adjustment. Unevenly tensioned spokes will promote rim misalignment - check the wheel runout and alignment (see Chapter 7) and seek the help of a wheel building expert if this is suspected.

Tyres

4 Check the tyre condition and tread depth thoroughly - see *Daily pre-ride checks*.

13 Wheel bearings - check

1 Wheel bearings will wear over a period of time and result in handling problems.

2 Support the motorcycle upright using an auxiliary stand so that the wheel being checked is off the ground. Check for any play in the bearings by pushing and pulling the wheel against the hub (see illustration). Also rotate the wheel and check that it rotates smoothly.

3 If any play is detected in the hub, or if the wheel does not rotate smoothly (and this is not due to brake or transmission drag), the wheel must be removed for closer inspection of its bearings (see Chapter 7).

14 Sidestand and cut-off switches - check

Sidestand

1 The sidestand return spring must be capable of retracting the stand fully and holding the stand retracted when the motorcycle is in use. If the spring is sagged or broken it must be renewed.

2 Lubricate the sidestand pivot regularly (see Section 18).

Cut-off switches

3 The clutch and sidestand are fitted with cut-off switches to prevent the bike being started in gear unless the clutch lever is pulled in, and to prevent the bike being ridden with the sidestand down.

4 Your bike's owners handbook contains a checking procedure for the sidestand and clutch switches. To test, turn the ignition ON and make sure the engine stop switch (kill switch) is in the RUN position. Sit on the bike and retract the sidestand, then shift the transmission into gear. Pull in the clutch lever and press the starter button - the engine should start, indicating that the clutch switch is in good order. With the engine idling and the clutch lever still held in, lower the sidestand - the engine should stop; if it doesn't, the sidestand switch should be checked out. Refer to Chapter 9 for clutch switch and sidestand switch tests.

15 Nuts and bolts - tightness check

1 Since vibration of the machine tends to loosen fasteners, all nuts, bolts, screws, etc. should be periodically checked for proper tightness.

Is
Kg

1.18 Every 4000 miles (6000 km) or 6 months

- 2 Pay particular attention to the following:
 - Sparkplugs
 - Engine oil drain plugs
 - Gearchange lever, brake and clutch lever, and brake pedal bolts
 - Footrest and stand bolts
 - Engine mounting bolts
 - Shock absorber and suspension linkage bolts and swingarm pivot bolts
 - Handlebar clamp bolts
 - Front axle bolt and axle clamp bolts
 - Front fork clamp bolts (top and bottom yoke)
 - Rear axle nut
 - Brake caliper mounting bolts
 - Brake hose banjo bolts and caliper bleed valves
 - Brake disc bolts
 - Exhaust system bolts/nuts
- 3 If a torque wrench is available, use it along with the torque specifications at the beginning of this and other Chapters.

each rubber coolant hose along its entire length. Look for cracks, abrasions and other damage. Squeeze each hose at various points. They should feel firm, yet pliable, and return to their original shape when released. If they are dried out or hard, renew them.

3 Check for evidence of leaks at each cooling system joint. Tighten the hose clips carefully to prevent future leaks.

4 Check the radiator for leaks and other damage. Leaks in the radiator leave tell-tale scale deposits or coolant stains on the outside of the core below the leak. If leaks are noted, remove the radiator (see Chapter 3) and have it repaired or renew it.

Caution: Do not use a liquid leak stopping compound to try to repair leaks.

5 Check the radiator fins for mud, dirt and insects, which may impede the flow of air through the radiator. If the fins are dirty, remove the radiator (see Chapter 3) and clean it using water or low pressure compressed air directed through the fins from the rear side. 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 radiator's surface area, renew the radiator.

6 To access the radiator pressure cap and filler, on TDM models, remove the right-hand fairing side panel, on TRX models remove the fairing, and on XTZ models remove the left-hand fairing side panel (see Chapter 8). On TRX models, remove the security bolt holding the radiator cap (see illustration). Remove

the pressure cap from the radiator filler neck by turning it anti-clockwise until it reaches a stop (see illustrations). If you hear a hissing sound (indicating there is still pressure in the system), wait until it stops. Now press down on the cap and continue turning the cap until it can be removed. Check the condition of the coolant in the system. If it is rust-coloured or if accumulations of scale are visible, drain, flush and refill the system with new coolant (See Section 27). Check the cap seal for cracks and other damage, if in doubt about the pressure cap's condition, have it tested by a Yamaha dealer or renew it. Install the cap by turning it clockwise until it reaches the first stop then push down on the cap and continue turning until it can turn further.

7 Check the antifreeze content of the coolant with an antifreeze hydrometer. Sometimes coolant looks like it's in good condition, but might be too weak to offer adequate protection. If the hydrometer indicates a weak mixture, drain, flush and refill the system (see Section 23).

8 Start the engine and let it reach normal operating temperature, then check for leaks again. As the coolant temperature increases beyond normal, the fan should come on automatically and the temperature should begin to drop. If it does not, refer to Chapter 3 and check the fan switch, fan motor and fan circuit carefully.

9 If the "coolant level is consistently low, and no evidence of leaks can be found, have the entire system pressure checked by a Yamaha dealer.

16 Cooling system - check



A Warning: The engine must be cool before beginning this procedure.

- 1 Check the coolant level (see Daily (pre-ride) checks).
- 2 The entire cooling system should be checked for evidence of leakage. Examine



16.6a On TRX models, remove the pressure cap security bolt (arrowed)



16.6b Pressure cap (arrowed) -TDM models



16.6c Pressure cap (arrowed) - XTZ models



17.3 Measure the amount of freeplay at the throttle grip flange

17 Throttle and choke cables - check

Throttle cables

1 Make sure the throttle grip rotates easily from fully closed to fully open with the front wheel turned at various angles. The grip should return automatically from fully open to fully closed when released.

2 If the throttle sticks, this is probably due to a cable fault. Remove the cables (see Chapter 4) and lubricate them (see Section 18). Install the cables, making sure they are correctly routed. If this fails to improve the operation of the throttle, the cables must be renewed. Note that in very rare cases the fault could lie in the carburetors rather than the cables, necessitating the removal of the carburetors and inspection of the throttle linkage (see Chapter 4).

3 With the throttle operating smoothly, check for a small amount of freeplay in the cable assembly, measured in terms of the amount of twistgrip rotation before the throttle opens and the pull of the cable is felt; compare this amount to that listed in this Chapter's Specifications (see illustration). If it's incorrect, adjust the cable assembly to correct it.

Every 4000 miles (6000 km) or 6 months 1.19

4 Freeplay adjustments can be made at the upper end of the accelerator cable. Loosen the locknut on the adjuster (see illustration). Turn the adjuster until the specified amount of freeplay is obtained, then retighten the locknut. Turn the adjuster clockwise to increase freeplay and anti-clockwise to reduce it.

5 If the adjuster has reached its limit of adjustment, reset it so that the freeplay is at a maximum, then remove the fuel tank and air filter housing (see Chapter 4) and adjust the accelerator cable at the carburettor end. Slacken the adjuster locknut, then screw the adjuster in or out until the specified amount of freeplay is obtained, then tighten the locknut (see illustration). Further adjustments can now be made at the cable's upper end. If the cable cannot be adjusted as specified, renew the accelerator and decelerator cables (see Chapter 4).

A **Warning:** Turn the handlebars all the way through their travel with the engine idling. Idle speed should not change. If it does, the cable may be routed incorrectly. Correct this condition before riding the bike.

6 Check that the throttle twistgrip operates smoothly and snaps shut quickly when released.

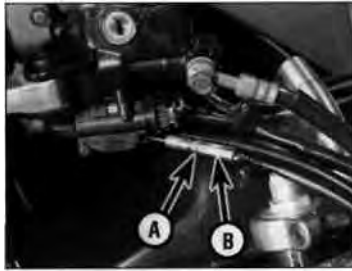
Choke cable

7 If the choke does not operate smoothly this is probably due to a cable fault. Remove the cable (see Chapter 4) and lubricate it (see Section 18). Install the cable, routing it so it takes the smoothest route possible.

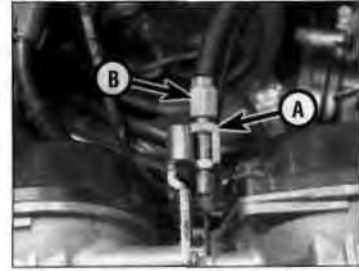
8 If this fails to improve the operation of the choke, the cable must be renewed. Note that in very rare cases the fault could lie in the carburettors rather than the cable, necessitating the removal of the carburettors and inspection of the choke plungers (see Chapter 4). Make sure there is a small amount of freeplay in the cable before the plungers move. If there isn't, check that the cable is seating correctly at the carburettor end. If it is, then slacken the choke outer cable bracket screw on the carburettor and slide the cable further into the bracket, creating some freeplay. Otherwise, renew the cable.



18.3a Lubricating a cable with a cable oiler clamp



17.4 Slacken the locknut (A) and turn the adjuster (B) as required



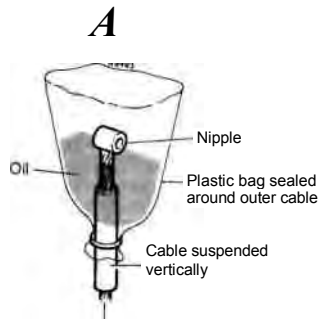
17.5 Slacken the locknut (A) and turn the adjuster (B) as required

18 Stand, lever pivots and cables - lubrication

Pivot points

1 Since the controls, cables and various other components of a motorcycle are exposed to the elements, they should be lubricated periodically to ensure safe and trouble-free operation.

2 The footrests, clutch and brake levers, brake pedal, gearshift lever linkage and sidestand pivots should be lubricated frequently. In order for the lubricant to be applied where it will do the most good, the component should be disassembled. However, if chain and cable lubricant is being used, it can be applied to the pivot joint gaps and will usually work its way into the areas where friction occurs. If motor oil or light grease is being used, apply it sparingly as it



- Cable lubricated when oil drips from far end

18.3b Lubricating a cable with a makeshift funnel and motor oil

may attract dirt (which could cause the controls to bind or wear at an accelerated rate). **Note:** One of the best lubricants for the control lever pivots is a dry-film lubricant (available from many sources by different names).

Cables

3 To lubricate the cables, disconnect the relevant cable at its upper end, then lubricate the cable with a cable oiler clamp, or if one is not available, using the set-up shown (see illustrations). See Chapter 4 for the choke and throttle cable removal procedures and Chapter 2 for the clutch cable procedure.

4 The speedometer cable should be removed (see Chapter 9) and the inner cable withdrawn from the outer cable and lubricated with motor oil or cable lubricant. Do not lubricate the upper few inches of the cable as the lubricant may travel up into the instrument head. Note that the speedometer on 1999 TDM models is electronically operated, and thus does not have a cable.

19 Swingarm and suspension bearings (XTZ models) - re-greasing

1 The swingarm and suspension linkage components are equipped with grease nipples (see illustration). Clean off the nipples using a rag, then apply some lithium-based grease to the nipples using a grease gun.



19.1 Apply grease to the nipples on the suspension linkage (arrowed) and to the nipple on the swingarm pivot

1.20 Every 4000 miles (6000 km) or 6 months



20.3 Check above and below the dust seal for signs of fluid leakage



20.7 Checking for play in the rear shock mountings and suspension linkage bearings (TRX and XTZ models)

20 Suspension – check

1 The suspension components must be maintained in top operating condition to ensure rider safety. Loose, worn or damaged suspension parts decrease the motorcycle's stability and control.

Front suspension

2 While standing alongside the motorcycle, apply the front brake and push on the handlebars to compress the forks several times. Check that they move up-and-down smoothly without binding. If binding is felt, the forks should be disassembled and inspected (see Chapter 6).

3 Inspect the area around the dust seal for signs of oil leakage, then carefully lever up the dust seal using a flat-bladed screwdriver and inspect the area around the fork seal (see illustration). If leakage is evident, the seals must be renewed (see Chapter 6). Check the fork tubes for scratches, corrosion and pitting as these will cause premature seal failure. If the damage is excessive the tubes should be renewed (see Chapter 6).

4 Check the tightness of all suspension nuts and bolts to be sure none have worked loose, referring to the torque settings specified at the beginning of Chapter 6.

Rear suspension

5 Inspect the rear shock for fluid leakage and tightness of its mountings. If leakage is found, the shock should be renewed or taken to a suspension specialist for overhaul (see Chapter 6).

6 With the aid of an assistant to support the bike, compress the rear suspension several times. It should move up and down freely without binding. If any binding is felt, the worn or faulty component must be identified and renewed. The problem could be due to either

the shock absorber, the suspension linkage components (TRX and XTZ models) or the swingarm components.

7 Support the motorcycle using an auxiliary stand so that the rear wheel is off the ground. Grab the swingarm and rock it from side to side - there should be no discernible movement at the rear. If there's a little movement or a slight clicking can be heard, inspect the tightness of all the rear suspension mounting bolts and nuts, referring to the torque settings specified at the beginning of Chapter 6, and re-check for movement. Next, grasp the top of the rear wheel and pull it upwards - there should be no discernible freeplay before the shock absorber begins to compress (see illustration). Any freeplay felt in either check indicates worn bearings in the suspension linkage (TRX and XTZ models) or swingarm, or worn shock absorber mountings. The worn components must be renewed (see Chapter 6).

8 To make an accurate assessment of the swingarm bearings, remove the rear wheel (see Chapter 7) and the bolt securing the shock absorber (TDM models) or suspension linkage assembly (TRX and XTZ models) to the swingarm (see Chapter 6). Grasp the rear of the swingarm with one hand and place your other hand at the junction of the swingarm and the frame. Try to move the rear of the swingarm from side-to-side. Any wear (play) in the bearings should be felt as movement between the swingarm and the frame at the front. If there is any play the swingarm will be felt to move forward and backward at the front (not from side-to-side). Yamaha specify a maximum lateral movement of 1 mm measured at the rear ends of the swingarm. Next, move the swingarm up and down through its full travel. It should move freely, without any binding or rough spots. If any play in the swingarm is noted or if the swingarm does not move freely, the bearings must be removed for inspection or renewal (see Chapter 6).

9 On XTZ models, the swingarm sideplay should be measured. Push the swingarm to one side of the frame, then slip a feeler gauge between the frame and the swingarm cap on the side from which the swingarm was pushed and measure the clearance. If it is greater than specified, remove the swingarm (see Chapter 6) and follow the procedure in Section 14 of that Chapter to calculate the shims required to restore sideplay to the correct amount.

21 Steering head bearings - freeplay check and adjustment s| &>

1 Steering head bearings can become dented, rough or loose during normal use of the machine. In extreme cases, worn or loose steering head bearings can cause steering wobble - a condition that is potentially dangerous.

Check

2 Support the motorcycle on an auxiliary stand so that the front wheel is off the ground.

3 Point the front wheel straight-ahead and slowly move the handlebars from side-to-side. Any dents or roughness in the bearing races will be felt and the bars will not move smoothly and freely.

4 Next, grasp the fork sliders and try to pull and push them forward and backward. Any looseness in the steering head bearings will be felt as front-to-rear movement of the forks. If play is felt in the bearings, adjust the steering head as follows.

HAYNES **TR7T** **Freeplay in the fork due to worn fork bushes can be misinterpreted for steering head bearing play - do not confuse the two.**

Every 4000 miles (6000 km) or 6 months 1.21



21.6a Slacken the fork clamp bolts (arrowed)...



21.6b ... and unscrew the steering stem nut



21.7 Ease the top yoke up off the steering stem and forks

Adjustment

TDM and TRX models

5 Displace the handlebars from the top yoke (see Chapter 6). On 1996-on TDM models, unscrew the bolts securing the choke knob and the cable guide to the top yoke.

6 Slacken the fork clamp bolts in the top yoke (see illustration). Unscrew the steering stem nut and remove it along with its washer, where fitted (see illustration).

7 Gently ease the top yoke upwards off the fork tubes and position it clear, using a rag to protect the tank or other components (see illustration). Make sure no strain is placed on the ignition switch wiring. On TRX models the yoke should be supported so that the master cylinder reservoir remains upright and so that no strain is placed on the hydraulic hose.

8 Remove the tabbed lockwasher, noting how it fits, then unscrew and remove the locknut using either a C-spanner, a peg spanner or a drift located in one of the notches (see illustrations). Remove the washer.

9 To adjust the bearings as specified by Yamaha, a special service tool (part No. 90890-01403) and a torque wrench are required. If the tool is available, first slacken the adjuster nut, then tighten it to the initial torque setting specified at the beginning of the Chapter, making sure the torque wrench handle is at right angles (90°) to the centreline between the adjuster nut and the wrench socket in the special tool (see illustration). Now slacken the nut one turn, then tighten it to the final torque setting specified. Check that the steering is still able to move freely from side to side, but that all freeplay is eliminated.

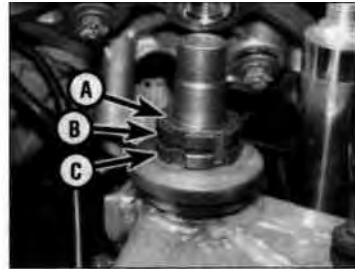
10 If the Yamaha tool is not available, using either a C-spanner, a peg spanner or a drift located in one of the notches, slacken the adjuster nut slightly until pressure is just released, then tighten it until all freeplay is removed, then tighten it a little more. This pre loads the bearings. Now slacken the nut, then tighten it again, setting it so that all freeplay is just removed yet the steering is able to move

freely from side to side. To do this tighten the nut only a little at a time, and after each tightening repeat the checks outlined above (Steps 3 and 4) until the bearings are correctly set. The object is to set the adjuster nut so that the bearings are under a very light loading, just enough to remove any freeplay.

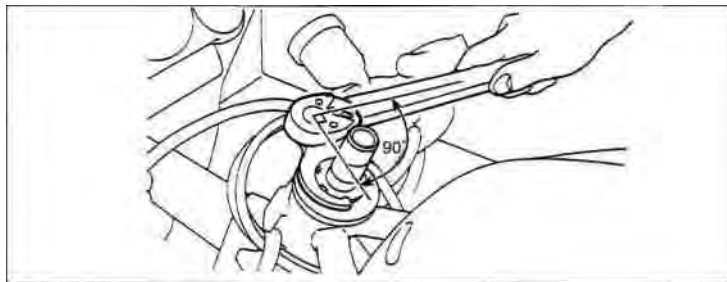
Caution: Take great care not to apply excessive pressure because this will cause premature failure of the bearings. 11 With the bearings correctly adjusted, install the washer and the locknut (see illustration 22.8b). On 1991 to 1995 TDM models the tapered side of the locknut must face down. Tighten the locknut finger-tight, then tighten it further until its notches align with those in the adjuster nut. If necessary, counter-hold the adjuster nut and tighten the locknut using a C-spanner or drift until the notches align, but make sure the adjuster nut does not turn as well. Install the tabbed lockwasher so that the tabs fit into the notches in both the locknut and adjuster nut (see illustration 22.8a). 12 Fit the top yoke onto the steering stem (see illustration 22.7), then install the washer (where fitted) and steering stem nut; tighten the nut to the torque setting specified at the beginning of the Chapter (see



21.8a Remove the tabbed lockwasher...



1.8b ... then unscrew the locknut (A), remove the washer (B), and adjust the bearings as described using the adjuster nut (C)



21.9 Make sure the torque wrench arm is at right angles (90°) to the tool

1» 22 Every 4000 miles (6000 km) or 6 months

illustration). Now tighten both the fork clamp bolts to the specified torque setting (see illustration).

13 Re-check the bearing adjustment as described above and re-adjust if necessary.

14 Install the handlebars (see Chapter 6). **XTZ models**

15 Displace the handlebars from the top yoke (see Chapter 6).

16 Slacken the fork clamp bolts in the top yoke, then slacken the steering stem bolt (see illustration). There is no need to remove the top yoke.

17 To adjust the bearings as specified by Yamaha, a special service tool (part No. 90890-01268) and a torque wrench are required. If the tool is available, first slacken the adjuster nut (see illustration 22.18), then tighten it to the initial torque setting specified at the beginning of the Chapter, making sure the torque wrench handle is at right angles (90°) to the line between the adjuster nut and the wrench socket in the special tool (see illustration 22.9). Now slacken the nut one turn, then tighten it to the final torque setting specified. Check that the steering is still able to move freely from side to side, but that all freeplay is eliminated.

18 If the Yamaha tool is not available, using either a C-spanner or drift located in one of the notches, slacken the adjuster nut slightly until pressure is just released, then tighten it until all freeplay is removed, then tighten it a little more (see illustration). This pre-loads the bearings. Now slacken the nut, then tighten it again, setting it so that all freeplay is just removed yet the steering is able to move freely from side to side. To do this tighten the nut only a little at a time, and after each tightening repeat the checks outlined above

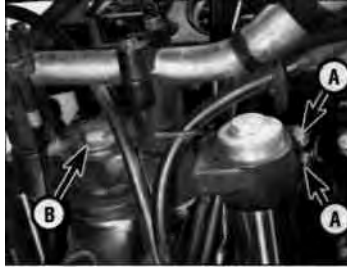


21.12a Tighten the steering stem nut.



and the fork clamp bolts to the specified torque

21.18 Steering head bearing adjuster nut



21.16 Slacken the fork clamp bolts (A) and the steering stem bolt (B)

(Steps 3 and 4) until the bearings are correctly set. The object is to set the adjuster nut so that the bearings are under a very light loading, just enough to remove any freeplay. **Caution: Take great care not to apply excessive pressure because this will cause premature failure of the bearings.** 19 With the bearings correctly adjusted,



(arrowed)

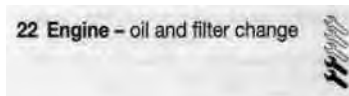
tighten the steering stem bolt and both the fork clamp bolts to the torque settings specified at the beginning of the Chapter (see illustration 22.16).

20 Re-check the bearing adjustment as described above and re-adjust if necessary.

21 Install the handlebars (see Chapter 6).

Every 8000 miles (12,000 km) or 12 months

Carry out all the items under the 4000 mile (6000 km) check, plus the following:



A Warning: Be careful when draining the oil, as the exhaust pipes, the engine, and the oil itself can cause severe burns.

1 Consistent routine oil and filter changes are the single most important maintenance procedure you can perform on a motorcycle. The oil not only lubricates the internal parts of the engine, transmission and clutch, but it also acts as a coolant, a cleaner, a sealant, and a protectant. Because of these demands, the oil takes a terrific amount of abuse and should be changed often with new oil of the recommended grade and type. Saving a little

money on the difference in cost between a good oil and a cheap oil won't pay off if the engine is damaged. The oil filter should be changed with every second oil change.

2 Before changing the oil, warm up the engine so the oil will drain easily. On 1991 to 1995 TDM models and XTZ models, remove the engine bashplate (see Chapter 8).

3 Put the motorcycle on its sidestand, and position a clean drain tray below the engine. On 1991 to 1995 TDM models remove the seat, and on XTZ models remove the right-hand side cover (see Chapter 8). Unscrew the oil filler cap from the oil tank to vent it and to act as a reminder that there is no oil in the engine (see Daily (pre-ride) checks).

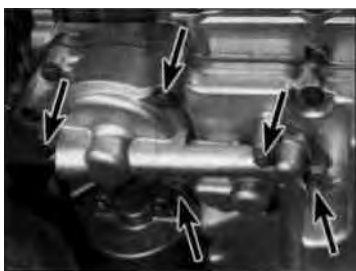
4 First unscrew the oil drain plug from the crankcase and allow the oil to flow into the drain tray (see illustrations 7.4a and b). Next

unscrew the oil drain plug from the oil filter housing and allow the oil to flow into the drain tray (see illustrations 7.4c and d). Check the condition of the sealing washers on the drain plugs and discard them if they are in any way damaged or worn. On 1996-on TDM and TRX models, Yamaha specify using new ones as a matter of course.

5 When the oil has completely drained, fit the plugs to the sump and oil filter housing, using new sealing washers if required, and tighten them to the torque settings specified at the beginning of the Chapter. Avoid overtightening, as damage to the crankcase will result.

6 With the drain tray still under the engine to catch any residue oil, unscrew the bolts securing the oil filter cover to the crankcase and remove the cover along with the filter,

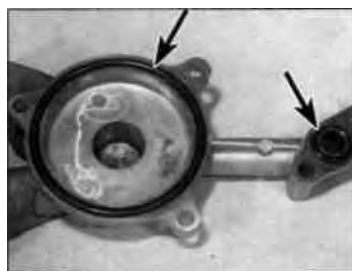
Every 8000 miles (12,000 km) or 12 months **1.23**



22.6a Unscrew the filter cover bolts (arrowed)...



22.6b ... and remove the cover and filter



22.7a Fit the new O-rings (arrowed)...



22.7b ... then install the filter with the projection fitting into the cover...



22.7c ... and fit the cover onto the engine

noting which way up it fits (see illustrations). Discard the filter. Discard the O-rings as new ones must be used.

7 Fit new O-rings into the cover, making sure they fit properly in the groove and around the collar (see illustrations). Fit the filter into the cover with the projection on the filter facing into the cover (see illustration). Fit the cover onto the sump, then apply a suitable non-permanent thread locking compound to the bolts and tighten them to the torque setting specified at the beginning of the Chapter (see illustration).

8 Refill the oil tank to the proper level using the recommended type and amount of oil (see *Daily (pre-ride) checks and this Chapter's Specifications*). With the motorcycle vertical, the oil level should lie between the maximum and minimum level lines on the dipstick or inspection window (according to model) (see *Daily (pre-ride) checks*). Install the filler cap. Start the engine and let it run for two or three minutes. It is advisable to perform an oil pressure check (see Section 32). Stop the engine, wait a few minutes, then check the oil level. If necessary, add more oil to bring the

level up to the maximum level line on the dipstick or window. Check around the drain plugs for leaks.

9 The old oil drained from the engine cannot be re-used and should be disposed of properly. Check with your local refuse disposal company, disposal facility or environmental agency to see whether they will accept the used oil for recycling. Don't pour used oil into drains or onto the ground - see Haynes Hint and UK's safe oil disposal contact in Section 7.

23 Fuel filter - renewal (1999 TDM models) f^ ||

1 The fuel filter should be renewed periodically. To do so, loosen the hose clamps and slide them down the hoses, away from the filter. Pry the hoses off each end of the filter and connect a new filter in its place (see illustration 15.12 in Chapter 4); fuel filters usually have an arrow on their body indicating the direction of fuel flow.

2 Check that there is no sign of leakage from the fuel pump. Check that the fuel pump hose connections are secure.

Every 16,000 miles (24,000 km) or two years

Carry out all the items under the 8000 mile (12,000 km) check:

24 Swingarm and suspension bearings (TDM and TRX models) - re-greasing S* « S^

- 1 Over a period of time the grease will harden or dirt will penetrate the bearings due to failed dust seals. Unlike the XTZ, these models are not equipped with grease nipples
- 2 Remove the swingarm as described in Chapter 6 for greasing of the bearings.
- 3 On TRX models, the suspension linkage is

not equipped with grease models. Remove the linkage as described in Chapter 6 for greasing of the bearings.

25 Steering head bearings - lubrication S| fr

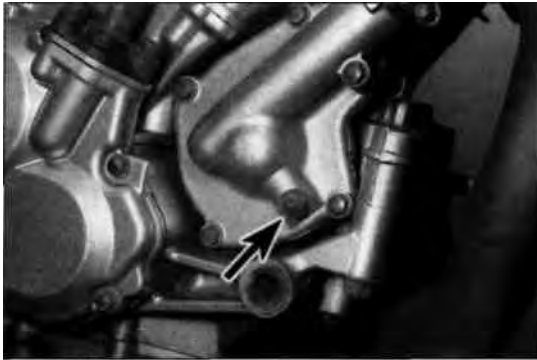
1 Over a period of time the grease will harden or may be washed out of the bearings by incorrect use of jet washes.

2 Disassemble the steering head for re-greasing of the bearings. Refer to Chapter 6 for details.

26 Brakes - fluid change and seal renewal E^ X

1 The brake fluid should be changed every two years or whenever a master cylinder or caliper overhaul is carried out. Refer to the

1.24 Every 16,000 miles (24,000 km) or 2 years



27.2a Unscrew the water pump drain plug (arrowed)...



27.2b ... and allow the coolant to drain

brake bleeding section in Chapter 7, noting that all old fluid must be pumped from the fluid reservoir and hydraulic line before filling with new fluid.

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.

2 Brake caliper and master cylinder seals will deteriorate over a period of time and lose their effectiveness, leading to sticking operation or fluid loss, or allowing the ingress of air and dirt. Refer to Chapter 7 and dismantle the components for seal renewal every two years.

27 Cooling system - draining, flushing and refilling

A *Warning: Allow the engine to cool completely before performing this maintenance operation. Also, don't allow antifreeze to come into contact with your skin or the*

painted surfaces of the motorcycle. Rinse off 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 local authorities (councils) about disposing of antifreeze. Many communities have collection centres which will see that antifreeze is disposed of safely. Antifreeze is also combustible, so don't store it near open flames.

Draining

1 On all models remove the seat, on TDM models the right-hand fairing side panel, on TRX models the fairing, and on XTZ models the left-hand fairing side panel (see Chapter 8). On 1991 to 1995 TDM models and XTZ models, remove the engine bashplate (see Chapter 8). On TRX models, remove the security bolt holding the radiator cap (see illustration 16.6a). Remove the radiator pressure cap by turning it anticlockwise until it reaches a stop (see illustrations 16.6b and c). If you hear a hissing sound (indicating there is still pressure in the system), wait until it stops. Now press down on the cap and continue turning the cap until it can be removed.

2 Position a suitable container beneath the water pump. Remove the coolant drain plug from the water pump and allow the coolant to drain completely from the system (see illustrations). Retain the old sealing washer for use during flushing.

3 Position the container beneath the cylinders, then remove the drain plug from the cylinder block and allow the coolant to drain completely from the engine (see illustrations). Retain the old sealing washer for use during flushing.

4 Position the container beneath the coolant reservoir and remove the filler cap. Release the clamp and detach the hose from the bottom of the reservoir and allow the coolant to completely drain (see illustration). Fit the hose back onto the reservoir and secure it with the clamp.

Flushing

5 Flush the system with clean tap water by inserting a garden hose in the radiator filler neck. Allow the water to run through the system until it is clear and flows cleanly out of the drain holes. If the radiator is extremely corroded, remove it (see Chapter 3) and have it cleaned professionally.

6 Clean the drain holes then install the drain plugs using the old sealing washers.



27.3a Unscrew the cylinder drain plug (arrowed)...



27.3b ... and allow the coolant to drain



27.4 Release the clamp and detach the hose (arrowed) - XTZ shown

Every 16,000 miles (24,000 km) or 2 years 1.25

7 Fill the cooling system with clean water mixed with a flushing compound. Make sure the flushing compound is compatible with aluminium components, and follow the manufacturer's instructions carefully.

8 Start the engine and allow it to reach normal operating temperature. Let it run for about ten minutes.

9 Stop the engine. Let it cool for a while, then cover the pressure cap with a heavy rag and turn it anti-clockwise to the first stop, releasing any pressure that may be present in the system. Once the hissing stops, push down on the cap and remove it completely.

10 Drain the system once again.

11 Fill the system with clean water and repeat the procedure in Steps 7 to 9.

Refilling

12 Fit a new sealing washer to each drain plug and tighten them to the torque setting specified at the beginning of the Chapter.

13 Fill the system with the proper coolant mixture (see this Chapter's Specifications) (**see illustration**). **Note:** *Pour the coolant in slowly to minimise the amount of air entering the system.* When the radiator appears full, pull the bike upright off its stand and shake it slightly to dissipate the coolant, then place the bike back on the stand and top the radiator up.



27.13 Use only the specified coolant mixture to fill the system ...

14 When the system is full (all the way up to the top of the radiator filler neck), install the pressure cap (**see illustration**). Now fill the coolant reservoir to the UPPER level mark (see *Daily (pre-ride) checks*).

15 Start the engine and allow it to idle for 2 to 3 minutes. Flick the throttle twistgrip part open 3 or 4 times, so that the engine speed rises to approximately 4000 - 5000 rpm, then stop the engine. Any air trapped in the system should have bled back to the radiator filler neck.

16 Let the engine cool then remove the pressure cap as described in Step 1. Check that the coolant level is still up to the radiator



27.14 ... then fit the pressure cap

filler neck. If it's low, add the specified mixture until it reaches the top of the filler neck. Refit the cap, then on TRX models fit the security bolt.

17 Check the coolant level in the reservoir and top up if necessary.

18 Check the system for leaks.

19 Do not dispose of the old coolant by pouring it down the drain. Instead pour it into a heavy plastic container, cap it tightly and take it into an authorised disposal site or garage - see **Warning** at the beginning of this Section.

20 Install the seat and body panels as required (see Chapter 8).

Every 28,000 miles (42,000 km)

Carry out all the items under the 4000 mile (6000 km) check, plus the following

^m 28 Valve clearances - check and adjustment

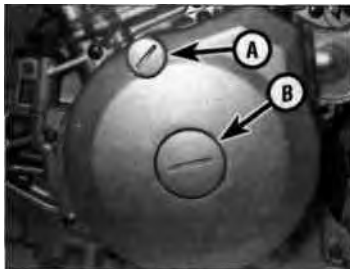
cylinder is referred to by a number: no. 1 cylinder is the left cylinder and no. 2 cylinder is the right.

3 Make a chart or sketch of all valve positions so that a note of each clearance can be made against the relevant valve. There are two exhaust valves and three inlet valves per cylinder.

4 Unscrew the timing inspection plug and the centre plug from the alternator cover on the left-hand side of the engine (**see illustration**). Discard the plug O-rings as new ones should

be used. The engine can be turned using a 19 mm socket on the alternator rotor bolt and turning it in an anti-clockwise direction only (**see illustration**). Alternatively, place the motorcycle on an auxiliary stand so that the rear wheel is off the ground, select a high gear and rotate the rear wheel by hand in its normal direction of rotation.

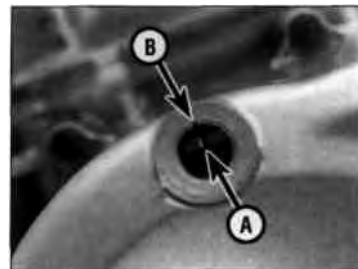
5 Turn the engine until the 'I' mark on the rotor aligns with the static timing mark on the alternator cover (a notch in the timing inspection hole) (**see illustration**), and the



28.4a Unscrew the timing inspection plug (A) and the centre plug (B)

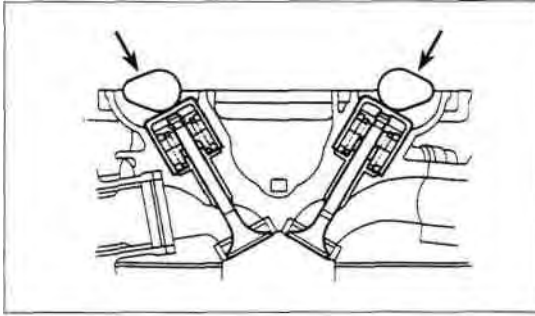


28.4b Turn the engine using a socket on the alternator bolt



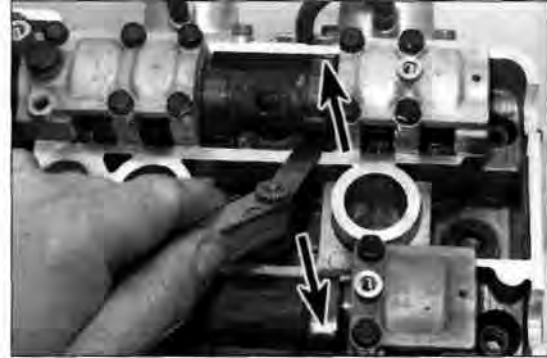
28.5a Turn the engine until the mark on the rotor (A) aligns with the static mark on the cover (B)

.26 Every 28,000 miles (42,000 km)



28.5b Note the position of the cam lobes (arrowed)

With the cylinder at TDC on the compression stroke the lobes should not be depressing the valves and should be facing away from each other



28.6 Make sure the cam lobes (arrowed) face away from each other, then check the valve clearances as shown

camshaft lobes for the No. 1 (left-hand) cylinder are facing away from each other (see illustration). **Note:** Do not confuse the 'T' mark on the rotor (which indicates TDC) with the 'H' mark which will appear first and which indicates the firing point of the ignition system. If the cam lobes are facing towards each other, rotate the engine anti-clockwise 360° (one full turn) so that the T mark again aligns with the static timing mark. The camshaft lobes will now be facing away from each other and the No. 1 cylinder is at TDC (top dead centre) on the compression stroke. 6 With No. 1 cylinder at TDC on the compression stroke, check the clearances on

the No. 1 cylinder inlet and exhaust valves. Insert a feeler gauge of the same thickness as the correct valve clearance (see Specifications) between the camshaft lobe and follower of each valve and check that it is a firm sliding fit - you should feel a slight drag when you pull the gauge out (see illustration). If not, use the feeler gauges to obtain the exact clearance. Record the measured clearance on the chart.

7 On 1991 to 1995 TDM models and XTZ models, now turn the engine anti-clockwise 360° (one full turn) so that the I mark on the timing plate again aligns with the static timing mark on the crankcase cover, and the camshaft lobes for the No. 2 (right-hand) cylinder are facing away from each other. On 1996-on TDM models and TRX models, turn the engine anti-clockwise 270° (3/4 turn) so that the camshaft lobes for the No. 2 (right-hand) cylinder are facing away from each other. The No. 2 cylinder is now at TDC on the compression stroke. Measure the clearances of the No. 2 cylinder valves using the method described in Step 6.

8 When all clearances have been measured and charted, identify whether the clearance on any valve falls outside that specified. If it does, the shim between the cam follower and the valve must be swapped with one of a

thickness which will restore the correct clearance.

9 Shim replacement requires removal of the camshafts (see Chapter 2). There is no need to remove both camshafts if shims from only one side of the engine need replacing. Place rags over the spark plug holes and the cam chain tunnel to prevent a shim from dropping into the engine on removal.

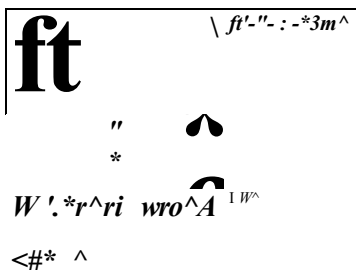
10 With the camshaft removed, remove the cam follower of the valve in question, then either retrieve the shim from the inside of the follower or pick it out of the top of the valve using either a magnet, a small screwdriver with a dab of grease on it (the shim will stick to the grease), or a screwdriver and a pair of pliers (see illustrations). Do not allow the shim to fall into the engine.

11 A size mark should be stamped on the upper face of the shim-ashim marked 175 is 1.75 mm thick. If the mark is not visible the shim thickness will have to be measured. It is recommended that the shim is measured anyway to check that it has not worn (see illustration).

12 Using the appropriate shim selection chart (either inlet or exhaust), find where the measured valve clearance and existing shim thickness values intersect and read off the shim size required (see illustrations). **Note:** //



28.10a Lift out the follower .



28.10b ... and remove the shim either from inside the follower ...



28.10c ... or from the top of the valve



28.11 Measure the shim using a micrometer

Every 28,000 miles (42,000 km) 1.27

MEASURED CLEARANCE	INSTALLED SHIM SIZE																											
	12	12	13	13	140	1145	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	230:	235	240			
0.00-0.04				12	125	130	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	230:	235	240
0.05-0.09			12	12	130	135	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	230:	235	240	
0.10-0.14		12	12	13	135	140	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	230:	235	240		
0.15-0.20	RECOMMENDED CLEARANCE																											
0.21-0.25	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24				
0.26-0.30	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24					
0.31-0.35	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24						
0.36-0.40	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24							
0.41-0.45	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24								
0.46-0.50	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24									
0.51-0.55	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24										
0.56-0.60	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24											
0.61-0.65	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24												
0.66-0.70	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24													
0.71-0.76	17	18	18	19	19	20	20	21	21	22	22	23	23	24														
0.76-0.80	18	18	19	19	20	20	21	21	22	22	23	23	24															
0.81-0.85	18	19	19	20	20	21	21	22	22	23	23	24																
0.86-0.90	19	19	20	20	21	21	22	22	23	23	24																	
0.91-0.95	1951200	20	21	21	22	22	23	23	24																			
0.96-1.00	2001205	21	21	22	22	23	23	24																				
1.01-1.05	2051210	21	22	22	23	23	24																					
1.06-1.10	2101215	22	22	23	23	24																						
1.11-1.15	2151220	22	23	23	24																							
1.16-1.20	2201225	23	23	24																								
1.21-1.25	2251230	23	24																									
1.26-1.30	2301235	24																										
1.31-1.35	2351240																											
1.36-1.40	240 i																											

28.12a Shim selection chart - inlet valves

MEASURED CLEARANCE	INSTALLED SHIM SIZE																												
	12	125	130	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24				
0.00-0.04					12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24
0.05-0.09				12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24	
0.10-0.14			12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24		
0.15-0.19		12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24			
0.20-0.24	12	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24				
0.25-0.30	RECOMMENDED CLEARANCE																												
0.31-0.36	12	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24					
0.36-0.40	13	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24						
0.41-0.45	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24							
0.46-0.50	14	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24								
0.51-0.55	14	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24									
0.56-0.60	15	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24										
0.61-0.65	15	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24											
0.66-0.70	16	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24												
0.71-0.75	16	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24													
0.76-0.80	17	17	18	18	19	19	20	20	21	21	22	22	23	23	24														
0.81-0.85	175	18	18	19	19	20	20	21	21	22	22	23	23	24															
0.86-0.90	18	18	19	19	20	20	21	21	22	22	23	23	24																
0.91-0.95	18	19	19	20	20	21	21	22	22	23	23	24																	
0.96-1.00	19	19	20	20	21	21	22	22	23	23	24																		
1.01-1.05	19	20	20	21	21	22	22	23	23	24																			
1.06-1.10	20	20	21	21	22	22	23	23	24																				
1.11-1.15	20	21	21	22	22	23	23	24																					
1.16-1.20	21	21	22	22	23	23	24																						
1.21-1.25	21	22	22	23	23	24																							
1.26-1.30	22	22	23	23	24																								
1.31-1.35	22	23	23	24																									
1.36-1.40	23	23	24																										
1.41-1.45	23	24																											
1.46-1.50	24																												

28.12b Shim selection chart - exhaust valves

1.28 Every 28,000 miles (42,000 km)



28.13 Fit the follower onto the valve

the existing shim is marked with a number not ending in 0 or 5, round it up or down as appropriate to the nearest number ending in 0 or 5 so that the chart can be used. Shims are available in 0.05 mm increments from 1.20 mm to 2.40 mm. **Note:** If the required



28.15 Use new O-rings on the plugs

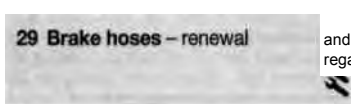
replacement shim is greater than 2.40 mm (the largest available), the valve is probably not seating correctly due to a build-up of carbon deposits and should be checked and cleaned or resurfaced as required (see Chapter 2).

13 Obtain the replacement shim, then lubricate it with molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and engine oil) and fit it into its recess in the top of the valve, with the size marking on each shim facing up (see illustration 28.10c). Check that the shim is correctly seated, then lubricate the follower with molybdenum disulphide oil and install it onto the valve (see illustration). Repeat the process for any other valves until the clearances are correct, then install the camshafts (see Chapter 2).

14 Rotate the crankshaft several turns to seat the new shim(s), then check the clearances again.

15 Install all disturbed components in a reverse of the removal sequence. Use new O-rings on the timing inspection plug and centre plug and tighten the plugs securely (see illustration).

Every four years



29 Brake hoses – renewal

1 The hoses will in time deteriorate with age and should be renewed every four years regardless of their apparent condition.

2 Refer to Chapter 7 and disconnect the brake hoses from the master cylinders and calipers. Always renew the banjo union sealing washers.

Non-scheduled maintenance

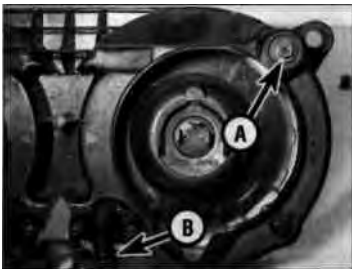
30 Headlight aim - check and adjustment

Note: An improperly adjusted headlight may cause problems for oncoming traffic or provide poor, unsafe illumination of the road ahead. Before adjusting the headlight aim, be sure to consult with local traffic laws and regulations - for UK models refer to MOT Test Checks in the Reference section. 1 The headlight beam can

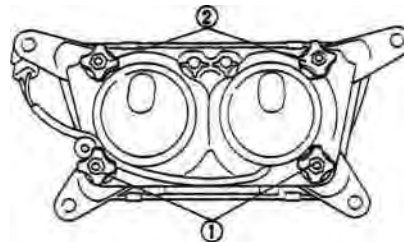
be adjusted horizontally and vertically. Before making any adjustment, check that the tyre pressures are correct and the suspension is adjusted as required. Make any adjustments to the headlight aim with the machine on level ground, with the fuel tank half full and with an assistant sitting on the seat. If the bike is usually ridden with a passenger on the back, have a second assistant to do this. 2 On 1991 to 1995 TDM models and XTZ models, vertical adjustment is made by turning the adjuster screw on the top outer corner of each headlight unit (see illustration). Turn it clockwise to raise the beam, and anti-clockwise to lower it.

Horizontal adjustment is made by turning the adjuster screw on the bottom inner corner of each headlight unit. For the left-hand beam, turn it clockwise to move the beam to the right, and anti-clockwise to move it to the left. For the right-hand beam, turn it clockwise to move the beam to the left, and anti-clockwise to move it to the right.

3 On 1996-on TDM models, vertical adjustment is made by turning the adjuster screw on the bottom outer corner of each headlight unit (see illustration). Turn it anticlockwise to raise the beam, and clockwise to lower it. Horizontal adjustment is made by turning the adjuster screw on the top outer



30.2 Vertical adjuster (A), horizontal adjuster (B) -1991 to 1995 TDM models and XTZ models



30.3 Vertical adjusters (1), horizontal adjusters (2) - 1996-on TDM models

Non-scheduled maintenance 1.29



30.4 Vertical adjuster (A), horizontal adjuster (B) - TRX models

corner of each headlight unit. For the left-hand beam, turn it clockwise to move the beam to the left, and anti-clockwise to move it to the right. For the right-hand beam, turn it clockwise to move the beam to the right, and anti-clockwise to move it to the left. 4 On TRX models, vertical adjustment is made by turning the adjuster screw on the bottom left corner of the headlight unit (see illustration). Turn it clockwise to raise the beam, and anti-clockwise to lower it. Horizontal adjustment is made by turning the adjuster screw on the top right corner of the headlight unit. Turn it clockwise to move the beam to the left, and anti-clockwise to move it to the right.

31 Cylinder compression - check

1 Among other things, poor engine performance may be caused by leaking valves, incorrect valve clearances, a leaking head gasket, or worn pistons, rings and/or cylinder walls. A cylinder compression check will help pinpoint these conditions and can also indicate the presence of excessive carbon deposits in the cylinder heads.

2 The only tools required are a compression gauge and a spark plug wrench. A compression gauge with a threaded end for the spark plug 12 mm diameter hole is preferable to the type which requires hand pressure to maintain a tight seal. Depending on the outcome of the initial test, a squirt-type oil can may also be needed.

3 Make sure the valve clearances are correctly set (see Section 28) and that the cylinder head fasteners are tightened to the correct torque setting (see Chapter 2).

4 Refer to *Fault Finding Equipment* in the Reference section for details of the compression test. Refer to the specifications at the beginning of the Chapter for compression figures.

32 Engine - oil pressure check

1 None of the models covered in this manual are fitted with an oil pressure warning light. If a lubrication problem is suspected, first check the oil level (see *Daily (pre-ride) checks*)

2 If the oil level is correct, an oil pressure check must be carried out.

3 To check the oil pressure, slacken the oil gallery bolt in the left-hand side of the cylinder head - there is no need to remove it (see illustration).

4 Start the engine and allow it to idle. After a short while oil should begin to seep out from the oil gallery plug (see illustration). If no oil has appeared after one minute, stop the engine immediately.

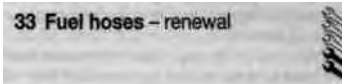
5 If the oil does not appear after one minute, either the pressure regulator is stuck open, the oil pump is faulty, the oil strainer or filter is blocked, or there is other engine damage. Begin diagnosis by checking the oil filter (Section 22 of this Chapter), strainer and regulator, then the oil pump (see Chapter 2). If those items check out okay, chances are the

bearing oil clearances are excessive and the engine needs to be overhauled.

6 If the oil appears very quickly and spurts out, the pressure may be too high, meaning either an oil passage is clogged, the regulator is stuck closed or the wrong grade of oil is being used.

7 Refer to Chapter 2 and rectify any problems before running the engine again.

8 Tighten the oil gallery bolt to the torque setting specified at the beginning of the Chapter.



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.

1 The fuel delivery and vacuum hoses should be renewed after a few years regardless of their condition.

2 Remove the fuel tank (see Chapter 4). Disconnect the fuel hoses from the fuel tap, fuel pump and from the carburetors, noting the routing of each hose and where it connects (see Chapter 4 if required). It is advisable to make a sketch of the various hoses before removing them to ensure they are correctly installed.

3 Secure each new hose to its unions using new clamps. Run the engine and check that there are no fuel leaks before taking the machine out on the road.



32.3 Slacken the gallery bolt (arrowed)...



32.4 ... then start the engine and check that the oil dribbles out within a minute

i.3o Non-scheduled maintenance

34 Front forks - oil change

TDM, TRX and 1995 XTZ models

1 Fork oil degrades over a period of time and loses its damping qualities. The forks do not have drain screws so it is necessary to remove them from the fork yokes (see Chapter 6, Section 6) and remove their top bolts, spacer and spring assembly so that they can be turned upside down and pumped to expel the fork oil.

2 Once the forks have been removed from the yokes, refer to the appropriate part of Section 7, Chapter 6, to unscrew the fork top bolt and withdraw the spacer and spring assembly. Note that there is no need to slacken the damper rod bolt as advised in the early part of this procedure because this relates to fork overhaul. Turn the fork upside down and pump the inner tube and slider to expel as much oil as possible.

3 Refill each fork with the specified amount and type of fork oil (see Chapter 6 Specifications) and install the fork spring, spacer and top bolt. Take careful note of how the oil level is measured and the importance of the level being identical in each fork. Refer to the final part of the relevant reassembly procedure in Chapter 6, Section 7 for details.

1989 to 1994 XTZ models

4 Fork oil degrades over a period of time and loses its damping qualities. These models are equipped with drain screws in the fork sliders (see illustration 7.59 in Chapter 6) and therefore changing the fork oil is a relatively straightforward task.

5 Position the bike on an auxiliary stand and support it under the engine so that the front wheel is off the ground. Unscrew the fork top bolt from the top of each fork tube.

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

6 Hold a piece of thick card to act as a chute beneath the fork drain screw on one fork slider, then remove the drain screw and allow the oil to drain. Pump the fork to expel all of the oil. Now do the same on the other fork leg.

7 Slide the fork tube down into the slider and withdraw the spacer, spring seat and the spring from the tube. Note which way up the spring is fitted.

8 Check the condition of the sealing washers on the drain screws and screw them back into the fork sliders.

9 Slowly pour in the specified quantity of the specified grade of fork oil (see Chapter 6

Specifications) and pump the fork at least ten times to distribute it evenly; the oil level should also be measured and adjustment made by adding or subtracting oil. Fully compress the fork tube into the slider and measure the fork oil level from the top of the tube (see illustration 7.26b in Chapter 6). Add or subtract fork oil until it is at the level specified at the beginning of the Chapter. Note that bike must be upright when the oil level is measured and the oil level must be the same in each fork.

10 Extend the fork tube and slider fully, then install the spring, the spring seat, with its shouldered side fitting down into the top of the spring, and the spacer.

11 Apply a smear of grease to the top bolt O-ring and thread the bolt into the top of the fork tube.

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

Keep the fork tube fully extended whilst pressing on the spring. Screw the top bolt carefully into the fork tube making sure it is not cross-threaded and tighten it to the specified torque setting (see Chapter 6 Specifications).

Chapter 2

Engine, clutch and transmission

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Degrees of difficulty

Easy , suitable for novice with little experience	Jk s? n	Fairly easy , suitable for beginner with some experience	.	Difficult , suitable for experienced DIY mechanic	5
		Fairly difficult , suitable for competent DIY mechanic	^S		Very difficult , suitable for expert DIY or professional

Specifications

General	
Type.....	Four-stroke parallel twin
Capacity	
TDM and TRX models	849 cc
XTZ models	749 cc
Bore	
TDM and TRX models	89.5 mm
XTZ models	87.0 mm
Stroke	
TDM and TRX models	67.5 mm
XTZ models	63 mm
Compression ratio	
1991 to 1995 TDM models	9.2 to 1
1996-on TDM models and TRX models	10.5 to 1
XTZ models	9.5 to 1
Cylinder numbering	No. 1 (left-hand), No. 2 (right-hand)
Cooling system	Liquid cooled
Clutch	Wet multi-plate
Transmission	Five-speed constant mesh
Final drive	Chain

2»2 Engine, clutch and transmission

Camshafts

Inlet lobe height 1991 to 1995 TDM models and

XTZ models	
Standard	35.7 to 35.8 mm
Service limit (min)	35.6 mm
1996-on TDM models and TRX models	
Standard	35.95 to 36.05 mm
Service limit (min)	35.85 mm
Exhaust lobe height - all models	
Standard	35.95 to 36.05 mm
Service limit (min)	35.85 mm
Journal diameter	24.967 to 24.980 mm
Journal holder diameter	25.000 to 25.021 mm
Journal oil clearance	0.020 to 0.054 mm
Runout (max)	0.03 mm

Cylinder head

Warpage (max)	0.03 mm
---------------------	---------

Valves, guides and springs

Valve clearances	see Chapter 1
Inlet valve Stem diameter	
Standard	5.475 to 5.490 mm
Service limit (min)	5.445 mm
Guide bore diameter	
Standard	5.500 to 5.512 mm
Service limit (max)	5.55 mm
Stem-to-guide clearance	
Standard	0.010 to 0.037 mm
Service limit (max)	0.08 mm
Head diameter	25.9 to 26.1 mm
Face width	2.06 to 2.46 mm
Seat width	0.9 to 1.1 mm
Margin thickness	0.8 to 1.2 mm
Exhaust valve Stem diameter	
Standard	5.460 to 5.475 mm
Service limit (min)	5.43 mm
Guide bore diameter	
Standard	5.500 to 5.512 mm
Service limit (max)	5.55 mm
Stem-to-guide clearance	
Standard	0.025 to 0.052 mm
Service limit (max)	0.10 mm
Head diameter	27.9 to 28.1 mm
Face width	2.06 to 2.46 mm
Seat width	0.9 to 1.1 mm
Margin thickness	0.8 to 1.2 mm
Valve stem runout (max)	0.01 mm
Valve springs free length (inlet and exhaust)	
Standard	37.29 mm
Service limit (min)	35.2 mm
Valve spring bend (max)	1.7 mm

Cylinder block

Bore TDM and TRX

models	
Standard	89.500 to 89.505 mm
Service limit (max)	89.6 mm
XTZ models	
Standard	87.000 to 87.005 mm
Service limit (max)	87.1 mm
Warpage (max)	0.03 mm
Ovality (out-of-round) (max)	0.03 mm
Taper (max)	0.05 mm
Cylinder compression	see Chapter 1

Pistons

Piston diameter (measured 4.5 mm (TDM and TRX models) or 4.7 mm (XTZ models) up from skirt, at 90° to piston pin axis)

TDM and TRX models.....	89.420 to 89.435 mm	
XTZ models.....	86.920 to 86.935 mm	
	Standard	Service Limit
Piston-to-bore clearance	0.065 to 0.085 mm	0.15 mm
Piston pin diameter	19.991 to 20.000 mm	19.975 mm
Piston pin bore diameter in piston	20.002 to 20.013 mm	20.043 mm (max)
Piston pin-to-piston pin bore clearance.....	0.002 to 0.022 mm	0.07 mm

Piston rings

Top ring TDM and TRX models

Ring width.....	3.5 mm
Ring thickness	1.0 mm
Ring end gap (installed)	
Standard	0.30 to 0.45 mm
Service limit (max)	0.70 mm
Piston ring-to-groove clearance	
Standard	0.035 to 0.070 mm
Service limit (max)	0.12 mm

XTZ models

Ring width.....	3.3 mm
Ring thickness.....	1.0 mm
Ring end gap (installed)	
Standard	0.30 to 0.50 mm
Service limit (max)	0.70 mm
Piston ring-to-groove clearance	
Standard	0.03 to 0.07 mm
Service limit (max)	0.12 mm

2nd (middle) ring 1991 to 1995

TDM models

Ring width.....	3.5 mm
Ring thickness	1.0 mm
Ring end gap (installed)	
Standard	0.30 to 0.45 mm
Service limit (max)	0.70 mm
Piston ring-to-groove clearance	
Standard	0.02 to 0.055 mm
Service limit (max)	0.12 mm

1996-on TDM models and TRX models

Ring width.....	3.5 mm
Ring thickness	1.0 mm
Ring end gap (installed)	
Standard	0.30 to 0.45 mm
Service limit (max)	0.70 mm
Piston ring-to-groove clearance	
Standard	0.035 to 0.070 mm
Service limit (max)	0.12 mm

XTZ models

Ring width.....	3.3 mm
Ring thickness.....	1.0 mm
Ring end gap (installed)	
Standard	0.30 to 0.50 mm
Service limit (max)	0.70 mm
Piston ring-to-groove clearance	
Standard	0.02 to 0.06 mm
Service limit (max)	0.12 mm

Oil ring TDM and TRX

models

Ring width.....	2.85 mm
Ring thickness	2.0 mm
Side-rail end gap (installed)	0.20 to 0.70 mm

XTZ models

Ring width.....	2.80 mm
Ring thickness.....	2.0 mm
Side-rail end gap (installed)	0.20 to 0.70 mm

2»4 Engine, clutch and transmission

Clutch

Friction plate thickness - all models	
Standard	2.9 to 3.1 mm
Service limit (min)	2.8 mm
Plain plates	
1991 to 1995 TDM models and all XTZ models	
Thickness (special 'slick' plate)	2.2 to 2.4 mm
Thickness (all other plates)	1.9 to 2.1 mm
Warpage (max)	0.1 mm
1996-on TDM models and all TRX models	
Thickness	1.9 to 2.1 mm
Warpage (max)	0.1 mm
Clutch springs Spring free length	
1991 to 1998 TDM and all TRX models	
Standard	55 mm
Service limit (min)	53 mm
1999 TDM models	
Standard	50 mm
Service limit (min)	48 mm
XTZ models	
Standard	51.8 mm
Service limit (min)	50 mm

Oil pump

Inner rotor tip-to-outer rotor clearance	
Standard	0.0 to 0.12 mm
Service limit (max)	0.17 mm
Outer rotor-to-body clearance	
Standard	0.03 to 0.08 mm
Service limit (max)	0.15 mm
Rotor end-float	0.03 to 0.08 mm

Connecting rods

Big-end side clearance	
Standard	0.160 to 0.272 mm
Service limit (max)	0.5 mm
Big-end oil clearance	
Standard	0.026 to 0.050 mm
Service limit (max)	0.09 mm

Crankshaft and bearings

Main bearing oil clearance	
Standard	0.020 to 0.038 mm
Service limit (max)	0.1 mm
Runout (max)	
1991 to 1995 TDM models and all XTZ models	0.02 mm
1996-on TDM models and all TRX models	0.035 mm

Transmission

Gear ratios (no. of teeth)	
1991 to 1995 TDM models	
Primary reduction	1.718 to 1 (67/39T)
Final reduction	2.750 to 1 (44/16T)
1st gear	2.846 to 1 (37/13T)
2nd gear	1.850 to 1 (37/20T)
3rd gear	1.318 to 1 (29/22T)
4th gear	1.074 to 1 (29/27T)
5th gear	0.900 to 1 (27/30T)
1996 to 1998 TDM models	
Primary reduction	1.718 to 1 (67/39T)
Final reduction	2.471 to 1 (42/17T)
1st gear	2.846 to 1 (37/13T)
2nd gear	1.850 to 1 (37/20T)
3rd gear	1.429 to 1 (30/21T)
4th gear	1.174 to 1 (27/23T)
5th gear	1.037 to 1 (28/27T)

Engine, clutch and transmission 2*5

1999 TDM models		
Primary reduction	1.718 to 1	:67/39T)
Final reduction	2.688 to 1	:43/16T)
1st gear	2.643 to 1	:37/14T)
2nd gear	1.947 to 1	:37/19T)
3rd gear	1.500 to 1	:30/20T)
4th gear	1.174 to 1	:27/23T)
5th gear	0.964 to 1	:27/28T)
TRX models		
Primary reduction	1.718 to 1	67/39T)
Final reduction	2.294 to 1	39/17T)
1st gear	2.571 to 1	36/14T)
2nd gear	1.850 to 1	37/20T)
3rd gear	1.429 to 1	30/21T)
4th gear	1.174 to 1	(27/23T)
5th gear	1.037 to 1	:28/27T)
XTZ models		
Primary reduction	1.718 to 1	67/39T)
Final reduction	2.875 to 1	46/16T)
1st gear	2.846 to 1	37/13T)
2nd gear	1.850 to 1	37/20T)
3rd gear	1.429 to 1	30/21T)
4th gear	1.174 to 1	27/23T)
5th gear	1.037 to 1	28/27T)
Shaft runout (max)	0.08 mm	
Selector fork shaft runout (max)	0.03 mm	
Torque settings		
Engine mounting bolts TDM		
models		
Small triangular engine bracket bolts to engine	30 Nm	
Engine bracket bolts to underside of engine at back	30 Nm	
Lower rear mounting bolt	64 Nm	
Upper rear mounting bolt nut	89 Nm	
Engine bracket to engine bolts	60 Nm	
Engine bracket to frame bolts	30 Nm	
TRX models		
Lower rear mounting bolt nut	75 Nm	
Upper rear mounting bolt nut	75 Nm	
Upper front mounting bolts	55 Nm	
Engine bracket to engine bolts (left-hand side)	30 Nm	
Engine bracket to frame bolt (left-hand side).....	55 Nm	
Engine bracket to engine bolt (with collar) (right-hand side).....	55 Nm	
Engine bracket to frame bolts (right-hand side).....	30 Nm	
XTZ models		
Swingarm pivot bolt nut	90 Nm	
Lower rear mounting bolt nut	58 Nm	
Upper rear mounting bolt nut	58 Nm	
Frame downtube bolts/nuts	32 Nm	
Lower front mounting bolt nut	58 Nm	
Valve cover bolts	10 Nm	
Camshaft holder bolts	10 Nm	
Camshaft sprocket bolts	24 Nm	
Cam chain tensioner mounting bolts	10 Nm	
Cam chain tensioner cap bolt.....	20 Nm	
Cylinder head nuts	40 Nm	
Cylinder head bolts.....	10Nm	
Oil pipe banjo bolt to cylinder head	21 Nm	
Coolant hose union bolts (cylinder block)	10 Nm	
Clutch nut.....	70 Nm	
Clutch spring bolts.....	8 Nm	
Clutch cover bolts.....	10 Nm	
Starter clutch bolts.....	10 Nm	
Selector drum retainer plate bolts	12Nm	
Stopper arm bolt		
1991 to 1995 TDM models and XTZ models	12 Nm	
1996-on TDM models and TRX models	10 Nm	
Gearchange linkage arm pinch bolt	12 Nm	

2*6 Engine, clutch and transmission

Torque settings (continued)

Outer sprocket cover bolts	5 Nm
Oil pump mounting screws	6 Nm
Oil pump assembly screw	6 Nm
Oil pump cover bolts	10Nm
Oil pipe to oil pump cover bolts.....	10 Nm
Oil pipe banjo bolts to crankcase cover/oil tank and cylinder head	21 Nm
Oil pipe to oil tank bolts	10 Nm
Oil pressure relief valve holder bolt	10Nm
Oil strainer cover screws	7 Nm
Oil sump bolts	10 Nm
Oil hose union to crankcase bolts	10 Nm
Balancer shaft holder bolts	10 Nm
Balancer shaft retainer plate Torx bolt	12 Nm
Oil strainer holder bolts	10 Nm
Crankcase top cover bolts (1991 to 1995 TDM models and all XTZ models).....	10 Nm
Crankcase 6 mm bolts	12 Nm
Crankcase 8 mm bolts	24 Nm
Crankcase 10 mm bolts	40 Nm
Connecting rod cap nuts	
Initial setting	
1991 to 1995 TDM models and all XTZ models.....	46 Nm
1996-on TDM models and all TRX models	35 Nm
Final setting (all models)	48 Nm
Transmission output shaft retainer plate bolts (left-hand side)	10 Nm
Transmission input shaft bearing retainer Torx screws	12 Nm
Oil gallery bolt	10 Nm

1 General information

The engine/transmission unit is a liquid-cooled parallel twin with five valves per cylinder (three inlet and two exhaust). The valves are operated by double overhead camshafts which are chain driven off the crankshaft. The engine/transmission assembly is constructed from aluminium alloy. The crankcase is divided horizontally.

The crankcase incorporates a dry sump, pressure-fed lubrication system which uses two gear-driven oil pumps, one a feed pump to lubricate the engine, the other a scavenge pump to return oil to the tank, both driven off the crankshaft. The sump houses the oil filter, by-pass valve assembly and relief valve. The oil tank is mounted behind the engine on 1991 to 1995 TDM models and all XTZ models, and on the engine behind the cylinders on later TDM models and all TRX models. The oil pumps are gear driven off the crankshaft.

The crankshaft also drives two balancer shafts which eliminate the vibration inherent in parallel twin engines

The alternator and starter clutch are on the left-hand end of the crankshaft.

Power from the crankshaft is routed to the transmission via the clutch. The clutch is of the wet, multi-plate type and is gear-driven off

the crankshaft. The transmission is a five-speed constant-mesh unit. Final drive to the rear wheel is by chain and sprockets.

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
Camshafts
Cylinder head
Cylinder block, pistons and piston rings
Pick-up coil assembly
Clutch
Gearchange mechanism (external components)
Alternator
Starter clutch
Oil filter
Oil pumps, oil strainer, oil pressure relief valve and by-pass valve
Starter motor
Water pump
Balancer shafts (1991 to 1995 TDM and all XTZ models)
Cam chain

Operations requiring engine removal

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

Transmission shafts
Selector drum and forks
Connecting rods and bearings
Crankshaft and bearings
Balancer shafts (1996-on TDM models and all TRX models)

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 rods 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.

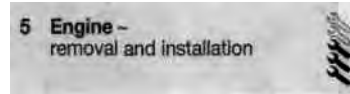
6 An engine overhaul generally involves restoring the internal parts to the specifications of a new engine. The piston rings and main and connecting rod bearings are usually renewed and the cylinder walls honed or, if necessary, re-bored during a major overhaul. Generally the valve seats are re-ground, 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.

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.



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 Support the bike securely in an upright position using an auxiliary stand. Work can be made easier by raising the machine to a suitable working height on an hydraulic ramp or a suitable platform. Make sure the motorcycle is secure and will not topple over (see *Tools and Workshop Tips* in the Reference section). When disconnecting any wiring, cables and hoses, it is advisable to mark or tag them as a reminder to where they connect.

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, side covers, fairing side panels (TDM and XTZ models), fairing, and engine bashplate (1991 to 1995 TDM models and XTZ models) (see Chapter 8). On 1996-on TDM models and XTZ models, the fairing can be left in situ, though it is advisable to remove

it to avoid the possibility of damaging it while removing the engine.

4 Remove the fuel tank (see Chapter 4).

5 Drain the engine oil and the coolant (see Chapter 1).

6 Disconnect the negative (-ve) lead from the battery, then disconnect the positive (+ve) lead (see Chapter 9). On 1991 to 1995 TDM models, remove the battery and the battery box (see Chapter 9).

7 Remove the radiator (see Chapter 3).

8 Remove the exhaust system (see Chapter 4).

9 Remove the carburetors (see Chapter 4).

Detach the vacuum hose(s) from the inlet manifolds. On 1991 to 1995 TDM models, unscrew the bolts securing the choke knob to the left-hand engine mounting bracket and position it clear. Plug the engine inlet manifolds with clean rag. On 1999 TDM remove the fuel pump and fuel filter as a unit complete with their mounting bracket (see Chapter 4).

10 On TDM and TRX models, remove the thermostat housing (see Chapter 3). When removing the housing, remove it along with the pipe that bolts onto the valve cover, rather than separating the hose from the pipe. The pipe is secured by a bolt - make sure the pipe O-ring does not fall into the engine when easing out the pipe (see illustration 7.2). Discard the O-ring as a new one must be used.

11 On XTZ models, unscrew the bolt securing the coolant pipe to the valve cover and ease the pipe out, making sure the O-ring does not fall into the engine. Discard the O-ring as a new one must be used.

12 Trace the alternator, ignition pick-up coil and neutral switch wiring from the top of the alternator cover and disconnect it at the connectors (see illustrations). Release the wiring from any clips or ties, noting its routing, and coil it so that it does not impede engine removal.

13 Disconnect the spark plug caps from the spark plugs and secure them clear of the engine.



5.12a Alternator/pick-up coil/neutral switch wiring connectors (arrowed) - TDM models



5.12b Alternator/pick-up coil/neutral switch wiring connectors (arrowed) - TRX models



5.12c Alternator/pick-up coil/neutral switch wiring connectors (arrowed) - XTZ models

2»8 Engine, clutch and transmission



5.14 Unscrew the nut and detach the starter motor lead from the starter relay



5.16 Unscrew the bolt (arrowed) and detach the cable and hose clip

14 Disconnect the starter motor lead from the starter relay (see illustration).

15 Disconnect the earth wiring connector from the main wiring loom.

16 On 1991 to 1995 TDM models and all XTZ models, the battery's main earth cable can remain attached to the engine. On 1996-on TDM models and all TRX models, unscrew the bolt securing the cable to the back of the engine and detach it along with the clip securing the hoses (see illustration).

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

18 Remove the front sprocket (see Chapter 6). On TDM and XTZ models, also remove the gearchange lever (see Chapter 6).

19 On 1991 to 1995 TDM models and all XTZ models, disconnect the crankcase breather hose from the crankcase (see illustration). Also slacken the clamp and detach the hose from its union on the oil filter housing (see illustration). Now unscrew the bolts and detach the oil pipe from the oil pump cover

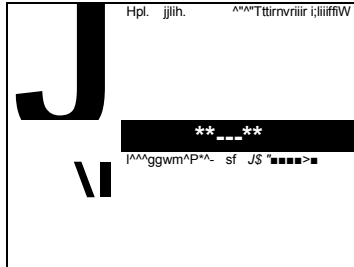
(see illustration). Discard the O-ring as a new one must be used.

20 At this point, position a hydraulic or mechanical jack under the engine with a block of wood between the jack head and crankcase (see illustration). 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. It is also advisable to place a block of wood between the rear wheel and the ground, or under the swingarm, to prevent the bike tilting back onto the rear wheel 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. Check that any protruding mounting brackets will not get in the way and remove them if necessary.

21 On TDM models, unscrew the bolts securing the engine bracket to the frame and the engine on each side and remove the brackets (see illustrations). Note which bolt fits where as they are of different lengths. Make sure the engine is properly supported on the jack, and have an assistant support it



5.19a Release the clamp and detach the breather hose (arrowed)



5.19b Slacken the clamp screw (arrowed) and detach the hose



5.19c Unscrew the bolts (arrowed) and detach the pipe



5.20 Position a jack under the engine



5.21a Unscrew the bolts (arrowed) and remove the left-hand ...



5.21b ... and right-hand engine brackets



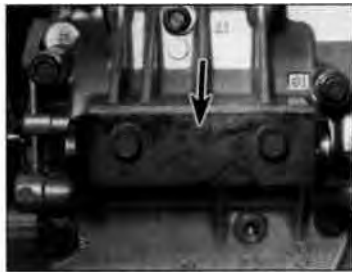
5.21c Upper rear engine mounting bolt (arrowed)



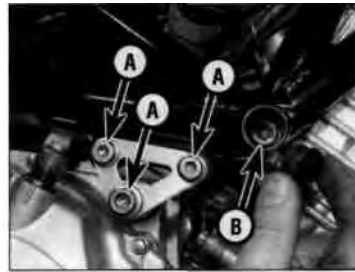
5.21d Lower rear engine mounting bolt (arrowed)



5.21 e Remove the triangular bracket (arrowed)...



5.21f ... and the bottom bracket (arrowed)

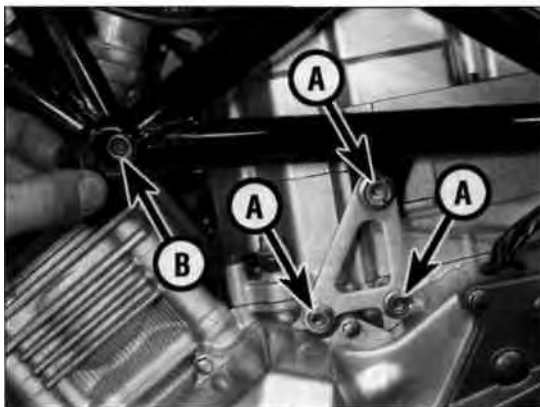


5.22a Engine bracket bolts (A) and upper front mounting bolt (B) - right-hand side

as well. Remove the cap from each end of the upper rear mounting bolt, then unscrew the nut and withdraw the bolt (see illustration). Finally unscrew and remove the lower rear mounting bolt (see illustration). If required, after the engine has been removed, unscrew the bolts securing the small triangular mounting bracket to the left-hand side of the engine and the bolts securing the bracket to

the underside of the engine at the back and remove the brackets (see illustrations). 22 On TRX models, unscrew the bolts securing the engine bracket to the frame and the engine on each side and remove the brackets, along with the collar fitted with the right-hand bracket (see illustrations). Note which bolt fits where as they are of different lengths. Remove the caps from the upper

front mounting bolts, then unscrew the bolts. Make sure the engine is properly supported on the jack, and have an assistant support it as well. Unscrew the nut from the upper rear mounting bolt and withdraw the bolt (see illustration). Finally unscrew the nut on the lower rear mounting bolt and remove the bolt. 23 On XTZ models, unscrew the nut from the lower front mounting bolt and remove the bolt

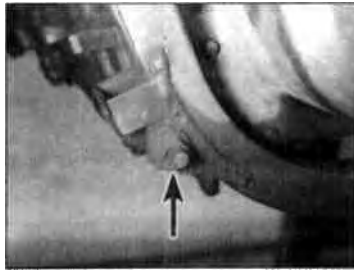


5.22b Engine bracket bolts (A) and upper front mounting bolt (B) -left-hand side



5.22c Upper and lower rear mounting bolts (arrowed)

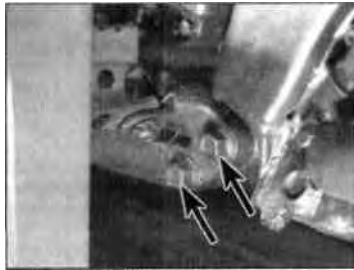
2»10 Engine, clutch and transmission



5.23a Lower front mounting bolt (arrowed)



5.23b Downtube upper bolts (arrowed)



5.23c Downtube lower bolts (arrowed)



5.23d Upper and lower rear mounting bolts (arrowed)

(see illustration). Unscrew the four bolts securing each of the frame downtubes and remove the downtubes (see illustrations). Remove the cap from each end of the upper rear mounting bolt, then unscrew the nut and withdraw the bolt (see illustration). Unscrew the nut on the lower rear mounting bolt and remove the bolt. Remove the cap from each end of the swingarm pivot bolt, then unscrew the nut on its right-hand end. The swingarm pivot bolt also acts as the middle rear engine mounting bolt, so it must be removed. To prevent the swingarm/rear wheel assembly from becoming unstable, partially withdraw the pivot bolt from the left-hand side and slide into its place from the right-hand side a suitable bolt that will support the swingarm, making sure that it does not go into the engine mount. Withdraw the pivot bolt further until the engine is free, but leave it partially inserted so that it still supports the left-hand side of the swingarm.

24 The engine can now be removed from the frame. Check that all wiring, cables and hoses are well clear, then carefully lower the engine and manoeuvre it forward and out of the side of the frame (see **Caution** above).

Installation

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

- Make sure no wires, cables or hoses become trapped between the engine and the frame when installing the engine.
- Many of the engine mounting bolts are of different size and length. Make sure the

correct bolt is installed in its correct location, with its washer if fitted. Install all of the bolts and nuts finger-tight until they are all located, then tighten them in the order given in the relevant Step below to their torque settings as specified at the beginning of the Chapter.

- On TDM models, if removed, and before the engine is mounted, fit the small triangular mounting bracket onto the left-hand side of the engine and the bracket to the underside of the engine at the back and tighten their bolts to the specified torque setting (see illustration 5.21e and f). Locate all the mounting bolts, not forgetting the washers with the engine bracket-to-engine mounting bolts, and tighten them finger-tight. Now tighten the lower rear mounting bolt first, then the upper rear mounting bolt nut, then the engine bracket-to-engine bolts, and finally the engine bracket-to-frame bolts, tightening them all to their specified torque. Fit the caps into each end of the upper rear bolt.
- On TRX models, locate all the mounting bolts, not forgetting the washers with the upper and lower rear bolts (they locate under the bolt head, not the nut), and the collar between the right-hand engine bracket and the engine, and tighten them finger-tight. Now tighten the lower rear mounting bolt nut first, then the upper rear mounting bolt nut, then the upper front mounting bolts (left-hand side first), then the engine bracket-to-engine and

frame bolts (left-hand side), and finally the engine bracket-to-engine and frame bolts (right-hand side), tightening them all to their specified torque. Fit the caps into the upper front bolts.

- On XTZ models, locate the swingarm pivot bolt first, followed by the lower and upper and rear mounting bolts, then fit the frame downtubes, and finally locate the lower front bolt, not forgetting the washers with the swingarm bolt nut and the lower rear bolt nut, and tighten them finger-tight. Now tighten them in the same order to the specified torque settings. Fit the caps into each end of the swingarm pivot and the upper rear bolt.
- On 1991 to 1995 TDM models and all XTZ models, use a new O-ring on the oil pipe to oil pump cover union and tighten the bolts to the specified torque setting.
- Use new gaskets on the exhaust pipe connections.
- Make sure all wires, cables and hoses are correctly routed and connected, and secured by any clips or ties, i) Refill the engine with oil and coolant (see Chapter 1). j) Adjust the throttle and clutch cable freeplay and engine idle speed (see Chapter 1). k) Adjust the drive chain slack (see Chapter 1). l) 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, the external surfaces of the unit should be thoroughly cleaned and degreased. 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. 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 inlet and exhaust ports.

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

2 When clean and dry, arrange the unit on the workbench, leaving 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 so that notes can be made and labels attached where necessary. A supply of clean rag is also required.

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3 Before commencing work, read through the appropriate section so that some idea of the necessary procedure can be gained. When removing 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 made from short lengths of 2 x 4 inch wood bolted together into a rectangle will help support the engine (see illustration). 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, cylinders, 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 A complete engine/transmission disassembly should be done in the following general order with reference to the appropriate Sections of this Chapter.

Remove the valve cover

Remove the camshafts

Remove the cylinder head

Remove the cylinder block

Remove the pistons

Remove the clutch

Remove the alternator/pick-up coil

assembly (see Chapter 9) Remove the

starter motor (see Chapter 9) Remove the

gearchange mechanism

external components Remove the oil

pumps Remove the oil sump Separate

the crankcase halves Remove the

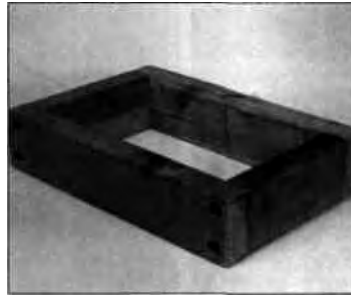
crankshaft Remove the transmission

shafts Remove the selector drum and

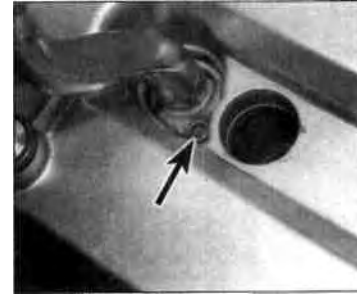
forks Remove the balancer shafts

Reassembly

7 Reassembly is accomplished by reversing the general disassembly sequence.



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



7.2 Unscrew the bolt (arrowed) and detach the pipe from the cover

7 Valve cover - removal and installation

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Note: The valve covers 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 fuel tank, the air filter housing and the carburetors (see Chapter 4). Drain the coolant (see Chapter 1).

2 On TDM and TRX models, remove the thermostat housing (see Chapter 3). When removing the housing, remove it along with the pipe that bolts onto the valve cover, rather than separating the hose from the pipe. The pipe is secured by a bolt - make sure the pipe O-ring does not fall into the engine when easing out the pipe (see illustration). Discard the O-ring as a new one must be used.

3 On XTZ models, unscrew the bolt securing the coolant pipe to the valve cover and ease the pipe out, making sure the O-ring does not fall into the engine (see illustration 7.2). Discard the O-ring as a new one must be used.

4 If required, release the clamp securing the breather hose to the valve cover and detach the hose (see illustration).

5 Pull the spark plug caps off the plugs and secure them clear of the engine, noting which fits where.

6 Unscrew the bolts securing the valve cover then lift the cover off the cylinder head (see illustration). On 1996-on TDM models and all TRX models, note which bolt fits where as some are of different length. 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. Also remove the gasket. Note the rubber spark plug hole gaskets fitted inside the cover and remove them if they are loose.

Installation

7 Examine the valve cover gasket and the spark plug hole gaskets for signs of damage or deterioration and renew them if necessary. Similarly check the rubber grommets on the cover bolts (see illustration 7.10b).

8 Clean the mating surfaces of the cylinder head and the valve cover with lacquer thinner, acetone or brake system cleaner.

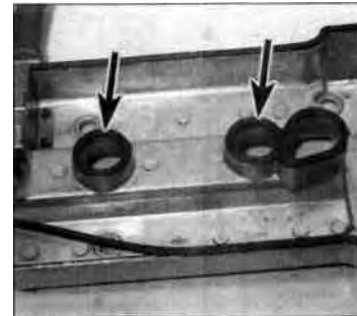
9 Install the gasket onto the valve cover, making sure it fits correctly into the groove (see illustration). Also fit the spark plug hole gaskets. Use a few dabs of grease to keep the gaskets in place while the cover is fitted.



7.4 Release the clamp and detach the breather hose (arrowed)



7.6 Unscrew the valve cover bolts (arrowed) and remove the cover - early TDM and XTZ type cover shown



7.9 Fit the main gasket and the spark plug hole gaskets (arrowed) into their grooves

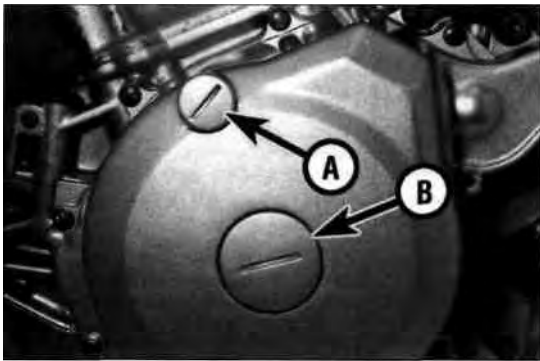
2*12 Engine, clutch and transmission



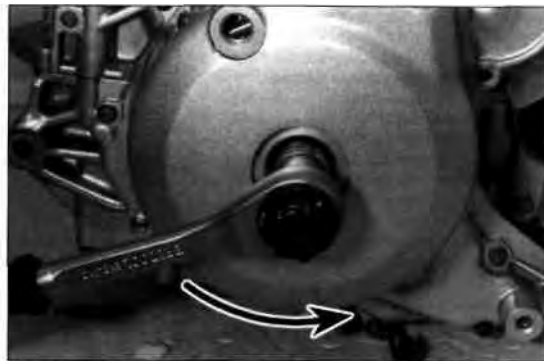
7.10a Install the valve cover...



7.10b ... and tighten the bolts



8.2a Unscrew the timing inspection plug (A) and the centre plug (B)



8.2b Turn the engine using a socket on the alternator bolt

10 Position the valve cover on the cylinder head, making sure the gaskets stay in place (**see illustration**). Install the cover bolts and tighten them to the torque setting specified at the beginning of the Chapter (**see illustration**).
11 Install the remaining components in the reverse order of removal.

8 Camshafts and followers - removal, inspection and installation

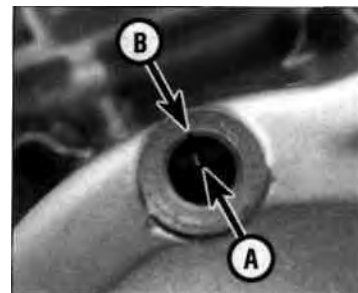
Note: The camshafts can be removed with the engine in the frame. Place rags over the spark plug holes and the camchain tunnel to prevent any component from dropping into the engine on removal.

Removal

1 Remove the valve cover (see Section 7).
 2 Unscrew the timing inspection plug and the centre plug from the alternator cover on the left-hand side of the engine (**see illustration**).

Discard the plug O-rings as new ones should be used. The engine can be turned using a 19 mm socket on the alternator rotor bolt and turning it in an anti-clockwise direction only (**see illustration**). Alternatively, place the motorcycle on an auxiliary stand so that the rear wheel is off the ground, select a high gear and rotate the rear wheel by hand in its normal direction of rotation.
 3 Turn the engine until the T mark on the rotor aligns with the static timing mark on the alternator cover (a notch in the timing inspection hole), and the camshaft lobes for the No. 1 (left-hand) cylinder are facing away from each other (**see illustration**). **Note:** Do not confuse the T mark on the rotor (which indicates TDC) with the 'H' mark which will appear first and which indicates the firing point of the ignition system. If the cam lobes are facing towards each other, rotate the engine anti-clockwise 360° (one full turn) so that the 'I' mark again aligns with the static timing mark. The camshaft lobes will now be facing away from each other and the No. 1 cylinder is at TDC (top dead centre) on the

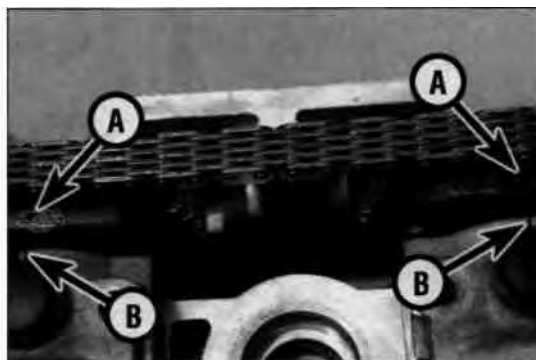
compression stroke. Before disturbing the camshafts, make a note of the timing markings on the sprockets and how they align with the cylinder head. With the No. 1 cylinder at TDC, The 'E' mark on the exhaust camshaft sprocket is parallel with the cylinder head top



8.3a Turn the engine until the mark on the rotor (A) aligns with the static mark on the cover(B)



8.3b Note the alignment of the timing mark letters on the sprockets with the cylinder head...



8.3c ... and of the punch marks (A) on the ends of the camshafts with the lines (B) on the camshaft holders

surface and faces back, while the 'I' mark on the inlet camshaft sprocket is parallel with the cylinder head top surface and faces forward (see illustration). Also the punch mark on each camshaft sprocket holder faces up and aligns with the mark on the top of the camshaft holder (see illustration). If you are in any doubt as to the alignment of the markings, or if they are not visible, make your own alignment marks between all components, and also between a tooth on each sprocket and its corresponding link on the chain, before disturbing them. These markings ensure that the valve timing can be correctly set up on assembly without difficulty. As it is easy to be a tooth out on installation, marking between a tooth on each sprocket and its link in the chain is especially useful.

4 Unscrew the bolts securing the cam chain top guide and remove the guide, noting how it fits (see illustration).

5 Slacken, but do not remove, the camshaft sprocket bolts (see illustration). If the sprockets turn, counter-hold them by

inserting a screwdriver or bar through the hole in the centre of the camshaft (see illustration 8.29a), or by counter-holding the alternator rotor.

6 Remove the cam chain tensioner (see Section 9).

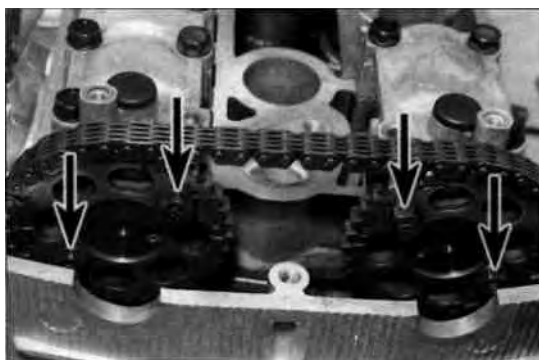
7 Make a mark on each sprocket to denote whether it fits with the exhaust or inlet camshaft (the appropriate existing letter can be highlighted). Remove the sprocket bolts, then draw each sprocket off the end of its camshaft and slip it out of the chain (see illustration). If required, also lift the cam chain front guide out of the front of the cam chain tunnel, noting how and which way round it fits (see Section 24). While the camshaft sprockets are off, don't allow the cam chain to go slack and do not rotate the crankshaft - the chain may drop down and bind between the crankshaft and case, which could damage these components. Wire the chain to another component or secure it using a rod of some sort to prevent it from dropping.

8 Before removing the camshaft holders, make a note of which fits where. All the

holders are marked with a letter and number to denote their location - I 1 is the inlet camshaft holder on the No. 1 cylinder (left-hand) side, E 1 is the exhaust camshaft holder on the No. 1 cylinder, and so on. Also each holder is marked with an arrow which points towards the cam chain. Otherwise their



8.4 Unscrew the bolts (arrowed) and remove the guide

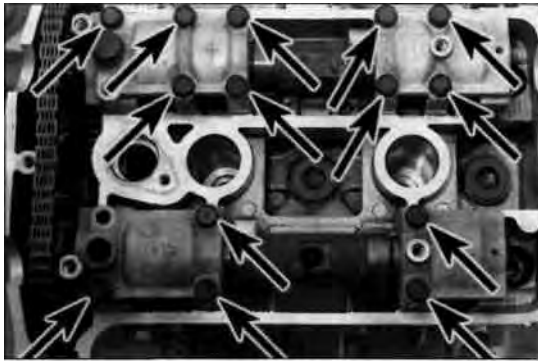


8.5 Slacken the camshaft sprocket bolts (arrowed)



8.7 Slide the sprockets off the camshafts and out of the chain

2*14 Engine, clutch and transmission



8.9 Unscrew and remove the camshaft holder bolts (arrowed)



8.10a Lift out the follower ...



8.10b ... and remove the shim either from inside the follower...



8.10c ... or from the top of the valve

locations are readily identifiable by the differing number or location of bolts which secures each one.

9 Before slackening the camshaft holder bolts, check whether any of the cam lobes are directly depressing the valves and if so, rotate the camshaft slightly to release the pressure; this will prevent distortion or undue strain on the holders as the bolts are slackened. Unscrew the camshaft holder bolts for the camshaft being worked on, evenly and a little at a time in a criss-cross

8.11 Check the journal surfaces of the camshaft for scratches or wear

pattern, until they are all loose (see illustration).

Caution: If the bolts aren't loosened evenly, the camshaft may bind.

Remove the bolts, then lift off the camshaft holders, noting how they fit, and remove the camshafts (see illustrations 8.26a and 8.25). Retrieve the dowels from either the holder or the cylinder head if they are loose. Keep all mated parts together.

10 Obtain a container which is divided into ten compartments, and label each compartment

with the location of its corresponding valve in the cylinder head and whether it belongs with an inlet or an exhaust valve. If a container is not available, use labelled plastic bags. Using a pair of pliers or a magnet if necessary, lift each follower out of the cylinder head and store it in its corresponding compartment in the container (see illustration). The shim is likely to stick to the inside of the follower so take great care not to lose it when removing the follower (see illustration). Retrieve the shim from either the inside of the follower or pick it out of the top of the valve using a magnet, a small screwdriver with a dab of grease on it (the shim will stick to the grease), or a screwdriver and a pair of pliers (see illustration). Do not allow the shim to fall into the engine.

Inspection

11 Inspect the bearing surfaces of the camshaft holders and the corresponding journals on the camshaft. Look for score marks, deep scratches and evidence of spalling (a pitted appearance) (see illustration).

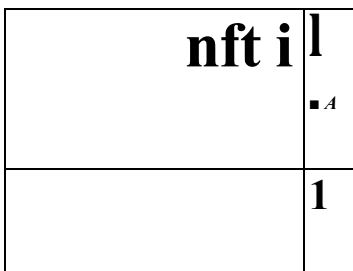
12 Check the camshaft lobes for heat discoloration (blue appearance), score marks, chipped areas, flat spots and spalling (see illustration). Measure the height of each lobe



8.12a Check the lobes of the camshaft for wear - here's an example of damage requiring camshaft repair or renewal



8.12b Measure the height of the camshaft lobes with a micrometer



8.13 Measuring camshaft runout



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

with a micrometer (see illustration) and compare the results to the minimum lobe height listed in this Chapter's Specifications. If damage is noted or wear is excessive, the camshaft must be renewed. Also, be sure to check the condition of the followers. 13 Check the amount of camshaft runout by supporting each end of the camshaft on V-blocks, and measuring any runout using a dial gauge (see illustration). If the runout exceeds the specified limit the camshaft must be renewed.

SB HINT Refer to Tools and Workshop Tips in the Reference section for details of how to read a micrometer and dial gauge.

14 Next, check the camshaft bearing oil clearances. Check each camshaft in turn rather than at the same time. Clean the camshaft, the bearing surfaces in the cylinder head and camshaft holders with a clean lint-free cloth, then lay the camshaft in place in the cylinder head.

15 Cut some strips of Plastigauge and lay one piece on each bearing journal, parallel with the camshaft centreline (see

illustration). Make sure the camshaft holder dowels are installed. Lay the holders in their correct place in the cylinder head (see Step 8) (see illustration 8.26a). Make sure the arrow on each camshaft holder points towards the cam chain. Tighten the bolts evenly and a little at a time in a criss-cross pattern, working from the centre of the camshaft outwards, to the torque setting specified at the beginning of the Chapter (see illustration 8.26b). Whilst tightening the bolts, make sure the holders are being pulled squarely down and are not binding on the dowels. While doing this, don't let the camshafts rotate.

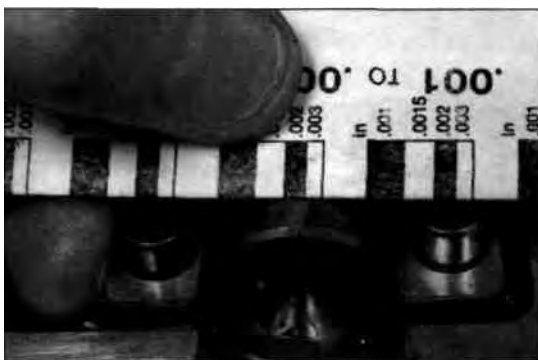
16 Now unscrew the bolts a evenly and a little at a time in a criss-cross pattern, and carefully lift off the camshaft holders.

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 cam bearing journal with a micrometer (see illustration). If the journal diameter is less than the specified limit, renew the camshaft and recheck the clearance. If the clearance is still too great, renew the cylinder head and holders.

fffff!q! Before renewing camshafts or the holders because of HiAT 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 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 be explored before condemning them as trash!

18 Except in cases of oil starvation, the cam chain wears 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, renew it. Refer to Section 24 for the procedure.

19 Check the sprockets for wear, cracks and other damage. If the sprockets are worn, the cam chain is also worn, and so is the sprocket on the crankshaft. If severe wear is apparent, the entire engine should be disassembled for inspection.



8.17a Compare the width of the crushed Plastigauge to the scale printed on the Plastigauge container

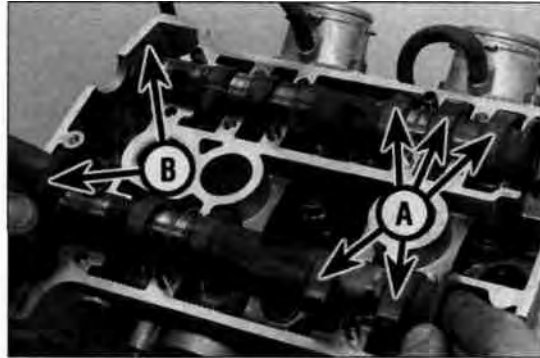


8.17b Measure the cam bearing journals with a micrometer

2*16 Engine, clutch and transmission



8.22 Fit the followers onto the valves



8.25 Install the camshafts as shown, with the No. 1 cylinder lobes (A) facing away from each other and the punch mark (B) on each sprocket holder facing up

20 Inspect the cam chain guide blade (see Section 24).

21 Inspect the outer surfaces of the cam 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. Check for clearance between the followers and their bores. Whilst no specifications are given, if slack is excessive, renew the followers. If the bores are seriously out-of-round or tapered, the cylinder head and the followers must be renewed.

Installation

22 Lubricate each shim and its follower with molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and engine oil) and fit each shim into its recess in the top of the valve, with the size marking on each shim facing up (see illustration 8.10c). Make sure each shim is correctly seated in the top of the valve assembly, then install each follower, making sure it fits squarely in its bore (see illustration). **Note:** It is most important that the shims and followers are returned to

their original valves otherwise the valve clearances will be inaccurate.

23 If removed, fit the cam chain front guide into the front of the cam chain tunnel, making sure it is the correct way round with the lugs properly located in the cutouts in the top of the cylinder head (see Section 24).

24 Make sure the bearing surfaces on the camshafts and in the holders are clean, then apply molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and engine oil) to each of them. Also apply it to the camshaft lobes.

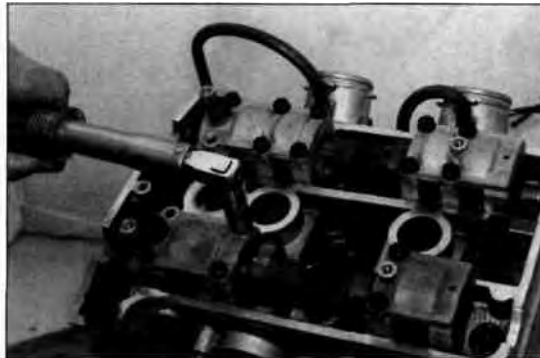
25 Verify that the T mark on the timing rotor is still aligned with the notch (see Step 3) (see illustration 8.3a). Lay the inlet camshaft (with six lobes) onto the back of the head, making sure the No. 1 (left-hand) cylinder lobes are facing backwards and the punch mark on the sprocket holder is facing up. Now lay the exhaust camshaft (with four lobes) onto the front of the head, making sure the No. 1 cylinder lobes are facing forward and the punch mark on the sprocket holder is facing up (see illustration).

26 Make sure the camshaft holder dowels are installed. Lay the holders in their correct place in the cylinder head (see Step 8) (see illustration). Make sure the arrow on each camshaft holder points towards the cam chain. Tighten the bolts evenly and a little at a time in a criss-cross pattern, working from the centre of the camshaft outwards, to the torque setting specified at the beginning of the Chapter (see illustration). Whilst tightening the bolts, make sure the holders are being pulled squarely down and are not binding on the dowels. **Caution: The holders are likely to break if they are not tightened down evenly and squarely.**

27 When installing the camshaft sprockets, align the 'E' marks (for the exhaust camshaft) and the 'I' marks (for the inlet camshaft) on the camshaft sprockets exactly with the cylinder head surface, with the letters that are the correct way up facing each other (see illustration 8.3b). Check that the punch mark on each sprocket holder is aligned with the mark on the camshaft holders (see illustration 8.3c). If the camshafts need to be



8.26a Fit the holders onto the dowels..



8.26b ... and tighten the bolts as described to the specified torque setting



8.28a Fit the exhaust sprocket into the chain and onto the camshaft...



8.28b ... then fit the inlet sprocket



8.29a Install the sprocket bolts and counter-hold the camshafts as shown...



8.29b ... then tighten the bolts to the specified torque



8.30 Install the cam chain top guide



8.33 Use new O-rings on the plugs

turned slightly, use a screwdriver or bar through the hole in the middle of the camshaft to turn them.

28 Fit the cam chain around the exhaust sprocket, aligning the marks between sprocket tooth and link if made. When fitting the chain, pull up on the front run to remove all slack from it (see illustration). Now fit the sprocket onto the end of the camshaft, aligning the bolt holes. Next fit the inlet sprocket into the chain and onto the inlet camshaft, making sure there is no slack in the chain between the camshafts, and aligning the bolt holes (see illustration). At this point check that all the timing marks are still in exact alignment as described in Step 3. Note that it is easy to be slightly out (one tooth on the sprocket) without the marks appearing drastically out of alignment. If all marks align correctly, install the sprocket bolts and tighten them finger-tight. If the marks are out, verify which sprocket is misaligned and slide it off the camshaft, then disengage it from the chain and move it round as required, then fit it back into the chain and onto the sprocket, and check the marks again.

Caution: If the marks are not aligned exactly as described, the valve timing will be incorrect and the valves may strike the pistons, causing extensive damage to the engine.

29 With everything correctly aligned, tighten the sprocket bolts to the torque setting specified at the beginning of the Chapter,

using a screwdriver or bar inserted through the hole in each camshaft to prevent them turning, or by counter-holding the alternator rotor (see illustrations).

30 Install the cam chain top guide and tighten the bolts to the same torque setting as the other camshaft holder bolts (see illustration).

31 Install the cam chain tensioner (see Section 9). Turn the engine anti-clockwise through two full turns and check again that all the timing marks still align (see Step 3).

32 Check the valve clearances and adjust them if necessary (see Chapter 1). **Note:** A valve clearance check is essential if you have installed any new valve components or a new camshaft.

33 Use new O-rings on the timing inspection plug and centre plug and tighten the plugs securely (see illustration).

34 Install the valve cover (see Section 7).

9 Cam chain tensioner - removal, inspection and installation

Note: This procedure can be performed with the engine in the frame. **Caution:** Once you start to remove the tensioner bolts, you must remove the tensioner all the way and reset it before tightening the bolts. The tensioner extends

itself and locks in place, so if you loosen the bolts partway and then retighten them, the tensioner or cam chain will be damaged.

Removal

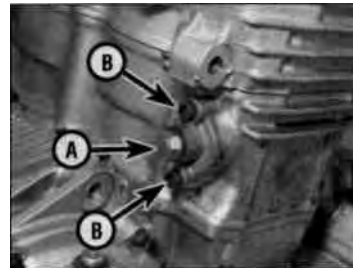
1 Unscrew the tensioner spring cap bolt and withdraw the springs from the tensioner body (see illustration).

2 Unscrew the two tensioner mounting bolts and withdraw the tensioner from the back of the cylinder block, noting which way up it fits (see illustration 9.1).

3 Discard the tensioner body gasket as a new one must be used.

Inspection

4 Examine the tensioner components for signs of wear or damage.



9.1 Tensioner cap bolt (A), tensioner mounting bolts (B)



9.5 Release the ratchet and press the plunger in



9.8a Install the tensioner using a new gasket...



9.8b ... and tighten the mounting bolts to the specified torque



9.9 Install the springs and cap bolt

5 Release the ratchet mechanism from the tensioner plunger and check that the plunger moves freely in and out of the tensioner body (see illustration).

6 If the tensioner or any of its components are worn or damaged, or if the plunger is seized in the body, the tensioner must be renewed - individual components are not available.

Installation

7 Release the ratchet mechanism and press the tensioner plunger all the way into the tensioner body (see illustration 9.5).

8 Fit a new gasket onto the tensioner body, then install the tensioner in the engine and tighten the bolts to the torque setting

specified at the beginning of the Chapter (see illustrations).

9 Install the springs and cap bolt, with its washer, and tighten the bolt to the specified torque setting (see illustration).

10 Remove the alternator cover centre plug and turn the crankshaft anti-clockwise through two full turns using a socket on the rotor bolt (see illustrations 8.2a and b). This will allow the tensioner to set itself properly. Use a new O-ring on the centre plug.

11 It is advisable to remove the valve cover (see Section 7) and check that the cam chain is tensioned and all the timing marks are in alignment (see Section 8). If the chain is slack, the tensioner plunger did not release when the spring and cap bolt were installed. Remove the tensioner again and re-check it. Again check the timing marks (see Section 8), then install the valve cover (see Section 7).

Note 2: If no work is being carried out on the valves, the cylinder head can be removed with the camshafts in place. Holes in the camshafts and in the right-hand camshaft holders allow access to the cylinder head nuts. The camshaft sprockets must be removed.

Removal

1 Remove the valve cover (see Section 7), the camshaft sprockets (see Section 8), and if required the camshafts (see Note 2 above). If the camshafts are being left in place, remove the blanking cap from the top of each right-hand camshaft holder, then turn the camshafts using a screwdriver or rod through the hole in the middle of the camshaft until the access holes in the shafts align with the cylinder head nuts (see illustration). If the camshafts are left in place, the nuts and washers cannot be removed after they have been loosened as the camshafts will be in the way.

2 Remove the exhaust system (see Chapter 4).

3 If not already done, remove the cam chain front guide (see Section 24).

4 If required, release the clamp(s) securing the vacuum hose(s) to the inlet manifold(s) and detach the hose(s).

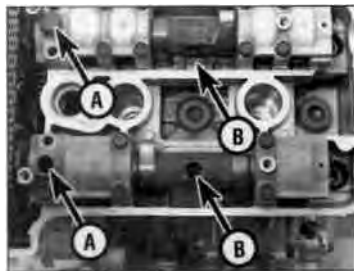
5 Unscrew the oil pipe banjo bolt from the cylinder head and detach the pipe from the cylinder head (see illustration). Discard the banjo bolt sealing washers as new ones must be used.

10 Cylinder head - removal and installation

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

Note 1: The cylinder head can be removed with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.



10.1 Remove the blanking caps (A) from the holes in the holders. Turn the shafts using the centre holes (B) until the access holes in each camshaft align with the nuts



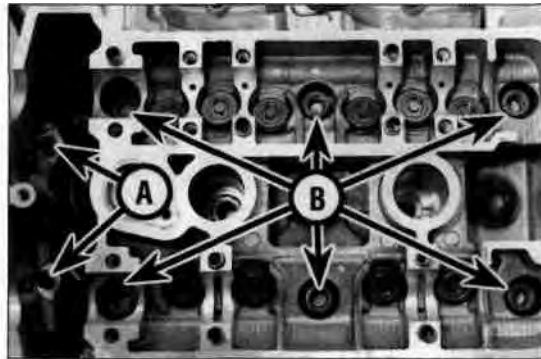
10.5 Unscrew the banjo bolt (arrowed) and detach the oil pipe



10.6a On TDM models, remove the cylinder head-to-bracket bolt (arrowed) on each side



10.6b On TRX models, remove the blanking cap, then remove the frame-to-cylinder head bolt (arrowed) on each side



10.7 Cylinder head bolts (A) and nuts (B)

6 On TDM and TRX models, unscrew the engine mounting bolts which thread into the cylinder head on each side (see illustrations). On TRX models, first remove the caps.

7 Each cylinder head is secured by two bolts, located in the cam chain tunnel, and six nuts (see illustration). First unscrew and remove the bolts (see illustration 10.16). Now slacken the nuts evenly and a little at a time in a criss-cross pattern until they are all slack, then remove the nuts and their washers (see illustration 10.15).

8 Pull the cylinder head up off the block (see illustration). If it is stuck, tap around the joint faces of the cylinder head with a soft-faced mallet to free the head. Do not attempt to free the head by inserting a screwdriver between the head and cylinder block - you'll damage the sealing surfaces. Remove the old cylinder head gasket and discard it as a new one must be used.

9 If they are loose, remove the dowels from the cylinder block. If they appear to be missing they are probably stuck in the underside of the cylinder head.

10 Check the cylinder head gasket and the mating surfaces on the cylinder head and block for signs of leakage, which could indicate warpage. Refer to Section 12 and check the flatness of the cylinder head.

Installation

11 Clean all traces of old gasket material from the cylinder head and block. If a scraper is used, take care not to scratch or gouge the soft aluminium. Be careful not to let any of the gasket material fall into the crankcase, the cylinder bores or the oil passages.

IJTHJT33 Refer to *Tools and milUSi workshop Tips* in the

Reference section for details of gasket removal methods.

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12 If removed, install the dowels into the cylinder block (see illustration 10.13). Lubricate the cylinder bores with engine oil.

13 Ensure both cylinder head and block mating surfaces are clean, then lay the new head gasket in place on the cylinder block, making sure all the holes are correctly aligned (see illustration). Never re-use the old gasket.

14 Carefully fit the cylinder head onto the block, making sure it locates correctly onto the dowels (see illustration 10.8).

15 Lubricate the threads of the cylinder head nuts with clean engine oil (if the camshafts are in place, one or two drops of oil can be squirted around the nuts into the stud holes). Install the nuts with their washers and tighten

them finger-tight (see illustration). Now tighten the nuts evenly and a little at a time in a criss-cross pattern to the torque setting specified at the beginning of the Chapter.

16 Install the two cylinder head bolts and tighten them to the specified torque setting (see illustration).

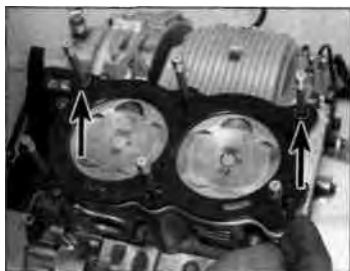
17 On TDM and TRX models, install the engine mounting bolts and tighten them to the specified torque setting (see illustrations 10.6a and b). On TRX models, fit the caps into the bolt heads.

18 Install the oil pipe onto the cylinder head, using new sealing washers on each side of



10.8 Carefully lift the head up off the block

2



10.13 Lay a new head gasket over the dowels (arrowed) and onto the head



10.15 Install the nuts with their washers and tighten them as described to the specified torque



10.16 Install the bolts and tighten them to the specified torque



10.18a Use new sealing washers on each side of the union ...



10.18b ... and tighten the banjo bolt to the specified torque

the union, and tighten the banjo bolt to the specified torque (see illustrations).

19 If removed, fit the vacuum hose(s) onto the inlet manifold(s) and fit the clamp(s).

20 Install the remaining components in a reverse of their removal sequence, referring to the relevant Sections or Chapters (see Steps 1, 2 and 3).

11 Valves/valve seats/valve guides - overhaul

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.

2 The home mechanic can, however, remove the valves from the cylinder head, clean and check the components for wear and assess the extent of the work needed, and, unless a valve overhaul is required, grind in the valves (see Section 12).

3 The engineer will renew the valves, guides and springs, recut the valve seats, clean and polish the valve ports and reassemble the valve components.

4 After the valve overhaul 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.

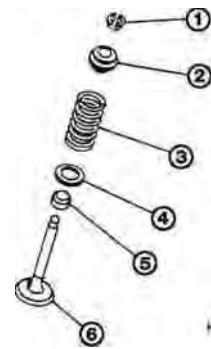
12 Cylinder head and valves - disassembly, inspection and reassembly

1 As mentioned in the previous section, valve overhaul should be left to an engineer. 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 essential. Make sure that it is suitable for motorcycle work.

Disassembly

3 Before proceeding, arrange to label and store the valves along with their related components in such a way that they can be returned to their original locations without getting mixed up (see illustration). A good way to do this is to use the same container as the shims are stored in (see Section 8), or to obtain a separate container which is divided into ten compartments, and to label each compartment with the identity of the valve which will be stored in it (ie number of cylinder, inlet or exhaust side, inner, middle or outer valve). Alternatively, labelled plastic bags will do just as well.



12.3 Valve components

- | | |
|-------------------|-----------------------|
| 1 Collets | 5 Valve stem oil seal |
| 2 Spring retainer | 6 Valve |
| 3 Valve spring | |
| 4 Spring seat | |

4 Clean all traces of old gasket material from the cylinder head. If a scraper is used, take care not to scratch or gouge the soft aluminium.

HAYNES HINT Refer to Tools and Workshop Tips in the Reference section for details of gasket removal methods.

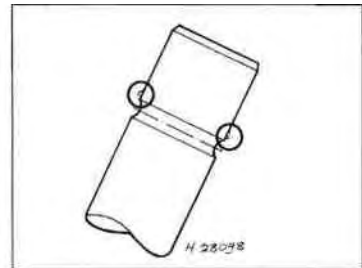
5 Compress the valve spring on the first valve with the spring compressor, making sure it is correctly located onto each end of the valve assembly (see illustration). Do not compress the spring any more than is absolutely necessary. Remove the collets, using either needle-nose pliers, tweezers, a magnet or a screwdriver with a dab of grease on it (see illustration). Carefully release the valve spring compressor and remove the spring retainer, noting which way up it fits, the spring, the spring seat, and the valve, from the head (see illustration 12.3). 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).



12.5a Compressing the valve springs using a valve spring compressor



12.5b Remove the collets with needle-nose pliers, tweezers, a magnet or a screwdriver with a dab of grease on it



12.5c If the valve stem won't pull through the guide, deburr the area above the collet groove



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



12.14a Measure the valve stem diameter with a micrometer



12.14b Insert a small-hole gauge into the valve guide and expand it so there's a slight drag when it's pulled out

6 Repeat the procedure for the remaining valves. Remember to keep the parts for each valve together and in order so they can be reinstalled in the same location.

7 Once the valves have been removed and labelled, pull the valve stem seals off the top of the valve guides with pliers and discard them (the old seals should never be reused).

8 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.

9 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.

10 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

11 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 8).

12 Using a precision straight-edge and a feeler gauge set to the warpage limit listed in the specifications at the beginning of the Chapter, check the head gasket mating surface for warpage. Refer to *Tools and Workshop Tips* in the Reference section for details of how to use the straight-edge.

13 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.

14 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-hole gauge and micrometer (see

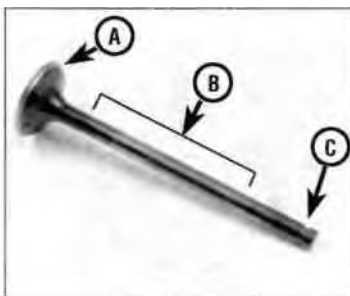
illustrations). The guides are measured at the ends and at the centre to determine if they are worn in a bell-mouth pattern (more wear at the ends). Subtract the stem diameter from the valve guide diameter to obtain the valve stem-to-guide clearance. If the stem-to-guide clearance is greater than listed in this Chapter's Specifications, the guides and valves will have to be renewed. If the valve stem or guide is worn beyond its limit, or if the guide is worn unevenly, it must be renewed.

15 Carefully inspect each valve face for cracks, pits and burned spots. Check the valve stem and the collet groove area for cracks (see illustration). Rotate the valve and check for any obvious indication that it is bent. Using V-blocks and a dial gauge if available, measure the valve stem runout and compare the results to the specifications (see illustration). If the measurement exceeds the service limit specified, the valve must be renewed. 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.

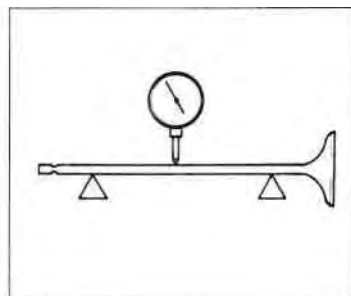
16 Measure the valve margin thickness and compare it to the specifications (see



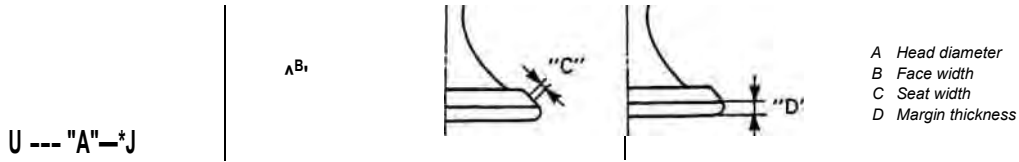
12.14c Measure the small-hole gauge with a micrometer



12.15a Check the valve face (A), stem (B) and collet groove (C) for signs of wear and damage



12.15b Check the valve stem for runout using V-blocks and a dial gauge



12.16 Valve head measurement points

illustration). If it is thinner than specified, renew the valve. The margin is the portion of the valve head which is below the valve seat.

17 Check the end of each valve spring for wear and pitting. Measure the spring free length and compare it to that listed in the specifications (see illustration). If any spring is shorter than specified it has sagged and must be renewed. 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 renewed.

18 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.

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

Reassembly

20 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.

21 Apply a small amount of coarse grinding compound to the valve face, 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.

22 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 (ie so that the valve rotates alternately clockwise and anticlockwise 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 width and unbroken around the entire circumference of the valve face and seat (see illustrations).

23 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.

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

25 Lay the spring seat for each valve in place



12.17a Measure the free length of the valve springs



12.17b Check the valve springs for squareness



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



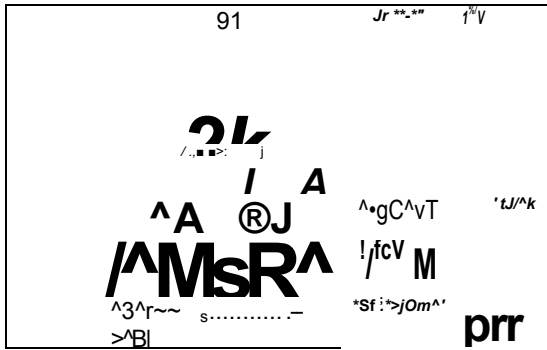
12.22a Rotate the valve grinding tool back and forth between the palms of your hands



12.22b The valve face and seat should show a uniform unbroken ring ...



12.22c ... and the seat (arrowed) should be the specified width all the way round



12.25a Fit the spring seat...



12.25b ... then press the valve stem seal into position using a suitable deep socket



12.26a Lubricate the stem and slide the valve into its correct location



12.26b Fit the valve spring with its closer-wound coils facing down...



14.26c ... then fit the spring retainer

in the cylinder head, with its shouldered side up so that the spring fits into it, then install new valve stem seals on each of the guides (see illustrations). Use an appropriate size deep socket to push the seals over the end of the valve guide until they are felt to clip into place. Don't twist or cock them, or they will not seal properly against the valve stems. Also, don't remove them again or they will be damaged.

26 Coat the valve stems with molybdenum disulphide grease, then install one of them into its guide, rotating it slowly to avoid damaging the seal (see illustration). Check

12.27a A small dab of grease will help to



keep the collets in place on the valve while the spring is released

that the valve moves up and down freely in the guide. Next, install the spring, with its closer-wound coils facing down into the cylinder head, followed by the spring retainer, with its shouldered side facing down so that it fits into the top of the spring (see illustrations).

27 Apply a small amount of grease to the collets to help hold them in place as the pressure is released from the springs (see illustration). Compress the springs with the valve spring compressor and install the collets (see illustration). When compressing the spring, depress them only as far as is

12.27b Compress the spring and install



the collets, making sure they locate in the groove

absolutely necessary to slip the collets into place. Make certain that the collets are securely locked in their retaining grooves. 28 Support the cylinder head on blocks so the valves can't contact the workbench top, then very gently tap each of the valve stems with a soft-faced hammer. This will help seat the collets in their grooves.

ffffflall Check for proper sealing of ""J"" the valves by pouring a HIRIT 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 Cylinder block-removal, inspection and installation

1

Note: The cylinder block can be removed with the engine in the frame.

Removal

- 1 Remove the cylinder head (see Section 10).
- 2 Unscrew the bolts securing the coolant hose union to the front of the block and

2»24 Engine, clutch and transmission



13.2 Unscrew the two bolts (arrowed) and remove the union



13.3 Lift the block up off the crankcase



13.4 Pick out the O-rings and discard them

remove the union (see illustration). The joint pipe between the union and the water pump housing may come with the union, otherwise leave it in place in the housing. Discard the O-rings as new ones must be used.

3 Hold the cam chain up and lift the cylinder block up, then pass the cam chain down through the tunnel (see illustration). Do not let the chain fall into the crankcase - secure it with a piece of wire or metal bar to prevent it from doing so. If the block is stuck, tap around the joint faces of the block with a soft-faced mallet to free it from the crankcase. Don't attempt to free the block by inserting a screwdriver between it and the crankcase - you'll damage the sealing surfaces. When the block is removed, stuff clean rags around the pistons to prevent anything falling into the crankcase. Remove the dowels from the mating surface of the crankcase or the underside of the block if they are loose. Be careful not to drop them into the engine.

4 Remove the O-ring from around each cylinder liner and discard them as new ones must be used (see illustration).

5 Remove the gasket and clean all traces of old gasket material from the cylinder block and crankcase mating surfaces. If a scraper is used, take care not to scratch or gouge the soft aluminium. Be careful not to let any of the gasket material fall into the crankcase or the oil passages.

Inspection

Caution: Do not attempt to separate the liners from the cylinder block.

6 Check the cylinder walls carefully for scratches and score marks. A rebore will be necessary to remove any deep scores.

7 Using telescoping gauges and a micrometer (see *Tools and Workshop Tips* in the Reference section), 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 - about 10 mm below the top of the cylinder), centre and bottom (but above the level of the oil ring at BDC - about 20 mm above the bottom of the cylinder) of the bore both parallel to and across the crankshaft axis (see illustration). Calculate any differences

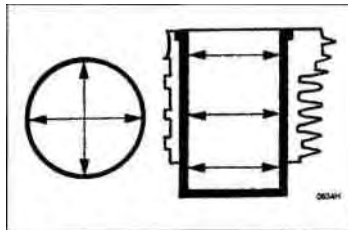
between the measurements taken to determine any taper and ovality in the bore. Compare the results to the specifications at the beginning of the Chapter. If the cylinders are tapered, oval, or worn beyond the service limits, or badly scratched, scuffed or scored, have them rebored and honed by a Yamaha dealer or engineer. If the cylinders are rebored, they will require oversize pistons and rings.

8 If the precision measuring tools are not available, take the block and pistons to a Yamaha dealer or engineer for assessment and advice.

9 If the block and cylinders are in good condition and the piston-to-bore clearance is within specifications (see Section 14), the cylinders should be honed (de-glazed). To perform this operation you will need the proper size flexible hone with fine stones (see *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.

10 Hold the block sideways (so that the bores are 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

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



micrometer

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. 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.

11 Wash the cylinders thoroughly with warm soapy water to remove all traces of the abrasive grit produced during the honing operation. Be sure to run a brush through the bolt holes and flush them with running water. After rinsing, dry the cylinders thoroughly and apply a thin coat of light, rust-preventative oil to all machined surfaces.

12 If you do not have the equipment or desire to perform the honing operation, take the block to a Yamaha dealer or engineer.

Installation

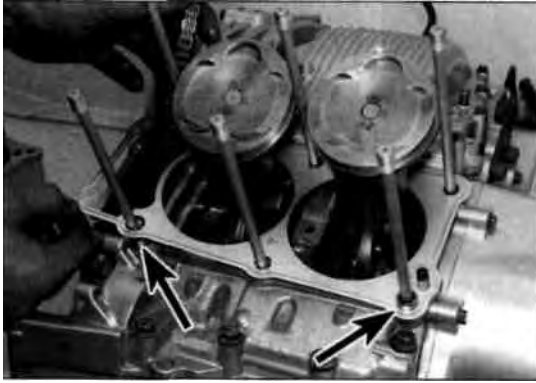
13 Check that the mating surfaces of the cylinder block and crankcase are free from oil or pieces of old gasket. If removed, fit the dowels into the crankcase (see illustration 13.15).

14 Fit a new O-ring into the groove around the base of each cylinder liner and press it into the groove between the liner and the cylinder block, taking care not to damage it (see illustration).

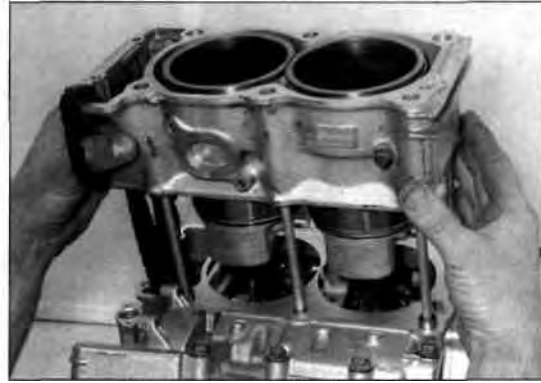
15 Remove the rags from around the pistons.



13.14 Fit a new O-ring into the groove around the liner base



13.15 Lay the new gasket over the dowels (arrowed) and onto the crankcase



13.17 Carefully lower the block onto the pistons



13.20a Fit a new O-ring onto the union .



13.20b ... and the joint pipe .



13.20c . then install the union

Lay the new base gasket in place on the crankcase, making sure all the holes are correctly aligned (**see illustration**). Never reuse the old gasket.

16 If required, install piston ring clamps onto the pistons to ease their entry into the bores as the block is lowered. This is not essential as each cylinder has a good lead-in enabling the piston rings to be hand-fed into the bore. If possible, have an assistant to support the block while this is done.

17 Lubricate the cylinder bores, pistons and piston rings, and the connecting rod big- and small-ends, with clean engine oil, then install the block down over the studs until the piston crowns fit into the bores (**see illustration**). At this stage feed the cam chain up through the block and secure it in place with a piece of wire to prevent it from falling back down.

18 Gently push down on the cylinder block, making sure the pistons enter the bore squarely and do not get cocked sideways. If piston ring clamps are not being used, carefully compress and feed each ring into the bore as the block is lowered. If necessary, use a soft mallet to gently tap the block down, but do not use force if the block appears to be stuck as the pistons and/or rings will be

damaged. If clamps are used, remove them once the pistons are in the bore.

19 When the pistons are correctly installed in the cylinders, press the block down onto the base gasket, making sure it locates correctly onto the dowels.

20 Fit a new O-ring into the groove in the coolant union face and around the pipe joint (**see illustrations**). Fit the coolant hose union onto the front of the block and the joint pipe, or fit the joint pipe into the water pump housing if it came away with the union (**see illustration**). Tighten the bolts to the torque setting specified at the beginning of the Chapter.

21 Install the cylinder head (see Section 10).

14 Pistons - removal, inspection and installation

Note: *The pistons can be removed with the engine in the frame.*

Removal

- 1 Remove the cylinder block (see Section 13).
- 2 Before removing the piston from the connecting rod, use a sharp scriber or felt

marker pen to write the cylinder identity on the crown of each piston (or on the inside of the skirt if the piston is dirty and going to be cleaned) as it must be installed in its original cylinder. Each piston should also have an arrow mark on its crown which should face the exhaust side of the bore (see **illustration**). If this is not visible, mark the piston accordingly so that it can be installed the correct way round.

3 Carefully prise out the circlip on one side of the piston using needle-nose pliers or a small



14.2 Note the arrow mark on the piston which must point forwards



14.3a Prise out the circlip ...



14.3b ... then push out the pin and remove the piston



14.5 Removing the piston rings using < ring removal and installation tool

flat-bladed screwdriver inserted into the notch (see illustration). Push the piston pin out from the other side to free the piston from the connecting rod (see illustration). If required, remove the other circlip. Discard the removed circlip(s) 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.

UJfifJfaggj To prevent the circlip from UUMB1 pingng away, pass a rod or HlMT 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.

JJfifJfif If a piston pin is a tight fit in the piston bosses, soak a

HlMT rag in boiling water then ^ out and wrap around the piston - this will expand the alloy piston sufficiently to release its grip on the pin. If the piston pin is particularly stubborn, extract it using a drawbolt tool, but be careful to protect the piston's working surfaces.

Inspection

- Before the inspection process can be carried out, the pistons must be cleaned and the old piston rings removed. Note that if the cylinders are being rebored, piston inspection can be overlooked as new ones will be fitted.
- 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 has a manufacturer's mark or letter at one end.
- 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.

7 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.

8 Once the deposits have been removed, clean the pistons with solvent and dry them thoroughly. If the identification previously marked on the piston is cleaned off, be sure to re-mark it with the correct identity. Make sure the oil return holes below the oil ring groove are clear.

9 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 should be checked thoroughly. Also check that the circlip grooves are not damaged.

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

11 Measure the piston ring-to-groove clearance by laying each piston ring in its groove and slipping a feeler gauge in beside it (see illustration). Make sure you have the correct ring for the groove (see Step 5). Check the clearance at three or four locations around the groove. If the clearance is greater than specified, renew both the piston and rings as a set. If new rings are being used, measure the clearance using the new rings. If the clearance is greater than that specified, the piston is worn and must be renewed.

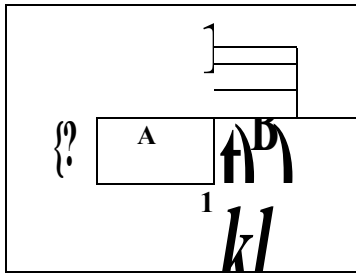
12 Check the piston-to-bore clearance by measuring the bore (see Section 13) and the piston diameter. Make sure each piston is matched to its correct cylinder. Measure the piston 4.5 mm (1991 to 1995 TDM models), 4.7 mm (XTZ models), or 5.5 mm (1996-on TDM and all TRX models) up from the bottom of the skirt and at 90° to the piston pin axis (see illustration). Subtract the piston diameter from the bore diameter to obtain the clearance. If it is greater than the specified figure, the piston must be renewed (assuming the bore itself is within limits, otherwise a rebore is necessary).



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



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



14.13a Slip the pin (A) into the piston (B) and try to rock it back and forth. If it's loose, renew the piston and pin



14.13b Measuring the internal diameter of the bore in the piston



14.16a Align the piston with the connecting rod small-end and insert the pin

13 Apply clean engine oil to the piston pin, insert it into the piston and check for any freeplay between the two (**see illustration**). Measure the pin external diameter (**see illustration 28.6b**), and the pin bore in the piston (**see illustration**). Calculate the difference to obtain the piston pin-to-piston pin bore clearance. Compare the result to the specifications at the beginning of the Chapter. If the clearance is greater than specified, renew the components that are worn beyond their specified limits.

Installation

14 Inspect and install the piston rings (**see Section 15**).

15 Lubricate the piston pin, the piston pin bore and the connecting rod small-end bore with clean engine oil.

16 When installing the pistons onto the connecting rods, make sure that the arrow points towards the exhaust side of the engine (**see illustration 14.2**). If both circlips were removed, install a new circlip in one side of the piston (do not re-use old circlips). Line up the piston on its correct connecting rod, and insert the piston pin from the other side (**see illustration**). Secure the pin with the other new circlip. When installing the circlips, compress them only just enough to fit them in the piston, and make sure they are properly seated in their grooves with the open end

away from the removal notch (**see illustration**).

17 Install the cylinder block (**see Section 13**).

15 Piston rings - inspection and installation

1 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 with the rings installed in the cylinder.

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

3 To measure the installed ring end gap, insert the top ring into the top of the first cylinder 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 cylinder. To measure the end gap, slip a feeler gauge between the ends of the ring and compare the measurement to the specifications at the beginning of the Chapter (**see illustration**).

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

5 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**).

6 Excess end gap is not critical unless it exceeds the service limit. Again, double-check to make sure you have the correct rings for your engine and check that the bore is not worn.

7 Repeat the procedure for each ring that will be installed in the cylinders. When checking the oil ring, only the side-rails can be checked as the ends of the expander ring should contact each other. Remember to keep the rings, pistons and cylinders matched up.

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

9 The oil control ring (lowest on the piston) is installed first. It is composed of three separate components, namely the expander and the upper and lower side rails. Slip the expander into the groove, then install the upper side rail. Do not use a piston ring installation tool on the 2 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



14.16b Do not over-compress the circlip when fitting it into the piston

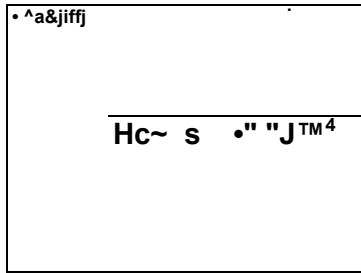


15.3 Measuring piston ring installed end gap

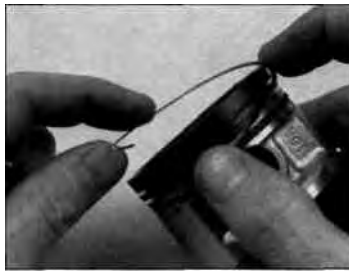


15.5 Ring end gap can be enlarged by clamping a file in a vice and filing the ring ends

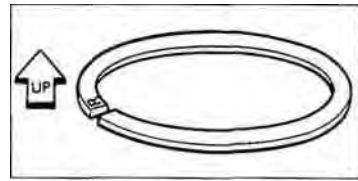
2*28 Engine, clutch and transmission



15.9a Install the oil ring expander in its groove...



15.9b ... and fit the side rails each side of it. The oil ring must be installed by hand



15.11 Compression ring top surface is marked by a letter

around the piston while pushing the rail into the groove. Next, install the lower side rail in the same manner (see illustrations). Make sure the ends of the expander do not overlap.

10 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.

11 The upper surface of each compression ring is marked with a mark or letter at one end (see illustration). Make sure that the identification mark or letter near the end gap is facing up when installed.

12 Fit the second ring into the middle groove in the piston. Make sure the identification letter near the end gap is facing up. Do not expand the ring any more than is necessary to slide it into place. To avoid breaking the ring, use a piston ring installation tool.

13 Finally, install the top ring in the same manner into the top groove in the piston. Make sure the identification letter near the end gap is facing up.

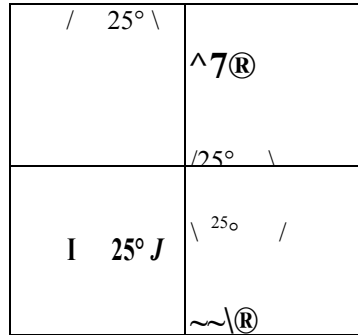
14 Once the rings are correctly installed, check they move freely without snagging and stagger their end gaps as shown (see illustration).

16 Clutch - removal, inspection and installation

Note: The clutch can be removed with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.

Removal

- 1 Drain the engine oil (see Chapter 1).
- 2 Detach the clutch cable from the operating lever on the clutch cover (see Section 17).
- 3 Working evenly in a criss-cross pattern, unscrew the clutch cover bolts (see illustration). Lift the cover away from the engine, being prepared to catch any residual oil which may be released as the cover is removed.
- 4 Remove the gasket and discard it. Note the positions of the two locating dowels fitted to the crankcase and remove them for safekeeping if they are loose.
- 5 Working in a criss-cross pattern, gradually slacken the clutch pressure plate bolts



15.14 Stagger the ring end gaps as shown

- 1 Top ring
- 2 Oil ring lower rail
- 3 Oil ring upper rail
- 4 Second (middle) ring

until spring pressure is released (see illustration). Counter-hold the clutch housing to prevent it turning. Remove the bolts and springs, then lift out the clutch pressure plate complete with its pull rod, thrust bearing and plate washer (see illustrations 16.30b and a). 6 Grasp the complete set of clutch plates and



16.3 Unscrew the clutch cover bolts (arrowed) and remove the cover



16.5 Clutch pressure plate bolts (arrowed)



16.6 Remove the clutch plates as a pack



16.7a Bend back the lockwasher tabs



16.7b Slackening the clutch nut using the holding tool described

remove them as a pack (see illustration). lockwasher from the mainshaft, noting how it fits. Unless the plates are being renewed, keep them. Discard the lockwasher as a new one must be used in their original order. On 1991 to 1995 TDM on installation.

models and 1990-on XTZ models, note the inner plate fitted in the clutch centre - if you remove it, keep it separate as it must be installed first (see illustration 16.27).

7 Bend back the tabs on the clutch nut lockwasher (see illustration). To remove the clutch nut the transmission input shaft must be locked. 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. Alternatively, the Yamaha service tool (pt. no. 90890-04086), or a similar homemade tool made from two strips of steel bent at the ends and bolted together in the middle (see Tool tip), can be used to hold the clutch centre whilst the nut is slackened (see illustration). Unscrew the nut and remove the

exception of 1989 to 1991 XTZ models, the thrust washer from the shaft (see illustration 16.22a).

8 F 12 On 1989 XTZ models, the clutch centre anti-judder assembly can be left intact unless the clutch has been chattering (juddering) excessively. If it is necessary to remove it, remove the wire retainer ring, plain plate, anti-judder spring and spring seat.

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

centre and the outer thrust plate from the shaft (see illustrations 16.26a and 16.25).

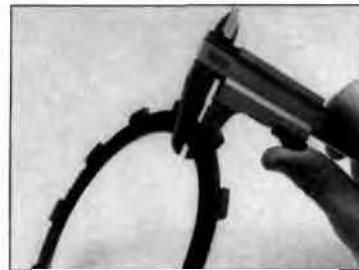
9 Support the clutch housing and remove the large sleeve from its centre (see illustration). To get a grip on the sleeve, grasp the housing and wiggle it out and in - it should draw the sleeve out far enough to grip it. If difficulty is experienced, screw a 6 mm bolt (a clutch cover bolt is the correct size) into one or both of the threaded holes and pull the sleeve from the housing.

10 Remove the caged needle roller bearing from the housing if it didn't come away with the sleeve, and then remove the housing from the engine (see illustrations 16.24a and 16.23).

11 Remove the inner thrust plate (see illustration 16.22b) and, with the



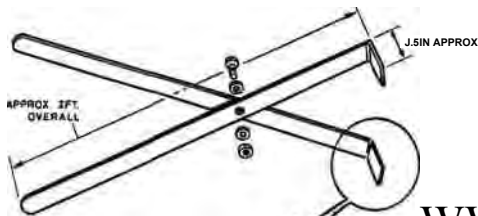
16.9 Remove the inner sleeve ; described



16.13 Measuring clutch friction plate thickness

EEHJ

TSP



WWIV-

holding tool can using two strips of steel with the ends bolted together in the middle

A clutch centre easily be made

OF CLUTCH CENTRE SPLINES

2*30 Engine, clutch and transmission



16.14 Check the plain plates for warpage

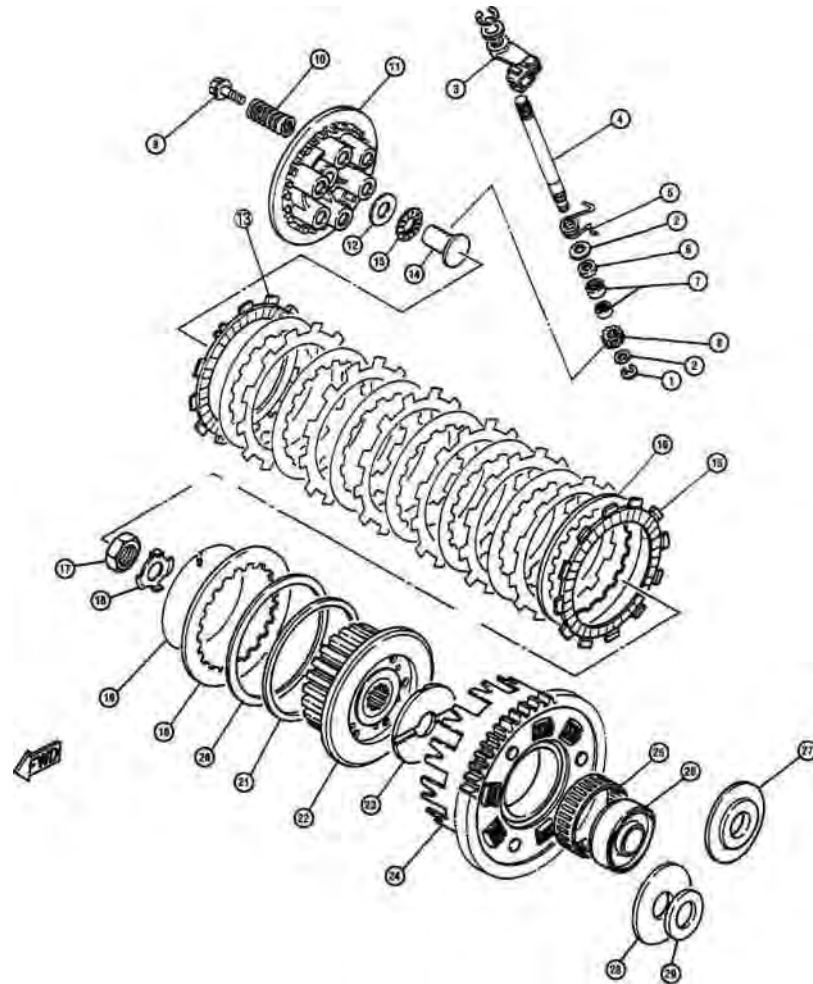


16.15 Measure the free length of the springs as shown

Specifications at the beginning of the Chapter, the friction plates must be renewed as a set. Also, if any of the plates smell burnt or are glazed, they must be renewed as a set.
 14 The plain plates should not show any signs of excess heating (bluing). Check for warpage using a flat surface and feeler gauges (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 Measure the free length of each clutch spring using a vernier caliper (see illustration). If any spring is below the service limit specified, renew all the springs as a set.
 16 Inspect the clutch assembly for burrs and

- 1 E-clip
- 2 Washer
- 3 Operating lever
- 4 Operating shaft
- 5 Return spring
- 6 Oil seal
- 7 Bearings
- 8 Pinion
- 9 Bolts
- 1 Springs
- 1 Pressure plate
- 1 Washer
- 1 Thrust bearing
- 1 Pullrod
- 7 Friction plates"
- 7 Plain plates'
- 1 Nut
- 7 Lock washer
- 7 Wire retainer ring - 1989 XTZ
- 2 Anti-judder spring - 1989 XTZ
- 2 Anti-judder spring seat - 1989 XTZ
- 2 Clutch centre
- 2 Outer thrust plate
- 2 Clutch housing
- 2 Caged needle roller bearing
- 2 Sleeve
- 2 Inner thrust plate - XTZ
- 2 Inner thrust plate - TDM, TRX
- 2 Thrust washer - TDM, TRX

*refer to clutch plate pack guide table



16.20 Clutch assembly

Clutch plate pack guide		
Model	No. of plates	Order of fitting to clutch centre
1991-93 TDM	8 friction, 8 plain	start with the special 'slick' plain plate, then alternate friction and plain plates until ending with special friction plate which has a slot in one of its tabs.
1994-95 TDM	8 friction, 8 plain	start with the special 'slick' plain plate, then alternate friction and plain plates.
1996-98 TDM and all TRX	9 friction, 8 plain	start with friction plate, then alternate plates until ending with a friction plate.
1999 TDM	9 friction, 8 plain	start with a special friction plate (black), then alternate plain and Motion plates until ending with a special friction plate (black).
1989 XTZ	8 friction, 8 plain	special plain plate fitted as part of anti-judder assembly, then alternate friction and plain plates, until ending with special friction plate which has a slot in one of its tabs.
1990-94 XTZ	8 friction, 8 plain	start with the special 'slick' plain plate, then alternate friction and plain plates until ending with special friction plate which has a slot in one of its tabs.
1995 XTZ	8 friction, 8 plain	start with the special 'slick' plain plate, then alternate friction and plain plates.

indentations on the edges of the protruding tangs of the friction plates and/or slots in the edge of the housing 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, since 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.

17 Inspect the sleeve and caged needle roller bearing in conjunction with the clutch housing's internal bearing surface. If there are any signs of wear, pitting or other damage the affected parts must be renewed.

18 Check the pressure plate, thrust bearing and plate washer for signs of roughness, wear or damage, and renew any parts as necessary.

19 On 1989 XTZ models, if removed, check the clutch centre anti-judder assembly components (consisting of the wire retainer ring, plain plate, anti-judder spring and spring seat) for wear or damage, and renew any parts as necessary.

20 Check the clutch operating mechanism in the clutch cover for smooth operation. Check the pinion and pullrod teeth for signs of damage. If necessary, prise off the E-clip securing the pinion to the actuating shaft, and withdraw the shaft from the cover (see

illustration). Check the two needle roller bearings for roughness, wear or damage. If they need to be renewed, heat the cover in very hot water to ease removal and drift them out. If the shaft is removed, lever out the oil seal and renew it. Clean all components and lubricate the seal and bearings with grease.

Installation

21 Remove all traces of old gasket from the crankcase and clutch cover surfaces. On 1989 XTZ models, if disassembled, reassemble the clutch centre anti-judder assembly components, fitting the spring seat, the anti-judder spring, the plain plate and the wire retainer ring in that order.

22 On all except 1989 to 1991 XTZ models, fit the thrust washer and the inner thrust plate onto the shaft (see **illustrations**). On 1989 to 1991 XTZ models, fit the inner thrust plate onto the shaft with its shouldered side inwards.

23 Lubricate the needle roller bearing and sleeve with clean engine oil. Install the clutch housing, without its needle roller bearing and sleeve, and support it in position, making sure it is engaged correctly with the primary drive gear on the crankshaft (see **illustration**).

24 Install the needle bearing and the sleeve into the middle of the clutch housing (see **illustrations**).

25 Lubricate the outer thrust plate with clean

16.22b ... and inner thrust plate onto the shaft



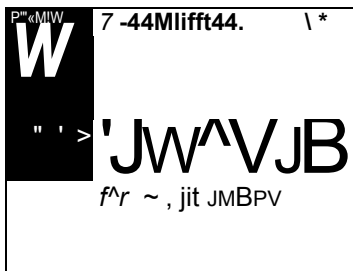
16.22a Fit the thrust washer.



16.23 Slide the housing into place so that it engages the primary drive gear...



16.24a ... then fit the needle bearing ...



16.24b ... and the sleeve into the middle of the housing

2«32 Engine, clutch and transmission



16.25 Fit the outer thrust plate .



16.26a ... then slide the clutch centre onto the splines



16.26b Install the lockwasher, fitting the smaller bent tabs into the slots in the centre



16.26c Fit the nut.



16.26d ... and tighten it to the specified torque, counter-holding the clutch centre



16.26e Bend up the lockwasher tabs to secure the nut



16.27 On the stated models, fit the inner plate

engine oil and fit it onto the shaft (see illustration).
 26 Install the clutch centre onto the shaft splines, then install the new lockwasher, engaging its tabs with the slots (see illustrations). Install the clutch nut and, using the method employed on dismantling to lock the input shaft, tighten the nut to the torque setting specified at the beginning of the Chapter (see illustrations). *Note: Check that the clutch centre rotates freely after tightening.* Bend up the tabs of the lockwasher to secure the nut (see illustration).

27 On 1991 to 1995 TDM models and 1990-on XTZ models, fit the inner plain plate

on the clutch centre - if it has become muddled with the rest, it is distinguishable by its slick surface (see illustration). 28 Build up the clutch plates, starting with a friction plate, then a plain plate and alternating friction and plain plates until all are installed (see illustrations). Coat each plate with engine oil prior to installation. On 1991 to 1993 TDM models and 1989 to 1994 XTZ models, make sure the friction plate with the slot in one of its tabs is fitted last, and align the slot with the embossed marks on the outside of the clutch housing. *Note: Refer to the table accompanying illustration 16.20 for plate fitting details per model.*



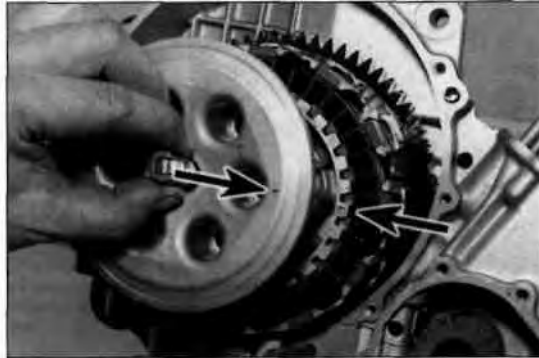
16.28a Start with a friction plate .



16.28b ... then fit a plain plate



16.29 Fit the pullrod assembly in the back of the pressure plate



16.30a Install the pressure plate, aligning the punch marks (arrowed)...

29 Lubricate the thrust bearing and washer with molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and engine oil). Install the thrust bearing and plate washer onto the pullrod, then install the pullrod assembly in through the back of the clutch pressure plate (see illustration).

30 Install the pressure plate onto the clutch, aligning the punch mark on the plate with that on the clutch centre (see illustration). Install the springs and the bolts with their washers, and tighten the bolts evenly in a criss-cross sequence to the specified torque setting (see illustration). Counter-hold the clutch housing to prevent it turning. Check that the pullrod rotates freely.

31 If disassembled, install the clutch operating mechanism in the clutch cover. Align the shaft so that the operating lever is facing back but angled out slightly.

32 Insert the dowels in the crankcase, then set the pullrod so that its teeth point towards the rear. Install the clutch cover using a new



16.30b ... then fit the springs, washers and bolts, and tighten them as described



16.32a Fit the gasket onto the dowels (arrowed)...

gasket and tighten its bolts evenly in a crisscross sequence to the specified torque setting (see illustrations). 33 Push the clutch operating lever forward or in (according to model) until all the freeplay in the operating mechanism has been taken up. At this point the mark on the lever should align with the mark on the cover (see illustration).

If the marks do not align, remove the E-clip and the lever, noting how the spring fits, and move the lever around on the splines of the shaft until they do. Make sure the spring is correctly set on the lever and install the E-clip.

34 Install the clutch cable onto the lever (see Section 17).

35 Refill the engine with oil (see Chapter 1).



16.32b ... then fit the cover

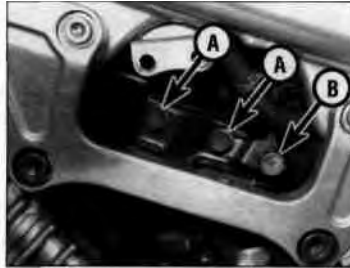


16.33 With the freeplay taken up the marks (arrowed) should align - TDM shown

2*34 Engine, clutch and transmission



17.1a Unscrew the two bolts (arrowed) and displace the tap



17.1b Unscrew the two bolts (A) securing the cable bracket, noting the idle speed adjuster (B)



17.1c Bend back the retaining tab ..

17 Clutch cable-removal and installation

&
87?

1 On TDM models, unscrew the two bolts securing the fuel tap and displace the tap (see illustration). Now unscrew the two bolts securing the cable bracket to the left-hand engine mounting bracket and detach the bracket, noting how the rear bolt also secures the idle speed adjuster (see illustration). Bend back the retaining tab securing the cable end in the clutch operating mechanism lever and disconnect the cable, noting how it

fits (see illustrations).

2 On TRX and XTZ models, fully slacken the adjuster nuts on the threaded section in the cable bracket on the right-hand side of the engine and slip the adjuster out of the bracket (see illustration). On TRX models, first remove the adjuster cover (see illustration). Disconnect the cable end from the clutch operating mechanism lever, noting how it fits (see illustrations 17.1c and d).

3 On all models fully slacken the locking on the adjuster at the handlebar end of the cable then screw the adjuster fully in (see illustration). This resets it to the beginning of its adjustment span.

4 Align the slots in the adjuster and lockwheel

with that in the lever bracket, then pull the outer cable end from the socket in the adjuster and release the inner cable from the lever (see illustrations). Remove the cable from the machine, noting its routing and any guides or clips.

BEffB?! Before removing the cable from the bike, take the inner cable from the lever

HIUT 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.



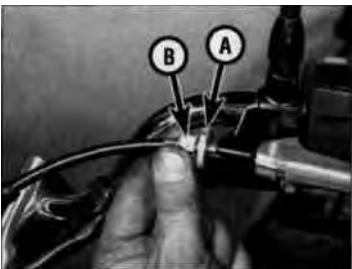
17.1d ... and detach the cable



17.2a Slacken the nuts (arrowed) and slip the cable out of the bracket



17.2b On TRX models, first remove the cover



17.3 Slacken the lockring (A) and thread the adjuster (B) in



17.4a Align the slots and slip the cable out of the bracket...



17.4b ... and the nipple from the lever

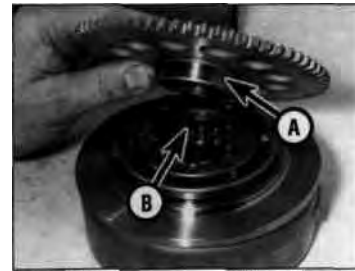
Hpni 1-4



17.5 Bend the tab to secure the cable in the lever



18.2 The gear should rotate freely in the direction shown



18.4 Check the surface of the hub (A) and the sprags (B) as described

5 Installation is the reverse of removal. Apply grease to the cable ends. Make sure the cable is correctly routed. Secure the cable end in the operating lever by bending the tab against it (see illustration). Adjust the amount of clutch lever freeplay (see Chapter 1).

18 Starter clutch and idle/reduction gear - removal, inspection and installation

Removal

1 Remove the alternator rotor (see Chapter 9). The starter driven gear should come away with the rotor. If it doesn't, remove it from the crankshaft. The starter clutch is secured to the back of the rotor by three Allen bolts on the inside of the rotor.

Inspection

2 Install the starter driven gear into the starter clutch (if removed) and, with the rotor face down on a workbench, check that the gear rotates freely in an anti-clockwise direction and locks against the rotor in a clockwise direction (see illustration). If it doesn't, renew the starter clutch - no replacement parts are available.
3 Withdraw the starter driven gear from the

starter clutch (see illustration 18.4). If it appears stuck, rotate it anti-clockwise as you withdraw it to free it from the starter clutch. Note the thrust washer fitted inside the starter clutch and remove it for safekeeping (see illustration 18.7).

4 Check the bearing surface of the starter driven gear hub and the condition of the sprags inside the clutch body (see illustration). If the bearing surface shows signs of excessive wear or the sprags are damaged, marked or flattened at any point, the starter clutch should be renewed.

5 Examine the teeth of the starter idle/reduction gear and the corresponding teeth of the starter driven gear and starter motor shaft. Renew the gears and/or starter motor if worn or chipped teeth are discovered.

6 To renew the starter clutch sprag assembly, hold the alternator rotor in a rotor holder then undo the three bolts securing the clutch to the rotor. Remove the clutch from the back of the rotor and install the new one back onto the rotor. Tighten the bolts to the torque setting specified at the beginning of the Chapter, using the rotor holder to hold the rotor. Lubricate the starter clutch sprags with new engine oil.

Installation

7 Install the thrust washer in the starter clutch (see illustration). Lubricate the hub of the

starter driven gear with clean engine oil, then install it into the clutch, rotating it clockwise as you do so to spread the rollers and allow the hub of the gear to enter (see illustration 18.4).

8 Install the alternator rotor (see Chapter 9).

19 Gearchange mechanism external components - removal, inspection and installation

Note: The gearchange mechanism (external components) can be removed with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.

Removal

1 Make sure the transmission is in neutral.
2 Remove the alternator cover (see Chapter 9). If required, disconnect the alternator and pick-up coil wiring connectors, otherwise ignore those Steps and lay the cover down so as not to strain the wiring.
3 Remove the clutch (see Section 16).
4 Remove the E-clip securing the left-hand end of the gearchange shaft in the crankcase, and slide the washer off the shaft (see illustrations).
5 Note how the gearchange shaft centralising spring ends fit on each side of the locating pin in the casing, and how the pawls on the



18.7 Do not omit the thrust washer



19.4a Remove the E-clip...



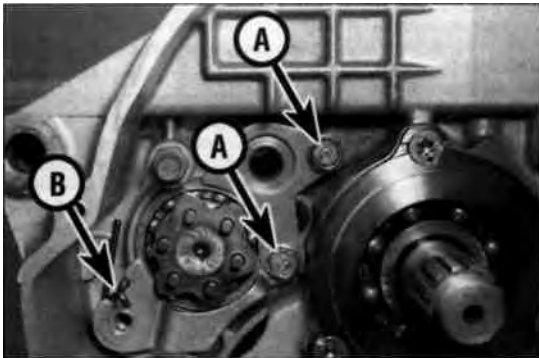
19.4b ... and slide off the washer



19.5 Draw the gearchange shaft and selector arm assembly off the selector drum and out of the casing



19.6a Note how the roller locates in the neutral detent (arrow), then unscrew the bolt and remove the stopper arm



19.6b If required, unscrew the bolts (A) and remove the plate and the spring (B)



19.8 Gearchange shaft centralising spring can be removed after releasing circlip and washer from shaft

selector arm locate onto the pins on the end of the selector drum (see illustration 19.12). Grasp the end of the shaft and withdraw the shaft/arm assembly (see illustration).

6 Note how the stopper arm spring ends locate and how the roller on the arm locates in the neutral detent on the selector drum (gearbox in neutral), then unscrew the stopper arm bolt and remove the arm, and on 1996-on TDM models and all TRX models, the spacer (see illustration). To remove the spring, unscrew the two remaining bolts securing the selector drum retainer plate and remove the plate - the spring sits behind the plate (see illustration).

Inspection

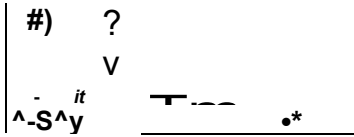
7 Check the selector arm for cracks, distortion and wear of its pawls, and check for any corresponding wear on the selector pins in the selector drum. Also check the stopper arm roller and the detents in the selector drum for any wear or damage, and make sure the roller turns freely. Renew any components that are worn or damaged.

8 Inspect the shaft centralising spring (see remove it and apply a non-permanent thread illustration) and the stopper arm return spring for locking compound to its threads, then tighten it fatigue, wear or damage; renew them if necessary, securely.

The centralising spring is retained on the shaft by a 9 Check the gearchange shaft for straightness circlip and washer - a new circlip should be used if and damage to the splines. If the shaft is bent removed. The stopper arm spring is secured by the you can attempt to straighten it, but if the splines retainer plate (see Step 6). Also check that the are damaged the shaft must be renewed. Also centralising spring locating pin in the crankcase is check the condition of the shaft oil seal in the left-hand side of the crankcase (see illustration). If it is damaged,

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19.9a Check the shaft oil seal (arrowed)
19.9b If required, lever out the old seal...



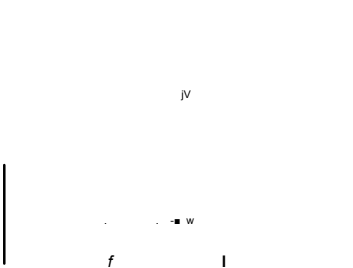
19.9c ... and press or drive a new one in



19.10a Locate the stopper arm spring ...



19.10b ... then fit the retainer plate



19.11a Apply thread lock to the bolt...



19.11 b ... then fit the stopper arm into the neutral detent on the selector drum and make sure the spring ends locate correctly



19.12 The installed assembly should be as shown

deteriorated or shows signs of leakage it must be renewed. Lever out the old seal and drive the new one squarely into place, with its lip facing inward, using a seal driver or suitable socket (see illustrations).

Installation

10 If removed, locate the stopper arm spring, then install the selector drum retainer plate (see illustrations). Apply a suitable non-permanent thread locking compound to the two front bolts and tighten them to the torque setting specified at the beginning of the Chapter (see illustration 19.6b).

11 Apply a suitable non-permanent thread locking compound to the stopper arm bolt (see illustration). Install the stopper arm, and on 1996-on TDM models and all TRX models, the spacer, making sure the spring ends are positioned correctly (see illustration). Locate the arm onto the neutral detent on the selector drum, then tighten the bolt to the specified torque setting (see illustration 19.6a).

12 Slide the gearchange shaft into place and push it all the way through the case until the splined end comes out the other side (see illustration 19.5). Locate the selector arm pawls onto the pins on the selector drum. Make sure the centralising spring ends locate correctly on each side of the locating pin (see illustration).

13 Slide the washer onto the left-hand end of the shaft, then fit the E-clip into its groove,

making sure it is secure (see illustrations 19.4b and a).

14 Install the clutch (see Section 16).

15 Install the alternator cover (see Chapter 9). Connect the alternator and pick-up coil wiring connectors, if disconnected.

20 Oil pumps - removal, inspection and installation

Note: The oil pumps can be removed with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.

Removal

1 Two oil pumps are fitted, a feed pump to



20.3 Unscrew the two bolts (arrowed) and detach the pipe

lubricate the engine and a scavenge pump to return oil to the tank. As you look at the engine from the right-hand side, the feed pump is the left-hand pump and the scavenge pump is the right-hand pump (see illustration 20.6).

2 Drain the engine oil (see Chapter 1). On XTZ models, remove the engine bashplate (see Chapter 8) and the exhaust system (see Chapter 4).

3 Unscrew the two bolts securing the oil pipe to the oil pump cover on the right-hand side of the engine (see illustration). Detach the pipe 2 and discard the O-ring as a new one must be used.

4 Unscrew the bolts securing the oil pump cover and remove the cover, being prepared to catch any residue oil (see illustration).



20.4 Oil pump cover bolts (arrowed)

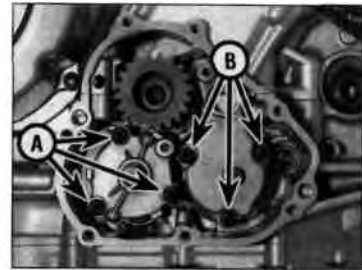
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20.5a Remove the circlip.



20.5b ... and slide off the gear



20.6 Feed pump screws (A), scavenge pump screws (B)



20.7a Remove the screw (arrowed).



20.7b ... and separate the housing



20.7c Draw out the shaft and remove the rotors

Discard the gasket as a new one must be used. Remove the dowels from either the cover or the crankcase if they are loose. Also note the oil passage collar located in the orifice in the scavenge pump cover. Discard the O-ring as a new one must be used, and remove the collar if required (see illustration 20.18).

5 Remove the circlip securing the oil pump driven gear to the feed pump shaft and remove the gear (see illustrations). Discard the circlip as a new one should be used. Do the same to free the driven gear from the scavenge pump.

6 Each pump is secured by three screws (see illustration). Remove the screws and remove the pump, noting how it fits. Discard the gasket as a new one must be used. Note the dowel locating the scavenge pump and remove it if it is loose.

Inspection

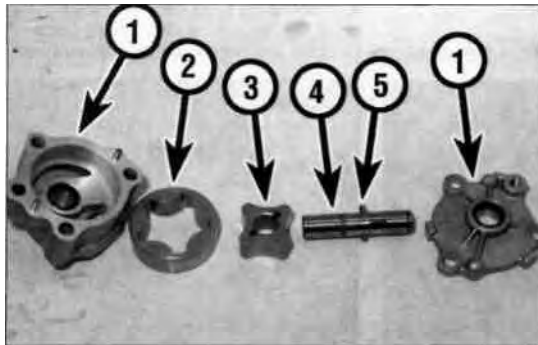
7 If required, the pumps can be disassembled for cleaning. Remove the single assembly screw and separate the pump housing, on the feed pump noting how the cam chain guide fits (see illustrations). Remove the housing locating pins if they are loose. Draw the inner rotor with the

driveshaft out of the pump housing, then remove the outer rotor (see illustration). Note which way round the rotors fit and how the driveshaft pin locates in the slots in the inner rotor.

8 Clean all the components in solvent (see illustration).

9 Inspect the pump body and rotors for scoring and wear (see illustration). If any damage, scoring or uneven or excessive wear is evident, renew the pump (individual components are not available).

10 Fit the outer rotor into the pump body. Fit the drive pin into the shaft, then slide the shaft into the inner rotor, locating the drive pin ends



20.8 Oil pump components

1 Housing 2 Outer rotor 3 Inner rotor 4 Shaft 5 Drive pin



20.9 Look for scoring and wear, such as on this outer rotor



20.10a Assembled oil pump



20.10b Measuring inner rotor tip-to-outer rotor tip clearance



20.11 Measuring outer rotor-to-body clearance

in the slots in the rotor, then fit the inner rotor into the outer rotor (**see illustration**). Measure the clearance between the inner rotor tip and the outer rotor with a feeler gauge and compare it to the maximum clearance listed in the specifications at the beginning of the Chapter (**see illustration**). If the clearance measured is greater than the maximum listed, renew the pump.

11 Measure the clearance between the outer rotor and the pump body with a feeler gauge and compare it to the maximum clearance listed in the specifications at the beginning of the Chapter (**see illustration**). If the clearance measured is greater than the maximum listed, renew the pump.

12 On 1996-on TDM models and all TRX models, lay a straight-edge across the rotors and

the pump body and, using a feeler gauge, measure the rotor end-float (the gap between the rotors and the straight-edge (**see illustration**). If the clearance measured is greater than the maximum listed, renew the pump. No specifications are given for other models.

13 Check the nylon pump driven gears for wear or damage, and renew them if necessary. Damage to the steel drive gear is unlikely, but if found will necessitate crankshaft renewal.

14 If the pump is good, make sure all the components are clean, then lubricate them with new engine oil. Assemble the housing, making sure the pins locate correctly, and tighten the assembly screw to the torque setting specified at the beginning of the Chapter, not forgetting the cam chain guide on

the feed pump (**see illustration 20.7b and a**).

15 Rotate the pump shaft by hand and check that the rotors turn smoothly and freely. If not, renew the pump.

Installation

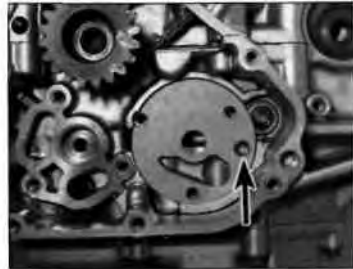
16 Install the pump using a new gasket, not forgetting the locating dowel for the scavenge pump, if removed, and tighten the screws to the torque setting specified at the beginning of the Chapter (**see illustrations**).

17 Locate the pump driven gear onto its shaft, aligning the flat in the gear with that on the shaft, and secure it using a new circlip (**see illustrations 20.5b and a**). Align the open end of the circlip with the flat on the shaft (**see illustration**).

18 If removed, install the oil passage collar



20.12 Measuring rotor end-float



20.16a Fit the gasket, on the scavenge pump locating it onto the dowel (arrowed)



20.16b Install the pump ...



20.16c ... and tighten its screws to the specified torque



20.17 Align the open ends of the circlips with the flats on the shafts

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20.18 Fit a new O-ring around the collar



20.20a Use a new O-ring on the oil pipe union...

20.19a Make sure the gasket fits onto the dowels (arrowed)...



20.20b ... and tighten its bolts to the specified torque

20.19b ... then install the cover

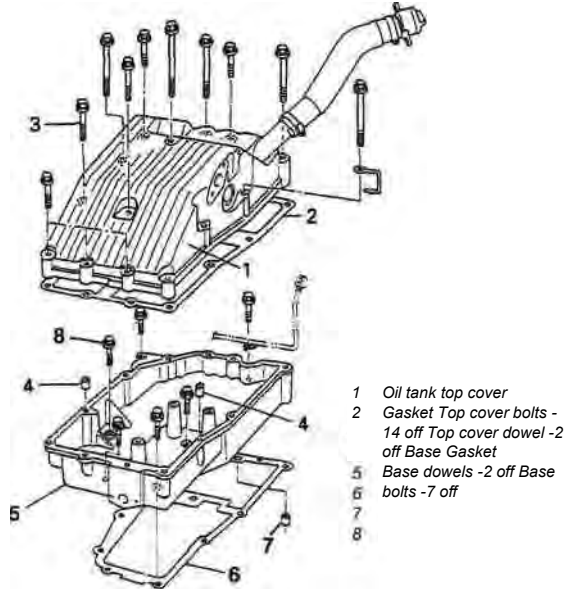
into the orifice in the scavenge pump, then fit a new O-ring (see illustration).

19 If removed, fit the oil pump cover dowels into the crankcase, then install the cover using a new gasket, making sure it locates correctly onto the dowels (see illustration). Tighten the cover bolts evenly in a criss-cross sequence to the specified torque setting (see illustration).

20 Fit the oil pipe onto the cover using a new O-ring and tighten the bolts to the specified torque setting (see illustrations).

21 On XTZ models, install the exhaust system (see Chapter 4) and the engine bashplate (see Chapter 8).

22 Fill the engine with the specified quantity and type of new engine oil (see Chapter 1).



- 1 Oil tank top cover
- 2 Gasket Top cover bolts - 14 off Top cover dowel - 2 off Base Gasket
- 3 Base dowels - 2 off Base bolts - 7 off
- 4
- 5
- 6
- 7
- 8

21.5 Oil tank (1996-on TDM and all TRX models)

21 Oil tank - removal and installation (1996-on TDM models and all TRX models)

Note: To remove the oil tank, the engine must be removed from the frame.

Removal

1 Remove the engine from the frame (see Section 5).

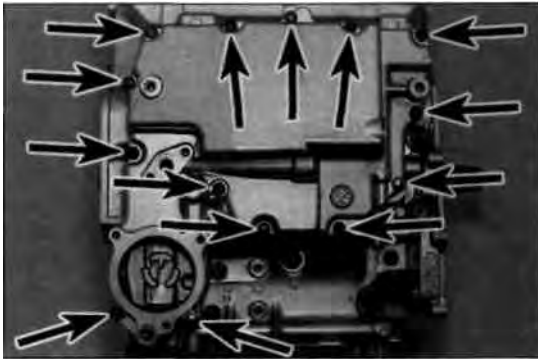
2 Unscrew the banjo bolts securing the oil pipe to the left-hand side of the oil tank and to the cylinder head, and the pipe bracket bolt, and remove the pipe. Discard the banjo bolt sealing washers as new ones must be used.

3 Unscrew the two bolts securing the oil pipe to the right-hand side of the oil tank and detach the pipe. Discard the O-ring as a new one must be used.

4 Slacken the clamp securing the oil pipe (from the rear of the oil tank) in the oil hose and detach the pipe from the hose. Unscrew the two bolts securing the pipe to the oil tank and withdraw the pipe. Discard the O-ring as a new one must be used.

5 Unscrew the bolts securing the top of the oil tank, noting which fits where as they are of different lengths, and noting the clip secured by the bolt on the right-hand side (see illustration). Lift off the top of the tank, being prepared to catch any residue oil. Discard the gasket as a new one must be used. Note the

Engine, clutch and transmission 2*41



22.3 Unscrew the bolts (arrowed) and remove the sump

positions of the two dowels and remove them if they are loose.

6 Unscrew the bolts securing the base of the oil tank to the crankcase and lift off the base. Discard the gasket as a new one must be used. Note the positions of the two dowels and remove them if they are loose.

Installation

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

- Clean the oil tank in solvent and dry it using compressed air, if available.
- Make sure the dowels are correctly located.
- Use new gaskets.



22.4b ... and lift off the cover ...



22.4c ... and the strainer

d) Tighten the oil tank base and top bolts to the torque setting specified at the beginning of the Chapter.

e) Use new sealing washers on each side of the oil pipe banjo unions and tighten the banjo bolts to the specified torque setting.

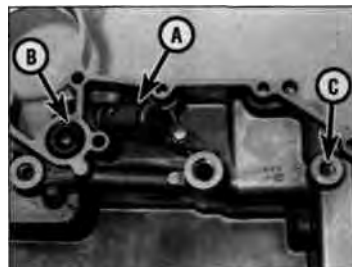
f) Use new O-rings on the oil pipe unions and tighten the bolts to the specified torque setting.

22 Oil sump, oil strainer and pressure relief valve-removal, inspection and installation

Note: The oil sump, strainer and pressure relief valve can be removed with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.

Removal

- On 1991 to 1995 TDM models and XTZ models, remove the engine bashplate (see Chapter 8). On TDM and TRX models remove the exhaust system (see Chapter 4).
- Drain the engine oil and remove the oil filter (see Chapter 1).
- Unscrew the sump bolts, slackening them evenly in a criss-cross sequence to prevent distortion, and remove the sump (see



22.5 Pressure relief valve (A), bypass valve (B), oil nozzle (C)



22.4a Remove the screws (arrowed).

illustration). Discard the gasket as a new one must be used. Note the positions of the dowels and remove them if they are loose.

4 Remove the screws securing the oil strainer cover and remove the cover and the strainer (see illustrations).

5 Remove the bolt securing the pressure relief valve holder and remove the holder (see illustration). Withdraw the valve and discard the O-ring as a new one must be used.

Inspection

6 Remove all traces of gasket from the sump and crankcase mating surfaces, and clean the inside of the sump with solvent.

7 Clean the oil strainer in solvent and remove any debris caught in its mesh. Inspect the strainer for any signs of wear or damage and renew it if necessary.

8 Push the relief valve plunger into the valve body and check that it moves smoothly and freely against the spring pressure. If not, renew the relief valve - individual components are not available. Similarly check that the bypass valve ball can be pushed into its bore and is not stuck (see illustration 22.5). Also check that the oil nozzle is securely screwed into its bore and has not worked loose.

9 Renew the O-rings around the oil passage collars in the crankcase (see illustration). Note their different sizes.



22.9 The O-rings (arrowed) should be renewed

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22.12 Fit the new gasket, making sure the dowels (arrowed) are in place ...

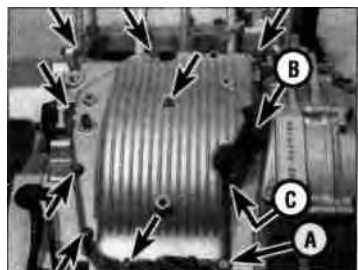
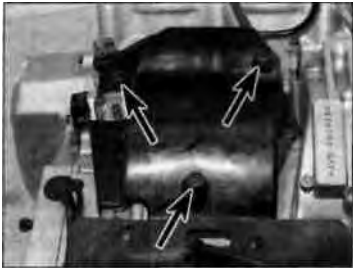
Installation

10 Fit a new O-ring onto the relief valve and smear it with clean oil, then push the valve into its socket in the crankcase. Fit the holder, then apply a suitable non-permanent thread locking compound to the bolt and tighten it to the torque setting specified at the beginning of the Chapter (see illustration 22.5).

11 Install the oil strainer and its cover (see illustrations 22.4c, b and a). Apply a suitable non-permanent thread locking compound to the cover screws and tighten them to the torque setting specified at the beginning of the Chapter.

12 If removed, fit the sump dowels into the crankcase. Lay a new gasket onto the sump (if the engine is in the frame) or onto the

23.3 Remove the screws (arrowed) and lift off the cover



23.4b Unscrew the bolts (arrowed) and remove the cover, noting the earth cable (A), cable guide (B) and copper washer (C)



22.13 ... then fit the sump

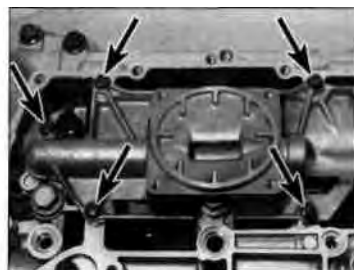
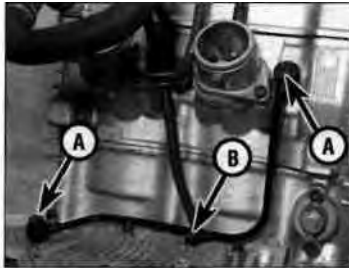
crankcase (if the engine has been removed and is positioned upside down on the work surface) (see illustration). Make sure the holes in the gasket align correctly with the bolt holes.

13 Position the sump onto the crankcase, then apply a suitable non-permanent thread locking compound to the bolts and install them finger-tight (see illustration). Tighten the bolts evenly in a criss-cross pattern to the specified torque setting.

14 Install the oil filter and cover and fill the engine with the correct type and quantity of oil (see Chapter 1).

15 On TDM and TRX models install the exhaust system (see Chapter 4). On 1991 to 1995 TDM models and XTZ models, install the

23.4a Unscrew the banjo bolts (A) and the bracket bolt (B) and remove the pipe



23.5a Unscrew the bolts (arrowed) and remove the holder

engine bashplate (see Chapter 8). Start the engine and check that there are no oil leaks around the sump and oil filter cover.

23 Balancer shafts - removal, inspection and installation

Note: On 1991 to 1995 TDM models and XTZ models, the balancer shafts can be removed with the engine in the frame. If the engine has been removed, ignore the steps which do not apply. On 1996-on TDM models and all TRX models, the engine must be removed from the frame.

Removal

1 On 1991 to 1995 TDM models and XTZ models, remove the seat, side covers and engine bashplate (see Chapter 8), the fuel tank and exhaust system (see Chapter 4), the starter clutch and idle/reduction gear (see Section 18), and the oil sump (see Section 22).

2 On 1996-on TDM models and TRX models, remove the oil tank (see Section 21), the starter clutch and idle/reduction gear (see Section 18), and the oil sump (see Section 22).

3 On 1992 to 1995 TDM models, unscrew the bolts securing the mudflap/engine top cover and remove the cover, feeding the earth cable through as you do (see illustration).

4 On 1991 to 1995 TDM models and XTZ models, unscrew the oil pipe banjo bolts and the bracket bolt securing the oil pipe to the cylinder head and the crankcase top cover and remove the pipe (see illustration). Discard the sealing washers as new ones must be used. Working evenly in a criss-cross pattern, unscrew the bolts securing the cover to the top of the crankcase and remove the cover (see illustration). Note the position of the earth cable and cable guide(s) and of the bolt with the copper sealing washer. Discard the gasket as a new one must be used. Note the positions of the dowels and remove them if they are loose.

5 Unscrew the bolts securing the oil strainer holder and remove the holder (see illustration). Remove the O-ring from the oil passage collar in the crankcase (see illustration); a new O-ring is required for reassembly.



23.5b The O-ring (arrowed) should be renewed

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23.6 Each retainer plate is secured by a Torx screw (arrowed)

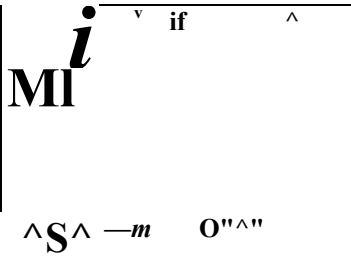
6 Unscrew the Torx bolt securing each balancer shaft retainer plate and remove the plates, noting how they fit (see illustration).

7 Unscrew the bolts securing the rear balancer shaft holder and remove the holder (see illustration). Remove the dowels if they are loose. Support the rear balancer shaft weight, then withdraw the shaft from the left-hand side of the crankcase and lift the weight out of the top (see illustration). Discard the shaft O-ring as a new one must be used. Keep the weight and shaft together as a matched pair, and do not confuse them with the front weight and shaft.

8 Unscrew the bolts securing the front balancer shaft holder and remove the holder (see illustration). Remove the dowels if they are loose. Support the front balancer shaft weight, then withdraw the shaft from the left-hand side of the crankcase and remove the weight from the bottom (see illustration).

Inspection

9 Check the weights for cracked, chipped and worn teeth on the driven gears and renew the weight if any are found. The drive gears on the crankshaft should also be checked. Check the condition of the needle bearings in the bore of the weight. If they are worn, the weight must be renewed as the bearings are not listed as being available separately, though it is worth checking with a Yamaha dealer or bearing specialist.



23.7a Unscrew the bolts (arrowed) and remove the holder...

10 Check the shafts are straight by rolling them on a flat surface such as a piece of glass. Also check the bearing surfaces for scuffing and wear.

Installation

11 Turn the crankshaft until the Woodruff key slot (for the alternator rotor) on the left-hand end aligns with the triangular mark on the crankcase (see illustration). The best way to turn the engine with the alternator rotor removed is to engage a gear and use the front sprocket nut. If the engine is still in the frame, the rear wheel can be used. Turn the sprocket in an anti-clockwise direction only and remove the spark plugs (see Chapter 1) to release the compression in the engine,

23.8a Unscrew the bolts (arrowed) and



remove the holder...



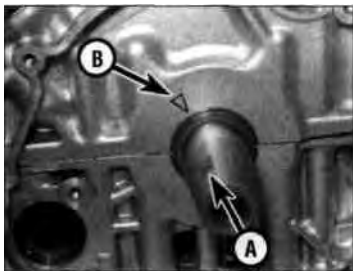
23.7b ... then withdraw the shaft and lift out the rear weight

making it much easier to turn and to prevent the nut from undoing.

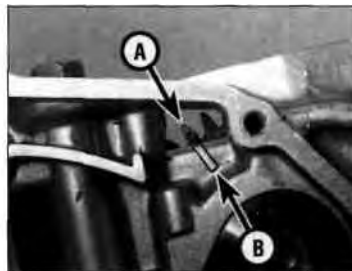
12 Apply clean engine oil to the front balancer shaft. Position the front balancer weight in the engine, aligning the punch mark on the larger gear with the mark on the crankcase, then slide the shaft in from the left-hand side until it is fully home (see illustration and 23.8b). Check that the marks on both the crankshaft and the balancer shaft are still correctly aligned. If removed, fit the balancer holder dowels, then install the holder and tighten its bolts to the torque setting specified at the beginning of the Chapter (see illustration).

13 Fit a new O-ring onto the rear balancer shaft and smear it with lithium-based grease

23.8b ... then withdraw the shaft and lift out the front weight



23.11 Align the Woodruff key slot (A) with the triangular mark (B)



23.12a Align the punch mark on the gear (A) with the mark on the crankcase (B)

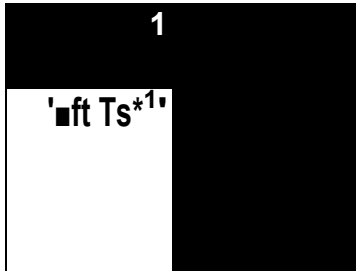


23.12b Fit the holder onto the dowels

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23.13a Fit a new O-ring into the narrow groove



23.13b Align the punch mark on the gear (A) with the mark on the crankcase (B)



23.13c Fit the holder onto the dowels

(see illustration). Apply clean engine oil to the shaft. Position the rear balancer weight in the engine, aligning the punch mark on the larger gear with the mark on the crankcase, then slide the shaft in from the left-hand side until it is fully home (see illustration and 23.7b). Check that the marks on both the crankshaft and the balancer shaft are still correctly aligned. If removed, fit the balancer holder dowels, then install the holder and tighten its bolts to the torque setting specified at the beginning of the Chapter (see illustration). 14 Fit the shaft retainer plates with the

counter-sink for the screw heads on the outside, then apply a suitable non-permanent thread locking compound to the Torx screw threads and tighten them to the specified torque setting (see illustration).

15 Fit a new O-ring around the oil passage collar (see illustration 23.5b), then fit the oil strainer holder (see illustration). Apply a suitable non-permanent thread locking compound to the holder bolts and tighten them to the specified torque setting.

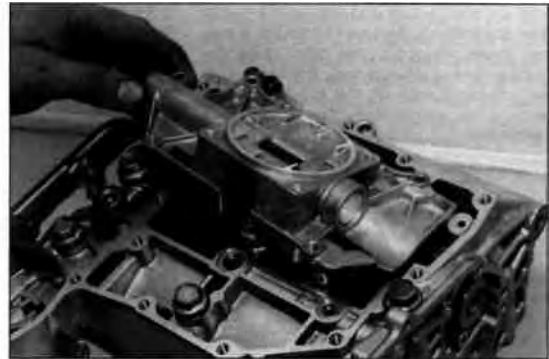
16 On 1991 to 1995 TDM models and XTZ models, if removed, install the crankcase top cover dowels. Fit the cover using a new

gasket, then tighten the bolts evenly in a criss-cross pattern to the specified torque, not forgetting the earth cable and cable guide(s) and making sure the bolt with the copper washer is positioned at the rear on the right-hand side (see illustrations). Install the oil pipe using new sealing washers on each side of the unions and tighten the banjo bolts and the bracket bolt to the specified torque settings (see illustration).

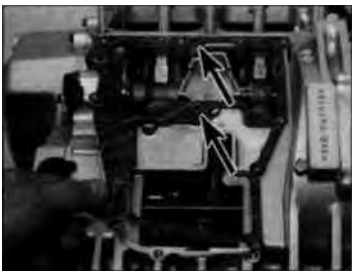
17 Install all remaining components or assemblies in a reverse of the removal procedure (see Steps 3, 2 and 1).



23.14 Fit each retainer plate into its slot in the shaft end



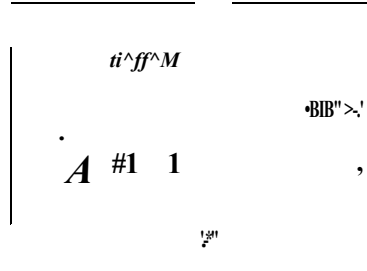
23.15 Install the strainer holder



23.16a Fit the new gasket onto the dowels (arrowed)...



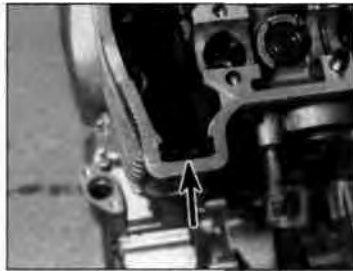
23.16b ... then install the cover



23.16c Use new sealing washers on each side of the union



24.2 Draw the cam chain out of the engine



24.4a Note how the front guide locates in the cylinder head (arrow)...



24.4b ... and lift it out

24 Cam chain and guides - removal, inspection and installation

Removal

Cam chain

1 Remove the valve cover (see Section 7), the cam chain tensioner (see Section 9), the cam chain top guide and the camshaft sprockets (see Section 8), and the oil pumps (see Section 20).
2 Feed the cam chain down through the tunnel and draw it out of the oil pump housing (see illustration).

Chain guides

3 The cam chain top guide can be unbolted from the cylinder head after the valve cover has been removed (see Section 7) (see illustration 8.4).
4 The cam chain front guide can be lifted from the cylinder head after the cam chain tensioner (see Section 9) and the exhaust camshaft sprocket have been removed (see Section 8) (see illustrations). Note which way up and round the guide fits and how it locates.
5 The cam chain rear guide is secured by a pivot pin, which is located behind one of the 6 mm crankcase bolts. Remove the cam chain tensioner (see Section 9), the inlet camshaft sprocket (see Section 8) and the oil pump

cover (see Section 20). Unscrew the bolt (see illustration). As the pivot pin is set deep, its centre is threaded to accept a 5 mm bolt. Thread the bolt into the pin, then draw out the bolt with the pin attached and lift the guide out of the top of the tunnel (see illustrations).

Inspection

Cam chain

6 Check the chain for binding, kinks and any obvious damage and renew it if necessary. Check the camshaft sprocket teeth for wear and renew the cam chain and sprockets as a set if necessary (see Chapter 8).

Chain guides

7 Check the guides for excessive wear, deep grooves, cracking and other obvious damage, and renew them if necessary. Check the condition of the pivot hardware on the rear guide and renew any components that are damaged or deteriorated.

Installation

8 Installation of the chain and guides is the reverse of removal, noting the following:

- a) Apply engine oil to the faces of the guides, to the rear guide pivot pin, and to the chain.
- b) Use a piece of bent wire to hook up the cam chain and draw it up the tunnel.
- c) Tighten the 6 mm crankcase bolt for the rear guide to the torque setting specified at the beginning of the Chapter.

25 Crankcase halves - separation and reassembly

Note: To separate the crankcase halves, the engine must be removed from the frame.

Separation

1 To access the connecting rods, crankshaft, bearings, transmission shafts and the selector drum and forks, the crankcase must be split into two parts.

2 To enable the crankcases to be separated, the engine must be removed from the frame (see Section 5). Before the crankcases can be separated the following components must be removed:

- a) Valve cover (Section 7).
- b) Cylinder head (Section 10).
- c) Cylinder block (Section 13).
- d) Pistons (Section 14).
- e) Clutch (Section 16).
- f) Starter clutch and idle/reduction gear (Section 18).
- g) Gearchange mechanism external components (Section 19).
- h) Oil pumps (Section 20).
- i) Cam chain and guides (Section 24).
- j) Oil tank (1996-on TDM models and all TRX models) (Section 21).
- k) Oil sump (Section 22).
- l) Balancer shafts (Section 23).
- m) Water pump (Chapter 3).
- n) Starter motor (if required) (Chapter 9).

2



24.5a Unscrew the crankcase bolt (arrowed)...



24.5b ... then thread a 5 mm bolt into the head of the pivot pin ...



.. then withdraw the pin and lift out the guide

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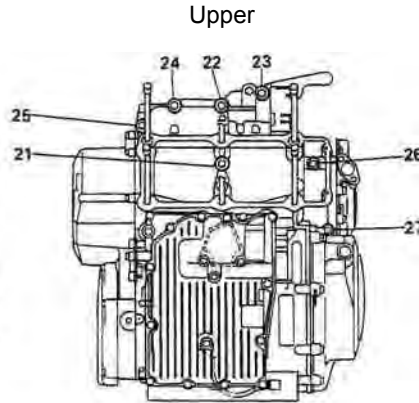
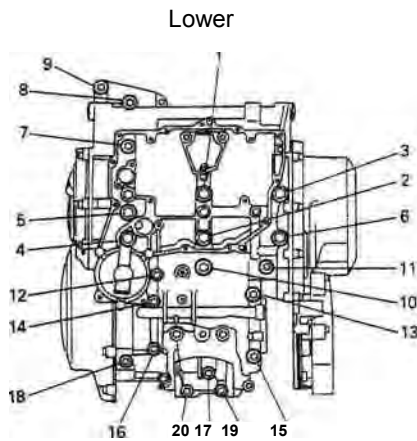
25.3 Unscrew the bolts (arrowed) and remove the plate

3 Unscrew the bolts securing the transmission output shaft retainer plate to the left-hand side of the crankcase and remove the plate (**see illustration**).

4 Unscrew the 6 mm and 8 mm upper crankcase bolts (**see illustrations**). Unscrew the bolts evenly, a little at a time in a reverse of the numerical sequence until they are finger-tight, then remove them. The number of each bolt is cast into the crankcase. Note the copper washers fitted with some of the bolts. **Note:** As each bolt is removed, store it in its relative position, with its washer where applicable, in a cardboard template of the crankcase halves. This will ensure all bolts are installed in the correct location on reassembly.

5 Turn the engine upside down so that it rests on the cylinder head studs.

6 Unscrew the 6 mm lower crankcase bolts, the 8 mm bolts, and the 10 mm bolts (**see illustrations 25.4a and b**). Unscrew the bolts evenly, a little at a time in a reverse of the numerical sequence until they are finger-tight, then remove them. The number of each bolt is cast into the crankcase. Note the copper washers fitted with some of the bolts, and also the cable guide. **Note:** As each bolt is removed, store it in its relative position, with its washer and cable guide where applicable, in a cardboard template of the crankcase halves. This will ensure all bolts are installed in the correct location on reassembly.

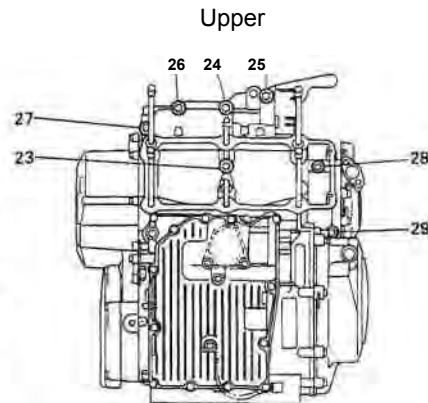
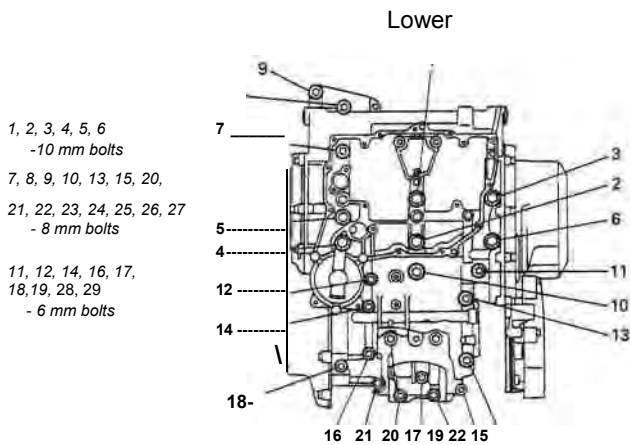


I, 2, 3, 4, 5, 6
- 10 mm bolts

7, 8, 9, 10, 13, 15,
21, 22, 23, 24, 25
- 8 mm bolts

II, 12, 14, 16, 17,
18, 19, 20, 26, 27
- 6 mm bolts

25.4a Crankcase bolts - 1991 to 1995 TDM models and XTZ models

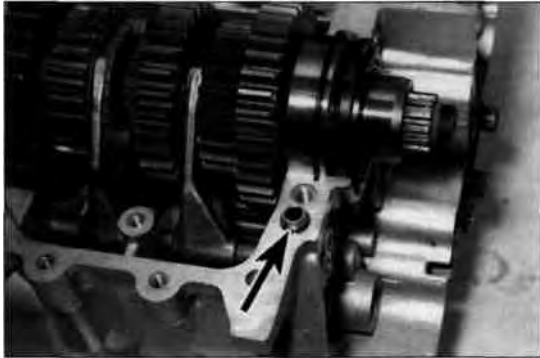


1, 2, 3, 4, 5, 6
- 10 mm bolts

7, 8, 9, 10, 13, 15, 20,
21, 22, 23, 24, 25, 26, 27
- 8 mm bolts

11, 12, 14, 16, 17,
18, 19, 28, 29
- 6 mm bolts

25.4b Crankcase bolts - 1996-on TDM models and TRX models



25.8 Remove the dowel (arrowed) if it is loose



25.11 Use a new output shaft oil seal if required

7 Carefully lift the lower crankcase half off the upper half, using a soft-faced hammer to tap around the joint to initially separate the halves if necessary (see illustration 25.15). **Note:** If the halves do not separate easily, make sure all fasteners have been removed. Do not try and separate the halves by levering against the crankcase mating surfaces as they are easily scored and will leak oil. Tap around the joint faces with a soft-faced mallet.

8 Remove the locating dowel from the crankcase if it is loose (it could be in either crankcase half) (see illustration).

9 Refer to Sections 26 to 32 for the removal and installation of the components housed within the crankcases.

Reassembly

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

11 Ensure that all components and their bearings are in place in the upper and lower crankcase halves. If the transmission shafts have not been removed, check the condition of the output shaft oil seal on the left-hand

end of the shaft and renew it if it is damaged or deteriorated (see illustration).

12 Generously lubricate the crankshaft and transmission shafts, particularly around the bearings, with clean engine oil, then use a rag soaked in high flash-point solvent to wipe over the mating surfaces of both crankcase halves to remove all traces of oil.

13 If removed, install the locating dowel in the upper crankcase half (see illustration 25.8).

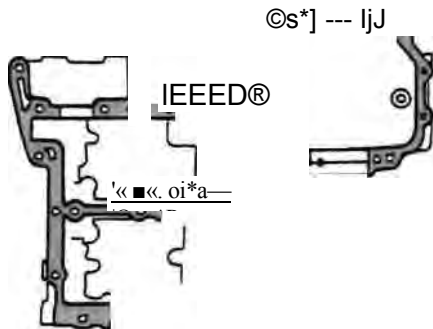
14 Apply a small amount of suitable sealant (such as Yamaha Bond 1215) to the outer mating surface of one crankcase half (see illustration). **Caution: Do not apply an excessive amount of sealant as it will ooze out when the case halves are assembled and may obstruct oil passages. Do not apply the sealant on or too close (within 2 to 3 mm) to any of the bearing inserts or surfaces.**

15 Check again that all components are in position, particularly that the bearing shells are still correctly located in the lower crankcase half. Carefully install the lower crankcase half down onto the upper

crankcase half, making sure the dowel locates correctly into the lower crankcase half (see illustration).

16 Check that the lower crankcase half is correctly seated. **Note:** The crankcase halves should fit together without being forced. 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 10 mm lower crankcase bolts and apply molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and new engine oil) to their threads. Insert them with their washers in their original locations. Clean the threads of the 8 mm and 6 mm lower crankcase bolts and apply new engine oil to their threads. Insert them (with their washers where fitted, and not forgetting the cable guide) in their original locations. Secure all bolts finger-tight at first, then tighten them evenly and a little at a time in the correct numerical sequence to the torque settings specified at the beginning of the Chapter (see illustrations 25.4a or b).



25.14 Apply the sealant to the shaded areas



25.15 Fit the lower half onto the upper half, making sure it locates onto the dowel (arrowed)

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25.20 Install the retainer plate

18 Turn the engine over. Clean the threads of the 8 and 6 mm upper crankcase bolts and apply new engine oil to their threads. Insert them (with their washers where fitted) in their original locations. Secure all bolts finger-tight at first, then tighten them evenly and a little at a time in the correct numerical sequence to the torque settings specified at the beginning of the Chapter (see illustrations 25.4a or b).

19 With all crankcase fasteners tightened, check that the crankshaft and transmission shafts rotate smoothly and easily. Check that the transmission shafts rotate freely and independently in neutral, then rotate the selector drum by hand and select each gear in turn whilst rotating the input shaft. Check that all gears can be selected and that the shafts rotate freely in every gear. If there are any signs of undue stiffness, tight or rough spots, or of any other problem, the fault must be rectified before proceeding further.

20 Install the transmission output shaft retainer plate onto the left-hand side of the crankcase (see illustration). Apply a suitable non-permanent thread locking compound to the threads of the bolts and tighten them to the specified torque setting.

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

26 Crankcase halves - inspection and servicing

1

1 After the crankcases have been separated, remove the crankshaft, connecting rods, transmission shafts, selector drum and forks, water pump drive gear, and neutral switch, referring to the relevant Sections of this Chapter, and to Chapter 3 for the water pump and Chapter 9 for the neutral switch. Also remove the oil passage collars and their O-rings (see illustration 22.9). Discard the O-rings as new ones must be used.

2 The crankcases should be cleaned thoroughly with new solvent and dried with compressed air. All oil passages should be blown out with compressed air. Also check that the oil nozzles are securely screwed into their bores and have not worked loose.

3 All traces of old gasket sealant should be

removed 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 oil 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 only 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. If any damage is found that 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 Heli-Coil 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 screw 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.

Refer to Tools and

HINT

Workshop Tips for details of installing a thread insert and using screw extractors.

7 Install all components and assemblies, referring to the relevant Sections of this Chapter and to Chapters 3 and 9, before reassembling the crankcase halves. Do not forget to install the oil passage collars using new O-rings.

27 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 connecting rod bearings, remove them 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 enable 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 pumps 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.

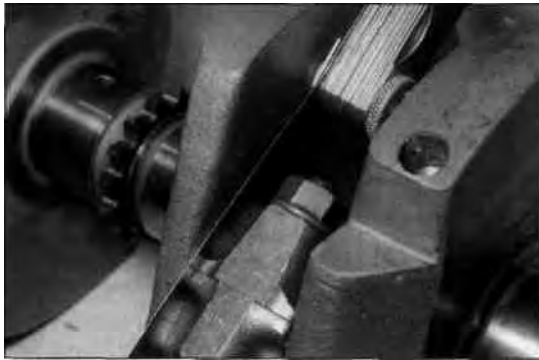
[*CT?B3] Refer to Tools and TJJJJJT Workshop Tips for bearing HINT faultfinding.

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 pieces 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.

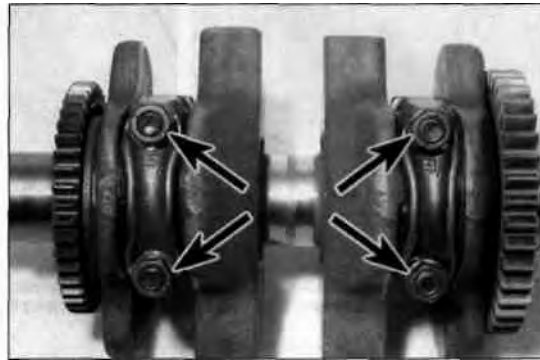
7 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight fitting bearings which leave insufficient bearing oil clearances result in oil starvation. Dirt or foreign particles trapped behind a bearing insert result in high spots on the bearing which lead to failure.

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.

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28.2 Measure the connecting rod side clearance using a feeler gauge



28.4 Unscrew the nuts (arrowed) and remove the connecting rods

28 Connecting rods - removal, inspection and installation

Note: To remove the connecting rods the engine must be removed from the frame and the crankcases separated.

Removal

- 1 Remove the engine from the frame (see Section 5) and separate the crankcase halves (see Section 25).
- 2 Before removing the rods from the crankshaft, measure the side clearance on each rod with a feeler gauge (see illustration). If the clearance between 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 on each connecting rod and cap. Mark across the cap-to-connecting rod join and note the Y mark on each connecting rod which must face to the left-hand side of the engine to ensure that the cap and rod are fitted the correct way around on reassembly. Note that the number etched

across the rod and cap indicates rod size grade, not cylinder number.

- 4 Unscrew the big-end cap nuts and separate the cap from the crankpin (see illustration). Do not remove the bolts from the connecting rods. Immediately install the relevant bearing shells (if removed), bearing cap, and nuts on each piston/connecting rod assembly so that they are all kept together as a matched set to ensure correct installation.

Inspection

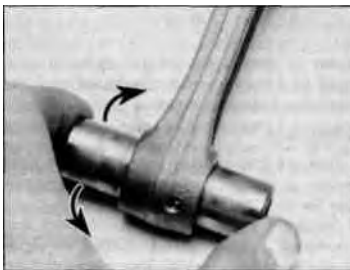
- 5 Check the connecting rods for cracks and other obvious damage.
- 6 Apply clean engine oil to the piston pin, insert it into the connecting rod small-end and check for any freeplay between the two (see illustration). Measure the pin external and compare the result to the specifications at the beginning of the Chapter (see illustration). If the piston pin is worn below the service limit it should be renewed.
- 7 Refer to Section 27 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.

- 8 Have the rods checked for twist and bend by a Yamaha dealer or engineer if you are in doubt about their straightness.

Oil clearance check

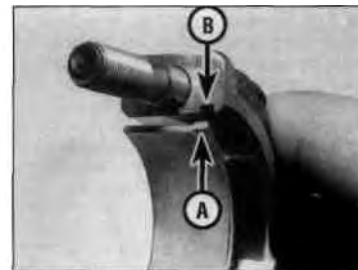
- 9 Whether new bearing shells are being fitted or the original ones are being re-used, the connecting rod bearing oil clearance should be checked prior to reassembly.
- 10 Clean the backs of the bearing shells and the bearing locations in both the connecting rod and cap.
- 11 Press the bearing shells 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.
- 12 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 (cleaned) crankpin journal.
- 13 Apply molybdenum disulphide grease to



28.6a Slip the piston pin into the rod's small-end and rock it back and forth to check for looseness

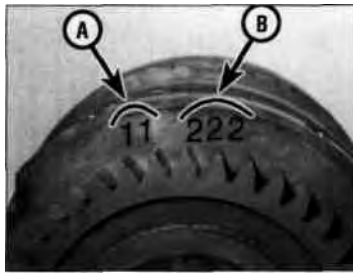


28.6b Measure the external diameter of the pin



28.11 Make sure the tab (A) locates in the notch (B)

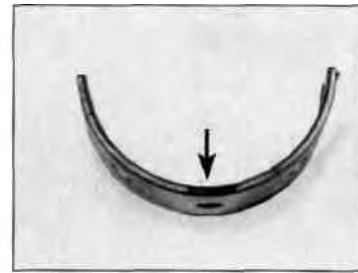
2*50 Engine, clutch and transmission



28.21a Big-end journal size numbers (A), main journal size numbers (B)



28.21b Connecting rod size number is marked across the cap and rod join



28.22 Bearing shell colour code location

the bolt shanks and threads and to the seats of the nuts. Install the (clean) connecting rod, shells and cap. Make sure the cap is fitted the correct way around so the previously made markings align, and that the rod is facing the right way (see Step 3). Tighten the nuts finger-tight, making sure the connecting rod does not rotate on the crankshaft.

14 Tighten the bearing cap nuts evenly, in two or three stages, to the initial torque setting specified at the beginning of the Chapter, making sure the connecting rod does not rotate on the crankshaft. Now tighten each nut in turn and in one continuous movement to the final torque setting specified. If the tightening is interrupted between the initial and final torque settings, slacken the nuts and begin the procedure again.

15 Slacken the cap nuts and remove the connecting rod, again taking great care not to rotate the rod or crankshaft.

16 Compare the width of the crushed Plastigauge on the crankpin to the scale printed on the Plastigauge envelope to obtain the connecting rod bearing oil clearance (see illustration 29.20). Compare the reading to the specifications at the beginning of the Chapter.

17 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.

18 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 beyond the service limit, renew the shells (see Steps 21 and 22). Check the oil clearance once again (the new shells may be thick enough to bring bearing clearance within the specified range). Always renew the shells in both connecting rods at the same time.

19 If the clearance is still greater than the service limit listed in this Chapter's Specifications, the crankpin is worn and the crankshaft should be renewed.

20 Repeat the bearing selection procedure for other connecting rod.

Bearing shell selection

21 New bearing shells for the big-end bearings are supplied on a selected fit basis. Code numbers stamped on various components are used to identify the correct parts. The crankshaft journal size numbers are stamped on the outside of the crankshaft web on the right-hand end (see illustration). The block of two numbers are for the big-end bearing journals (the block of three numbers are for the main bearing journals). The left-hand number is for the left-hand (No. 1 cylinder) journal. The connecting rod numbers are marked in ink on the flat face of the connecting rod and cap (see illustration).

22 A range of bearing shells is available. To select the correct bearing for a particular connecting rod, subtract the big-end bearing journal number (stamped on the crank web) from the connecting rod number (marked on the rod). Compare the bearing number calculated with the table below to find the colour coding of the new bearing required. The bearing shell colour code is marked on the side of the shell (see illustration).

Number	Colour
1	Blue
2	Black
3	Brown
4	Green

Installation

23 Clean the backs of the bearing shells and the bearing locations in both the connecting rod and cap.

24 Press the bearing shells into their locations, making sure the tab on each shell locates in the notch in the connecting rod/cap (see illustration 28.11). Make sure the bearings are fitted in their correct locations and take care not to touch any shell's bearing surface with your fingers. Lubricate the shells with clean engine oil.

25 Apply molybdenum disulphide grease to the bolt shanks and threads and to the seats of the nuts. Assemble the connecting rod and cap on the crankpin. Make sure the cap is

fitted the correct way around so the previously made markings align, and that the rod is facing the right way (see Step 3). Tighten the nuts finger-tight, making sure the connecting rod does not rotate on the crankshaft. Check again to make sure all components have been returned to their original locations using the marks made on disassembly.

26 Tighten the bearing cap nuts evenly, in two or three stages, to the initial torque setting specified at the beginning of the Chapter, making sure the connecting rod does not rotate on the crankshaft. Now tighten each nut in turn and in one continuous movement to the final torque setting specified. If the tightening is interrupted between the initial and final torque settings, slacken the nuts and begin the procedure again.

27 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.

28 Reassemble the crankcase halves (see Section 25).

29 Crankshaft and main bearings - removal, inspection and installation

Note: To remove the crankshaft the engine must be removed from the frame and the crankcase halves separated.

Removal

1 Remove the engine from the frame (see Section 5) and separate the crankcase halves (see Section 25).

2 Separate the connecting rods from the crankshaft (see Section 28). **Note:** If no work is to be carried out on the crankshaft or connecting rod assemblies, there is no need to separate them.

3 Lift the crankshaft out of the upper

29.3 Carefully lift the crankshaft out of the crankcase

crankcase half, taking care not to dislodge the main bearing shells (see illustration).

4 The main bearing shells can be removed from the crankcase halves by pushing their centres to the side, then lifting them out (see illustration). Keep the shells in order.

Inspection

5 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, and also blow through the oil passages. Check the drive gears for wear or damage (see illustration). If any of the gear teeth are excessively worn, chipped or broken, the crankshaft must be renewed. If wear or damage is found, check the driven gears on the balancer shafts, oil pumps, water pump and clutch housing.

6 Refer to Section 27 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 journals. 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.

7 Give the crankshaft journals a close visual examination, paying particular attention where damaged bearings have been discovered. If the journals are scored or pitted in any way a new crankshaft will be required. Note that undersizes are not available, precluding the option of re-grinding the crankshaft.

8 Place the crankshaft on V-blocks and check the runout at the main bearing journals using a dial gauge (see illustration). Compare the reading to the maximum specified at the beginning of the Chapter. If the runout exceeds the limit, the crankshaft must be renewed.

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 before the engine is reassembled. Main

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

bearing oil clearance is measured with a product known as Plastigauge.

10 Clean the backs of the bearing shells and the bearing housings in both crankcase halves.

11 Press the bearing shells into their cutouts, ensuring that the tab on each shell engages in the notch in the crankcase (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 the shells and crankshaft are clean and dry. Lay the crankshaft in position in the upper crankcase.

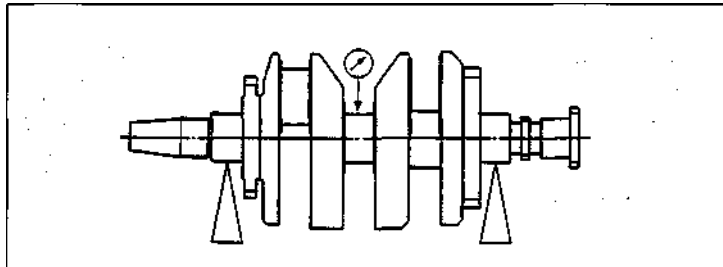
13 Cut several lengths of the appropriate size Plastigauge (they should be slightly shorter than the width of the crankshaft journals).

29.5 Check the condition of the gear and sprocket teeth

Place a strand of Plastigauge on each (cleaned) journal (see illustration). Make sure the crankshaft is not rotated.

14 If removed, install the locating dowel in the upper crankcase half (see illustration 25.8). Carefully install the lower crankcase half on to the upper half, making sure the dowel locates correctly into the lower crankcase half (see illustration 25.15). Check that the lower crankcase half is correctly seated. **Note:** Do not tighten the crankcase bolts if the casing is not correctly seated.

15 Clean the threads of the 10 mm lower crankcase bolts and apply molybdenum disulphide oil (a 50/50 mixture of molybdenum disulphide grease and new engine oil) to their threads. Insert them with their washers in their original locations. Clean the threads of the



29.8 Measuring crankshaft runout

2



29.11 Make sure the tab on the shell locates in the notch in the rod



29.13 Lay a strip of Plastigauge on each journal parallel to the crankshaft centreline



"ftSSS

29.20 Measure the width of the crushed Plastigauge (be sure to use the correct scale - metric and imperial are included)

8 and 6 mm lower crankcase bolts and apply new engine oil to their threads. Insert them (with their washers where fitted) in their original locations. Secure all bolts finger-tight at first, then tighten them evenly and a little at a time in the correct numerical sequence to the torque settings specified at the beginning of the Chapter (see illustrations 25.4a or b). Make sure that the crankshaft is not rotated as the bolts are tightened.

16 Turn the engine over. Clean the threads of the 8 and 6 mm upper crankcase bolts and apply new engine oil to their threads. Insert them (with their washers where fitted) in their original locations. Secure all bolts finger-tight at first, then tighten them evenly and a little at a time in the correct numerical sequence to the torque settings specified at the beginning of the Chapter (see illustrations 25.4a or b). Make sure that the crankshaft is not rotated as the bolts are tightened.

17 Unscrew the 6 mm and 8 mm upper crankcase bolts evenly, a little at a time in a reverse of the numerical sequence until they are finger-tight, then remove them (see illustrations 25.4a or b). The number of each bolt is cast into the crankcase. Note the copper washers fitted with some of the bolts. **Note:** As each bolt is removed, store it in its relative position, with its washer where applicable, in a cardboard template of the

crankcase halves. This will ensure all bolts are installed in the correct location on reassembly.

18 Turn the engine upside down so that it rests on the cylinder head studs.

19 Unscrew the 6 mm lower crankcase bolts, the 8 mm bolts, and the 10 mm bolts evenly, a little at a time in a reverse of the numerical sequence until they are finger-tight, then remove them (see illustrations 25.4a or b). The number of each bolt is cast into the crankcase. Carefully lift off the lower crankcase half, making sure the Plastigauge is not disturbed.

20 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). Compare the reading to the specifications at the beginning of the Chapter.

21 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.

22 If the oil clearance falls into the specified range, new bearing shells are not required (provided they are in good condition). If the clearance is beyond the service limit, refer to the marks on the case and the marks on the crankshaft and select new bearing shells (see Steps 24 and 25). Install the new shells and check the oil clearance once again (the new shells may bring bearing clearance within the specified range). Always renew all of the main bearing shells at the same time.

23 If the clearance is still greater than the service limit listed in this Chapter's Specifications (even with new shells), the crankshaft journal is worn and the crankshaft should be renewed.

Main bearing shell selection

24 New bearing shells for the main bearings are supplied on a selected fit basis. Code numbers stamped on various components are used to identify the correct size bearings. The crankshaft journal size numbers are stamped on the outside of the crankshaft web on the

right-hand end (see illustration 28.21a). The block of three numbers are for the main bearing journals (the block of two numbers are for the big-end bearing journals). The main bearing housing numbers are stamped into the upper crankcase half (see illustration). Note that if there is only one number stamped into the crankcase, it means that all the journals are the same number. 25 A range of bearing shells is available. To select the correct bearing for a particular journal, subtract the main bearing journal number (stamped on the crank web) from the main bearing housing number (stamped on the crankcase). Compare the bearing number calculated with the table below to find the colour coding of the new bearings required. The bearing shell colour code is marked on the side of the shell (see illustration 28.22).

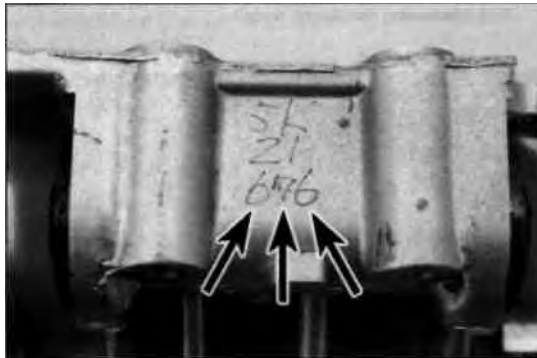
Number	Colour
1	Blue
2	Black
3	Brown
4	Green
5	Yellow
6	Pink
7	Red

Installation

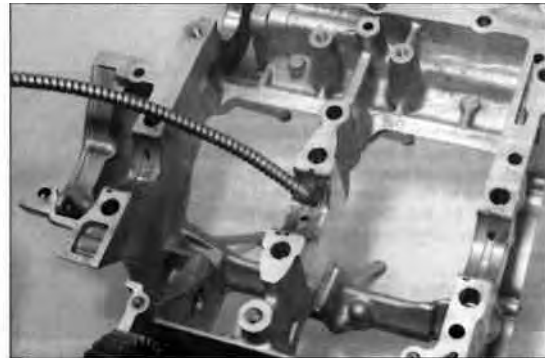
26 Clean the backs of the bearing shells and the bearing cut-outs in both crankcase halves. If new shells are being fitted, ensure that all traces of the protective grease are cleaned off using paraffin (kerosene). Wipe dry the shells and crankcase halves with a lint-free cloth. Make sure all the oil passages and holes are clear, and blow them through with compressed air if it is available.

27 Press the bearing shells into their locations. Make sure the tab on each shell engages in the notch in the casing (see illustration 29.11). 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 each shell with clean engine oil (see illustration).

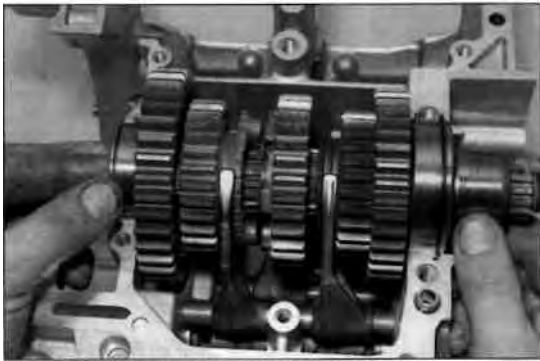
28 Lower the crankshaft into position in the



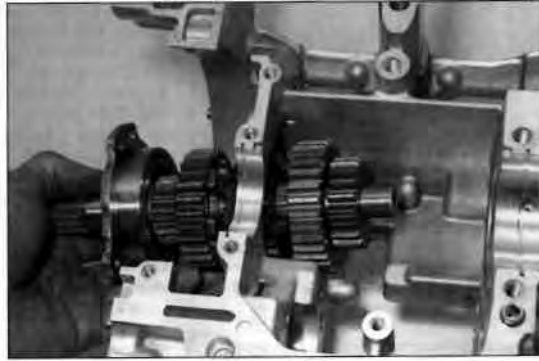
29.24 Main bearing housing numbers (arrowed)



29.27 Generously lubricate all the bearing shells



30.2 Lift out the output shaft



30.4a Draw out the shaft once the retainer screws have been removed

upper crankcase, making sure all bearings remain in place (see illustration 29.3).

29 Fit the connecting rods onto the crankshaft (see Section 28).

30 Reassemble the crankcase halves (see Section 25).

30 Transmission shafts and bearings - removal and installation

Note: To remove the transmission shafts the engine must be removed from the frame and the crankcase halves separated.

Removal

1 Remove the engine from the frame (see Section 5) and separate the crankcase halves (see Section 25).

2 Lift the output shaft out of the casing, noting how the selector forks locate in the grooves (see illustration). If it is stuck, use a soft-faced hammer and gently tap on the ends of the shaft to free it. Remove the bearing half-ring retainer from the right-hand end of the output shaft and note how the locating pin on each bearing fits into the cutouts in the crankcase (see illustration 30.11). If the half-ring retainer is not in the slot in the crankcase, remove it from the slot in the bearing.

3 Remove the selector forks (see Section 32).

4 Remove the three Torx screws securing the input shaft bearing retainer on the right-hand end of the shaft (see illustration 30.7c). Draw the shaft out of the crankcase from the right-hand side (see illustration). If it is stuck, thread a 6 mm bolt into the centre of the blanking plug on the left-hand end of the shaft and remove the plug by pulling on the bolt (see illustration). Discard the plug O Ring as a new one must be used. Once the plug is removed, tap on the end of the shaft using a soft-faced mallet to free it from the crankcase.

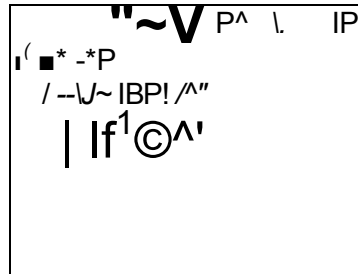
5 If necessary, the input shaft and output shaft can be disassembled and inspected for wear or damage (see Section 31).

6 Referring to *Tools and Workshop Tips* (Section 5) in the Reference Section, check the bearings on the transmission shafts or in the bearing housings in the crankcase. Renew the bearings if necessary. Also check the condition of the output shaft oil seal and renew it if it is worn or damaged (see illustration 25.11).

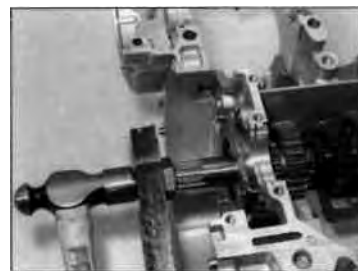
Installation

7 Slide the input shaft into the crankcase, aligning the four holes in the bearing retainer with those in the crankcase (see illustration and 30.4b). Use the screws, a long bolt or a

rod as a guide to align the holes, as once the retainer is in the housing it will be difficult to turn. Use a hammer and block of wood to drive the shaft fully home (see illustration). Apply a suitable non-permanent thread locking compound to the Torx screws and tighten them to the torque setting specified at the beginning of the Chapter. **Note:** It is advisable to renew the Torx screws because the originals are likely to have been damaged by previous staking. Using a suitable punch, stake the screws against the retainer (see illustration). If it was removed, fit the blanking plug with a new O-ring and press it home (see illustrations).



30.4b Thread a suitable bolt into the plug and pull it out



30.7b Tap the shaft into place as shown



30.7a Note how the holes must align (arrow)



30.7c Install the Torx screws (arrowed) and

stake them in place

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30.7d Fit a new O-ring onto the plug .



30.7e ... and press it into place



30.9 Fit the half-ring retainer into the slot

8 Install the selector forks (see Section 32).

9 Install the bearing half-ring retainer for the right-hand end of the output shaft into its slot in the upper crankcase half (see illustration).

10 If it has not been removed, slide the output shaft oil seal off the left-hand end of the shaft (see illustration 25.11); the seal must be renewed. Lubricate the shaft and new seal with clean oil and slide it onto the shaft. Smear the seal rim with oil.

11 Lower the output shaft into position in the crankcase half (see illustration 30.2), making sure the selector fork guide pins are engaged with their selector drum groove and the forks themselves fit into the grooves in the pinions, and the slot in the right-hand bearing engages correctly with the bearing half-ring retainer, the circlip on the left-hand bearing fits into its slot, and the bearing locating pins fit into the cutouts in the crankcase (see illustration).

12 Make sure both transmission shafts are correctly seated and their related pinions are correctly engaged.

Caution: If the bearing half-ring retainer, circlip and locating pins are not correctly engaged, the crankcase halves will not seat correctly.

13 Position the gears in the neutral position and check the shafts are free to rotate easily and independently (ie the input shaft can turn whilst the output shaft is held stationary) before proceeding further.

14 Reassemble the crankcase halves (see Section 25).

31 Transmission shafts- disassembly, inspection and reassembly

1 Remove the transmission shafts from the casing (see Section 30). Always disassemble the transmission shafts separately to avoid mixing up the components.

Input shaft disassembly

ffffjofth When disassembling the UUHISI transmission shafts, place HIUT the parts on a long rod or

thread a wire through them to keep them in order and facing the proper direction.

2 Remove the 2nd gear pinion from the left-hand end of the shaft using a puller, referring to *Tools and Workshop Tips* (Section 5) in the Reference Section if required (see illustration). If a legged puller is being used, it will be easier to set it up with the legs behind the 5th gear pinion, and draw the 2nd and 5th pinions off together. **Note:** In our experience an hydraulic press was needed to remove the 2nd gear pinion as it was so tight on the shaft. Take the shaft to a properly equipped workshop if necessary.

3 Slide the 5th gear pinion off the shaft (see illustration 31.17d).

4 To remove the 5th gear pinion bush, set up a puller behind the 3rd gear pinion and use

that to draw the bush off (see illustration). Remove the thrust washer and the 3rd gear pinion (see illustration 31.17a and 31.16).

5 Remove the circlip securing the 4th gear pinion, then slide the splined washer and the pinion off the shaft (see illustrations 31.15c, b and a). The 4th gear pinion bush is a press fit. Do not remove it unless it needs to be renewed. Remove it using a puller.

6 The 1st gear pinion is integral with the shaft.

Input shaft inspection

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

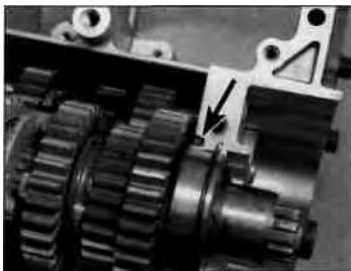
8 Check the gear teeth for cracking, chipping, pitting and other obvious wear or damage. Any pinion that is damaged as such must be renewed.

9 Inspect the dogs and the dog holes in the gears for cracks, chips, and excessive wear especially in the form of rounded edges. Make sure mating gears engage properly. Renew the paired gears as a set if necessary.

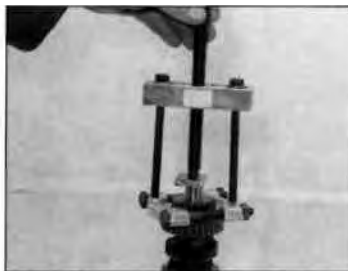
10 Check for signs of scoring or bluing on the pinions, bushes and shaft. This could be caused by overheating due to inadequate lubrication. Check that all the oil holes and passages are clear. Renew any damaged pinions or bushes.

11 Check that each mobile pinion moves freely on the shaft or bush but without undue freeplay.

12 The shaft is unlikely to sustain damage unless the engine has seized, placing an



30.11 Make sure that each pin (arrowed) locates in its cutout



31.2 Use a puller or press to remove the 2nd gear pinion



31.4 Draw off the bush using a puller behind the 3rd gear pinion



31.15a Slide the 4th gear pinion onto the bush...



31.15b . then slide on the splined washer....



31.15c ... and secure them with the circlip

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, or if there are any cracks. Damage of any kind can only be cured by renewal. Check the shaft runout using V-blocks and a dial gauge and renew the shaft if the runout exceeds the limit specified at the beginning of the Chapter.

13 Check the washers and circlips and renew any that are bent or appear weakened or worn. It is a good policy to renew all circlips and washers as a matter of course during a gearshaft overhaul.

Input shaft reassembly

14 During reassembly, apply engine oil to the

mating surfaces of the shaft, pinions and bushes. When installing the circlips, do not expand their ends any further than is necessary. Install the stamped circlips so that their chamfered side faces the pinion it secures and the sharp edged sides faces the direction of thrust load (see 'correct fitting of a stamped circlip illustration' in *Tools and Workshop Tips* in the Reference section).

15 If removed, drive or press the 4th gear pinion bush onto the shaft, aligning the oil hole in the bush with the hole in the shaft. Slide the 4th gear pinion, with the pinion dog holes facing away from the integral 1st gear onto the bush (see illustration). Slide the splined washer onto the shaft, then fit the circlip, making sure that it locates

correctly in the groove in the shaft (see illustrations).

16 Slide the 3rd gear pinion onto the shaft with the selector fork groove facing the 4th gear pinion (see illustration).

17 Slide the thrust washer onto the shaft, then drive or press the 5th gear pinion bush into place, aligning the oil hole in the bush with the hole in the shaft (see illustrations). Slide the 5th gear pinion onto the bush (see illustration).

18 Press the 2nd gear pinion onto the left-hand end of the shaft using a press or tubular drift, referring to *7bo/s and Workshop Tips* (Section 5) in the Reference Section if required (see illustration). Set the pinion so that the distance between the outside edge of the 2nd gear pinion and the outside edge of



31.16 Slide the 3rd gear pinion onto the shaft, making sure it is the correct way round



31.17a Slide on the thrust washer.



31.17b ... then fit the bush .



31.17c ... aligning the oil holes (arrowed)

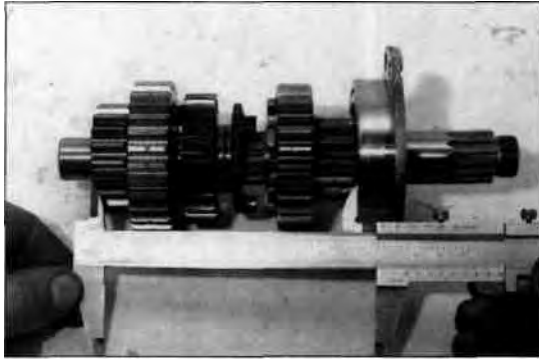


31.17d Install the 5th gear pinion over the bush

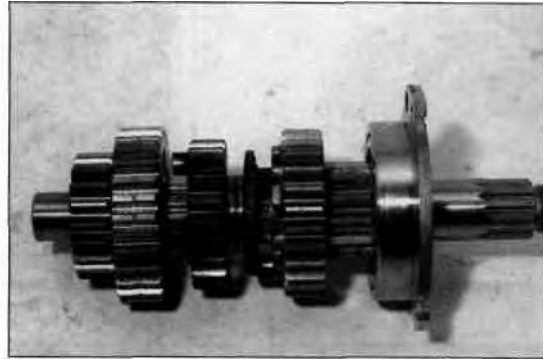


31.18a Fit the 2nd gear pinion .

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31.18b ... and set the distance as specified



31.19 The assembled input shaft should be as shown

the 1st gear pinion (which is integral with the shaft) is 116.6 mm to 116.8 mm (see illustration).

19 Check that all components have been correctly installed (see illustration).

Output shaft disassembly

1991 to 1994 TDM models and all XTZ models

20 Remove the caged ball bearing from the right-hand end of the shaft (see illustration 31.41).

21 Slide the 1st gear pinion and the 4th gear pinion off the right-hand end of the shaft (see illustrations 34.40b and a).

22 Remove the circlip securing the 3rd gear pinion, then slide the splined washer, the 3rd gear pinion and its splined bush, followed by the 5th gear pinion off the shaft (see illustrations 31.39d, c, b and a, and 31.37).

23 This leaves the 2nd gear pinion, its bush and the bearing on the left-hand end of the shaft; these components are not available individually - refer to a Yamaha dealer if they need renewing.

1995-on TDM models and all TRX models

24 Remove the caged ball bearing from the right-hand end of the shaft (see illustration 31.41).

25 Slide the thrust washer, the 1st gear pinion and the 4th gear pinion off the right-hand end of the shaft (see illustrations 31.40c, b and a).

26 Remove the circlip securing the 3rd gear pinion, then slide the splined washer, the 3rd gear pinion and its splined bush off the shaft (see illustrations 31.39d, c, b and a)

27 Slide the lockwasher and the splined washer off the shaft, noting how they fit together, then slide the 5th gear pinion off the shaft (see illustrations 31.38c, b and a, and 31.37).

28 This leaves the 2nd gear pinion, its bush and the bearing on the left-hand end of the shaft; these components are not available

individually - refer to a Yamaha dealer if they need renewing.

Output shaft inspection

29 Refer to Steps 7 to 13 above.

Output shaft reassembly

1991 to 1994 TDM models and XTZ models

30 During reassembly, apply engine oil to the mating surfaces of the shaft, pinions and bushes. When installing the circlips, do not expand their ends any further than is necessary. Install the stamped circlips so that their chamfered side faces the pinion it secures and the sharp edged sides faces the direction of thrust load (see 'correct fitting of a stamped circlip illustration' in *Tools and Workshop Tips* in the Reference section).

31 Slide the 5th gear pinion onto the right-hand end of the shaft, with its dogs facing the 2nd gear pinion (integral with the shaft) (see illustration 31.37).

32 Slide the 3rd gear pinion splined bush onto the shaft, followed by the 3rd gear pinion, and the splined washer, and secure them with the circlip, making sure it locates correctly in its groove in the shaft (see illustrations 31.39a, b, c and d).

33 Slide the 4th gear pinion onto the shaft, with its selector fork groove facing the 3rd gear pinion, followed by the 1st gear pinion (see illustrations 31.40a and b).

34 Fit the caged ball bearing onto the right-hand end of the shaft (see illustration 31.41).

35 Check that all components have been correctly installed.

1995-on TDM models and TRX models

36 During reassembly, apply engine oil to the mating surfaces of the shaft, pinions and bushes. When installing the circlips, do not expand their ends any further than is necessary. Install the stamped circlips so that their chamfered side faces the pinion it secures and the sharp edged sides faces the direction of thrust load (see 'correct fitting of a stamped circlip illustration' in *Tools and Workshop Tips* in the Reference section).

37 Slide the 5th gear pinion onto the right-hand end of the shaft, with its dogs facing the 2nd gear pinion (integral with the shaft) (see illustration).

38 Slide the slotted splined washer onto the shaft and locate it in its groove, then turn it in the groove so that the splines on the washer locate between the splines of the shaft and secure the washer in the groove (see illustrations). Slide the lockwasher onto the



31.37 Slide the 5th gear pinion onto the shaft, making sure it is the correct way round



31.38a Slide the slotted splined washer on ...



31.38b ... and align it as shown ...



31.38c ... then slide the lockwasher on, fitting the tabs into the slots



31.39a Slide on the splined bush ..

shaft, so that the tabs on the lockwasher face the left-hand end of the shaft and locate into the slots in the outer rim of the splined washer (see illustration).

39 Slide the 3rd gear pinion splined bush onto the shaft, followed by the 3rd gear pinion, and the splined washer, and secure them with the circlip, making sure it locates correctly in its groove in the shaft (see illustrations).

40 Slide the 4th gear pinion onto the shaft, with its selector fork groove facing the 3rd gear pinion, followed by the 1st gear pinion, and the thrust washer (see illustrations).

41 Fit the caged ball bearing onto the right-hand end of the shaft (see illustration).

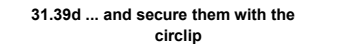
42 Check that all components have been correctly installed.



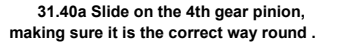
31.39b ... the 3rd gear pinion .



31.39c ... and the splined washer .



31.39d ... and secure them with the circlip



31.40a Slide on the 4th gear pinion, making sure it is the correct way round .

32 Selector drum and forks " 1
removal, inspection and installation ,... 3c

Note: To remove the selector drum and forks the engine must be removed from the frame and the crankcase halves separated.

Removal

1 Remove the engine (see Section 5) and separate the crankcase halves (see Section 25). The selector drum and forks are located in the upper crankcase half.



. followed by the 1st gear pinion...



31.41 ... and the bearing

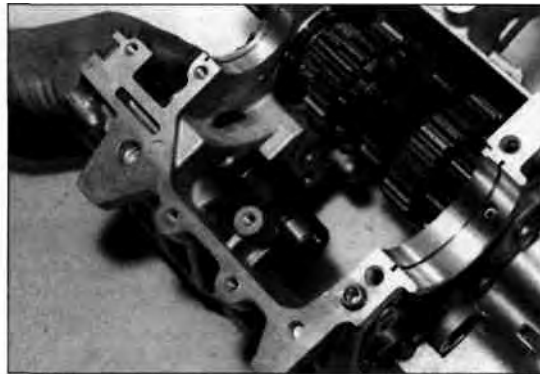


31.40c ... the thrust washer ..





32.4 Note the letter on each fork denoting its position



32.12 Slide the drum into the casing

2 Remove the transmission output shaft (see Section 30, Step 2).

3 If not already done when removing the gearchange mechanism (external components), remove the selector drum retainer plate and the stopper arm return spring, noting how the plate locates against the flats on the selector fork shaft ends (see Section 19).

4 Before removing the selector forks, note that each fork is lettered for identification. The right-hand fork has an 'R', the centre fork a 'C', and the left-hand fork an 'L' (see illustration). These letters face the right-hand side of the engine. If no letters are visible, mark them yourself using a felt pen.

5 Support the selector forks and withdraw the shafts from the casing, then remove the forks (see illustrations 32.13b and a). Once removed from the case, slide the forks back onto their shafts in their correct order and way round. On 1991 to 1995 TDM models and XTZ models, note the spring fitted on the outside of the left-hand fork.

6 Withdraw the selector drum from the right-hand side of the casing (see illustration 32.12).

Inspection

7 Inspect the selector forks for any signs of wear or damage, especially around the fork ends where they engage with the groove in the pinion. Check that each fork fits correctly in its pinion groove. Check closely to see if the forks are bent. If the forks are in any way damaged they must be renewed.

8 Check that the forks fit correctly on their shaft. They should move freely with a light fit but no appreciable freeplay. Check that the fork shaft holes in the casing are not worn or damaged.

9 The selector fork shaft can be checked for trueness by rolling it along a flat surface. A bent shaft will cause difficulty in selecting gears and make the gearchange action heavy. Renew the shaft if it is bent.

10 Inspect the selector drum grooves and selector fork guide pins for signs of wear or damage. If either component shows signs of wear or damage the selector(s) and drum must be renewed.

11 Check that the selector drum bearing rotates freely and has no sign of freeplay between it and the casing. Renew the bearing

if necessary (see *Tools and Workshop Tips* (Section 5) in the Reference Section). Also check that the neutral switch contact plunger in the other end of the drum is free to move in and out under spring pressure. If required, remove the screw securing the contact plate and remove the plunger and spring for inspection or renewal (see Chapter 9).

Installation

12 Slide the selector drum into position in the crankcase and position it so that the neutral contact is against the neutral switch (see illustration).

13 Refer to Step 4 for the correct location of each fork (see illustration 32.4). Lubricate the selector fork shafts with clean engine oil and slide them into the crankcase, with the cut end of the upper (single fork) shaft facing the right-hand side, and the spring (where fitted) in the lower shaft end facing the left-hand side. Slide each shaft through its fork(s) and into its bore, locating the guide pin on the end of each fork into its groove in the drum as you do (see illustrations).

14 Locate the stopper arm spring, then install the selector drum retainer plate, making sure



32.13a Fit the centre fork (C) into the groove in the input shaft pinion and locate the guide pin in its groove in the drum, then slide in the shaft



32.13b Slide the shaft into the casing and through each fork in turn - note the spring (arrowed)

it locates correctly against the flat in the end of the fork shaft (see Section 19).

- 15 Install the transmission output shaft (see Section 30, Step 11).
- 16 Reassemble the crankcase halves (see Section 25).

33 Initial start-up after overhaul

- 1 Make sure the engine oil level and coolant level are correct (see *Daily (pre-ride) checks*).
- 2 Make sure there is fuel in the tank, then turn the fuel tap to the ON or RES position as required, and set the choke on.
- 3 As there isn't an oil pressure warning light fitted, an oil pressure check must be carried out. Follow the procedure in Chapter 1, Section 32.
- 4 If the oil pressure test is satisfactory, allow the engine to run at a moderately fast idle until

it reaches operating temperature and check that there are no oil and coolant leaks. Stop the engine.

5 Check carefully that the transmission and controls, especially the brakes, function properly before road testing the machine. Refer to Section 34 for the recommended running-in procedure.

6 Upon completion of the road test, and after the engine has cooled down completely, recheck the valve clearances (see Chapter 1) and check the engine oil and coolant levels (see *Da/7y (pre-ride) checks*).

34 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 the engine has been rebored or a new crankshaft has been installed. In the case of a rebore, the bike will have to be run in as when new. This means greater use of the transmission and a restraining hand on the throttle until at least 600 miles (1000 km) have been covered. There's no point in keeping to any set speed limit - the main idea is to keep from labouring the engine and to gradually increase performance up to the 600 mile (1000 km) mark. 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 accompanying table indicates maximum engine speed limitations, which Yamaha provide for new motorcycles, can be used as a guide.

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.

1991 to 1995 TDM models and all XTZ models		
Up to 100 miles (150 km)	4000 rpm max	Vary throttle position/speed. Do not use full throttle. Stop the engine and let it cool for 5 to 10 minutes after every hour of operation.
100 to 300 miles (150 to 500 km)	5000 rpm max	Vary throttle position/speed. Do not use full throttle
300 to 600 miles (500 to 1000 km)	6000 rpm max	Vary throttle position/speed. Use full throttle for short bursts
Over 600 miles (1000 km)	8000 rpm max	Do not exceed tachometer red line
1996-on TDM models and all TRX models		
Up to 100 miles (150 km)	5000 rpm max	Vary throttle position/speed. Do not use full throttle. Stop the engine and let it cool for 5 to 10 minutes after every hour of operation.
100 to 300 miles (150 to 500 km)	6000 rpm max	Vary throttle position/speed. Do not use full throttle
300 to 600 miles (500 to 1000 km)	7000 rpm max	Vary throttle position/speed. Use full throttle for short bursts
Over 600 miles (1000 km)	8000 rpm max	Do not exceed tachometer red line

Chapter 3

Cooling system

Contents

Coolant hoses - removal and installation	9	General information	1
Coolant level check	see Daily (pre-ride) checks	Radiator - removal and installation	7
Coolant reservoir - removal and installation	3	Radiator pressure cap - check	2
Coolant temperature gauge and sender - check and renewal	5	Thermostat housing and thermostat - removal, check and installation	6
Cooling fan and thermostatic switch - check and renewal	4	Water pump - check, removal and installation	8
Cooling system checks	see Chapter 1		
Cooling system draining, flushing and refilling	see Chapter 1		

Degrees of difficulty

Easy , suitable for novice with little experience	Fairly easy , suitable for beginner with some experience	Fairly difficult , suitable for competent J ^A	Difficult , suitable for experienced DIY mechanic	Very difficult , suitable for expert DIY or professional
^	§	gx,	5j	!!S

Specifications

Coolant

Mixture type and capacity see Chapter 1

Radiator

Cap valve opening pressure..... 11 to 15 psi (0.75 to 1.05 Bar)

Fan switch

Cooling fan cut-in temperature 102 to 108°C
Cooling fan cut-out temperature 98°C

Coolant temperature sensor

Resistance - 1991 to 1995 TDM models and all XTZ models

@ 50°C	154 ohms
@ 80°C	47 to 53 ohms
@ 100°C	26 to 29 ohms
@ 120°C	16 ohms

Resistance - 1996-on TDM models and all TRX models

@ 80°C	47 to 53 ohms
@ 100°C	26 to 30 ohms

Thermostat

Opening temperature 80 to 84°C
Valve lift 8 mm (min) @ 95°C

Torque settings

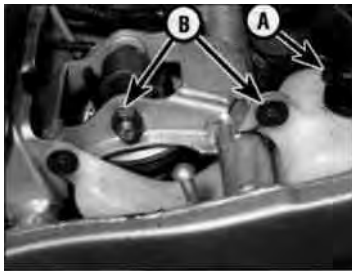
Cooling fan switch	28 Nm
Coolant temperature sensor	
1991 to 1995 TDM models and all XTZ models	13 Nm
1996-on TDM models and all TRX models	15 Nm
Thermostat cover bolts.....	10 Nm
Thermostat mounting bolt	10Nm
Water pump bolts	10Nm
Frame downtube bolts/nuts (XTZ models).....	32 Nm

3*2 Cooling system

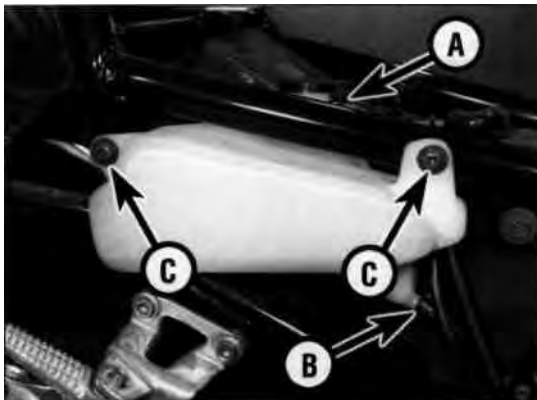
1 General information

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, driven by the front balancer shaft. 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.

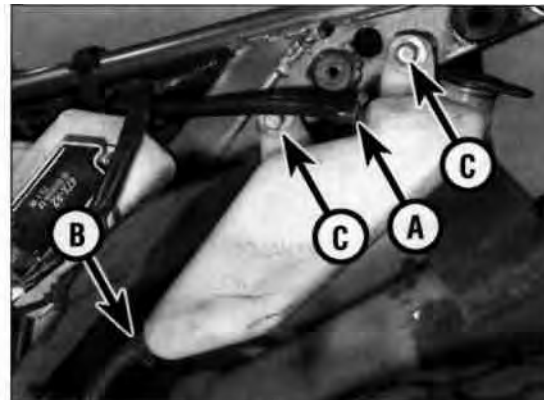
A thermostat is fitted in the system to prevent the coolant flowing through the radiator when the engine is cold, therefore accelerating the speed at which the engine reaches normal operating temperature. A coolant temperature sensor mounted in the thermostat housing transmits to the temperature gauge on the instrument panel. A thermostatically-controlled cooling fan is also fitted to aid cooling in extreme conditions. The fan switch is mounted in the thermostat housing.



3.2a Breather hose (A), mounting bolts (B) - TDM models



3.2b Breather hose (A), radiator overflow hose (B), mounting screws (C) - TRX models

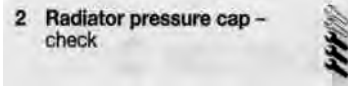


3.2c Breather hose (A), radiator overflow hose (B), mounting screws (C) - XTZ models

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.

A **Warning: Do not remove the pressure cap from the radiator when the engine is hot. Scalding hot coolant and steam may be blown out underpressure, 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 in 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.



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 Yamaha dealer with the special tester required to do the job. If the cap is defective, renew it.

Coolant reservoir - removal and installation

Removal

- 1 On TDM models, remove the seat (see Chapter 8). On TRX models, remove the seat and the side covers (see Chapter 8). On XTZ models remove the left-hand side cover (see Chapter 8).
- 2 Release the clamp securing the breather hose (coming out of the top of the reservoir) and detach the hose (see illustrations).
- 3 Place a suitable container underneath the reservoir, then release the clamp securing the radiator overflow hose to the base of the reservoir. Detach the hose and allow the coolant to drain into the container.
- 4 Unscrew the reservoir mounting bolts or screws and remove the reservoir, noting how it fits (see illustrations 3.2a, b and c).

Installation

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



4.3a Fan motor wiring connector (arrowed) - TDM models



4.3b Fan motor wiring connector (arrowed) - XTZ models

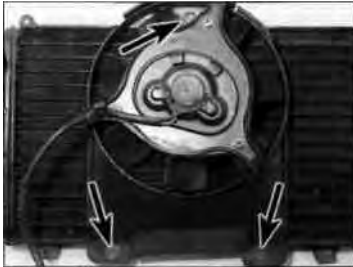
4 Cooling fan and cooling fan switch - check and renewal SK

Cooling fan

Check

1 If the engine is overheating and the cooling fan isn't coming on, first check the fan circuit fuse (see Chapter 9) and then the fan switch as described in Steps 9 to 13 below.

4.5 Fan assembly mounting bolts



(arrowed)

4.9b Fan switch wiring connector (A), temperature sender wiring connector (B) -



TRX models

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

3 To test the cooling fan motor, trace the fan motor wiring and disconnect it at the connector (see illustrations). Remove the fuel tank and on TDM and TRX the air filter housing for best access. Using a 12 volt battery and two jumper wires, connect the battery leads to the fan wiring connector. Once connected the fan should operate. If it

does not, and the wiring is all good, then the fan is faulty.

Renewal

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

4 Remove the radiator (see Section 7).

5 Unscrew the three bolts securing the fan shroud and fan assembly to the radiator (see illustration). On TDM and TRX models, unscrew the bolts on the front of the fan securing it to the shroud and remove the shroud. Separate the fan blade from the motor and renew the motor. On XTZ models, individual components are not available and the entire fan assembly must be renewed.

6 Installation is the reverse of removal.

7 Install the radiator (see Section 7).

Cooling fan switch

Check

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

9 If the fuse is good, on TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8). Disconnect the wiring connectors from the fan switch, mounted in the thermostat housing (see illustrations). Using a jumper wire, connect between the terminals in the wiring connectors. The fan should come on. If it does, the fan switch is defective and must be renewed. If it does not come on, the fan should be tested (see Step 3).

10 If the fan is on the whole time, disconnect the wiring connector. The fan should stop. If it does, the fan switch is defective and must be renewed. If it doesn't, check the wiring between the fan switch and the fan motor, and the fan itself.

11 If the fan works but is suspected of



4.9a Fan switch wiring connector (A), temperature sender wiring connector (B) - TDM models

Mb 10

J[A iS t; ^1

4.9c Fan switch wiring connector (A), temperature sender wiring connector (B) - XTZ models

3*4 Cooling system

cutting in at the wrong temperature, a more comprehensive test of the switch can be made as follows.

12 Remove the switch (see Steps 14 to 17). Fill a small heatproof container with coolant and place it on a stove. Connect the probes of an ohmmeter to the terminals of the switch, and using some wire or other support suspend the switch in the coolant so that just the sensing portion and switch body are submerged (see illustration). Also place a thermometer capable of reading temperatures up to 110°0 in the coolant so that its bulb is close to the switch.

Note: None of the components should be allowed to directly touch the container.

13 Initially the ohmmeter reading should be very high indicating that the switch is open (OFF). Heat the coolant, stirring it gently.

A **Warning: This must be done very carefully to avoid the risk of personal injury.** When the temperature reaches around 102 to 108°C the meter reading should drop to around zero ohms, indicating that the switch has closed (ON). Now turn the heat off. As the temperature falls below 98°C the meter reading should show infinite (very high) resistance, indicating that the switch has opened (OFF). If the meter readings obtained are different, or they are obtained at different temperatures, then the switch is faulty and must be renewed.

Removal and installation

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

14 Drain the cooling system (see Chapter 1). **Note:** The fan switch is positioned near the top of the cooling system so coolant draining can be avoided if care is taken to catch any coolant which escapes as the switch is removed.

15 On TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8). Disconnect the wiring

connector(s) from the fan switch, mounted in the thermostat housing (see illustrations 4.9a, b and c). Unscrew the switch and withdraw it from the housing.

16 Apply a suitable thread locking and sealing compound to the switch threads, then install the switch and tighten it to the torque setting specified at the beginning of the Chapter. Take care not to overtighten the switch as the housing could be damaged.

17 Reconnect the switch wiring and refill or top up the cooling system (see Chapter 1).

5 Coolant temperature gauge/warning light and sender - check and renewal

A **Warning: The engine must be completely cool before carrying out work on the temperature sender.**

Coolant temperature gauge (XTZ, TRX and 1991-98 TDM models)

Check

1 The circuit consists of the sender mounted in the thermostat housing and the gauge assembly mounted in the instrument panel. If the system malfunctions check first that the battery is fully charged and that the fuses are all good. If they are, on TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8).

2 Disconnect the wire from the sender and turn the ignition switch ON (see illustrations 4.9a, b and c). The temperature gauge needle should be on the C on the gauge. Now earth the sender wire on the engine. The needle should swing immediately over to the H on the gauge.

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

If the needle moves as described above, the sender is proven defective and must be renewed.

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

Removal and installation

4 See Chapter 9, Section 16.

Coolant temperature warning light (1999 TDM models)

5 The circuit consists of the sender mounted in the thermostat housing and the coolant temperature warning light in the instrument panel. The warning light should illuminate briefly when the ignition is first turned on as a check of the warning light bulb; the light should then extinguish. If the bulb doesn't light, it is probably blown and should be renewed as described in Chapter 9. Less likely is a wiring fault, but referring to the wiring diagram at the end of this manual, check the coolant temperature warning light circuit wiring for continuity.

6 The bulb should illuminate if the engine coolant ever reaches too high a temperature. If you suspect that the bulb is failing to come on check the sender as described below.

Sender check (all models)

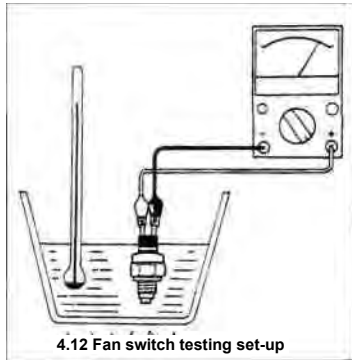
7 The sender is mounted in the thermostat housing. On TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8). Drain the cooling system (see Chapter 1). **Note:** The sender is positioned near the top of the cooling system so coolant draining can be avoided if care is taken to catch any coolant which escapes as the sender is removed.

8 Disconnect the sender wiring connector (see illustrations 4.9a, b and c). Using a continuity tester, check for continuity between the sender body and earth on the motorcycle's frame. There should be continuity. If there is no continuity, check that the thermostat mounting is secure, and where fitted, that the thermostat housing earth wire is securely connected.

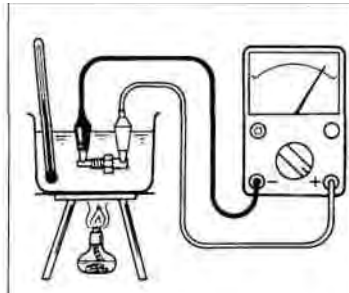
9 Unscrew the sender and remove it from the thermostat housing (see below). Test the sender according to the appropriate subsection.

1991 to 1995 TDM models and all XTZ models

10 Fill a small heatproof container with coolant mixture and place it on a stove. Using an ohmmeter, connect the positive (+ve) probe of the meter to the terminal on the sender, and the negative (-ve) probe to the tip of the sender. Using some wire or other support suspend the sender in the coolant so that it is submerged. Also place a thermometer capable of reading temperatures up to 120°C in the coolant so that its bulb is close to the sender (see illustration). **Note:** None of the components should be allowed to directly touch the container.



4.12 Fan switch testing set-up



5.10 Temperature sender testing set-up - 1991 to 1995 TDM models and all XTZ models

11 Heat the coolant, stirring it gently. When the temperature reaches around 50°C the meter should read 154 ohms. When the temperature reaches around 80°C the meter should read between 47 and 53 ohms. When the temperature reaches around 100°C the meter should read between 26 and 29 ohms. When the temperature reaches around 120°C the meter should read 16 ohms. If the meter readings obtained are different, or they are obtained at different temperatures, then the sender is faulty and must be renewed. **1996-on TDM models and all TRX models**

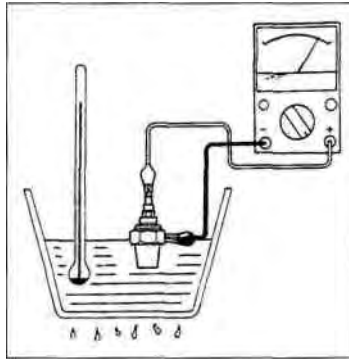
12 Fill a small heatproof container with water and place it on a stove. Using an ohmmeter, connect the positive (+ve) probe of the meter to the terminal on the sender, and the negative (-ve) probe to the body of the sender. Using some wire or other support suspend the sender in the water so that just the sensing portion and the threads are submerged. Also place a thermometer capable of reading temperatures up to 110°C in the water so that its bulb is close to the sender (see illustration). **Note:** None of the components should be allowed to directly touch the container.

13 Heat the water, stirring it gently. When the temperature reaches around 80°C the meter should read 47 to 53 ohms. When the temperature reaches around 100°C the meter should read 26 to 30 ohms. If the meter readings obtained are different, or they are obtained at different temperatures, then the sender is faulty and must be renewed.

Sender removal and installation (all models)

14 Drain the cooling system (see Chapter 1). On TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8).

15 Disconnect the sender wiring connector



5.12 Temperature sender testing set-up - 1996-on TDM models and all TRX models

(see illustrations 4.9a, b and c). Unscrew the sender and remove it from the thermostat housing.

16 Apply a suitable thread locking and sealing compound to the sender threads, then install the sender and tighten it to the torque setting specified at the beginning of the Chapter. Take care not to overtighten the sender as the housing could be damaged.

17 Reconnect the sender wiring and top up the cooling system (see Chapter 1).

Thermostat housing and thermostat - removal, check and installation

Removal

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

1 The thermostat is automatic in operation and should give many years of service without requiring attention. In the event of a failure, the valve will probably jam open, in which



6.3 Slacken the clamp screws and pull off the hoses

case the engine will take much longer than normal to warm up. Conversely, if the valve jams shut, the coolant will be unable to circulate and the engine will overheat. Neither condition is acceptable, and the fault must be investigated promptly.

2 Drain the cooling system (see Chapter 1).

3 The thermostat is located in the thermostat housing. On TDM and TRX models, remove the fuel tank and air filter housing (see Chapter 4). On XTZ models, remove the left-hand fairing side panel (see Chapter 8). Slacken the clamps securing the hoses to the housing and detach the hoses, noting which fits where (see illustration and 4.9b and c). On XTZ models, release the clamp securing the overflow hose to the filler neck and detach the hose.

4 Disconnect the fan switch and temperature sensor wiring connectors (see illustrations 4.9a, b and c). Where fitted, also slacken the screw securing the earth lead and detach the lead.

5 Unscrew the bolt securing the thermostat housing and remove the housing, noting how it fits (see illustration and 4.9b and c).

6 Unscrew the two bolts securing the cover and separate it from the housing (see illustration). Withdraw the thermostat, noting

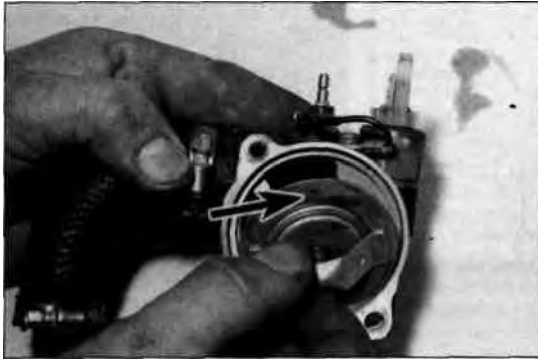


6.5 Thermostat housing mounting bolt (arrowed) - TDM models



6.6a Unscrew the bolts and remove the cover ...

3»6 Cooling system



6.6b ... and withdraw the thermostat



THERMOMETER

6.8 Thermostat testing set-up

how it fits (**see illustration**). Discard the cover O-ring as a new one must be used.

Check

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

8 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 specifications given at the beginning of the Chapter. Also check the amount the valve opens after it has been heated at 95°C for a few minutes and compare the measurement to the specifications. If the readings obtained differ from those given, the thermostat is faulty and must be renewed.

9 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

10 Fit the thermostat into the housing, making sure that it seats correctly and that the hole is at the top (**see illustration 6.6b**).

11 Fit a new O-ring onto the cover, using a dab of grease to keep it in place if required (**see illustration**). Fit the cover onto the housing, then install the two bolts and tighten them to the torque setting specified at the beginning of the Chapter (**see illustrations 6.6a**).

12 Install the thermostat housing and tighten the bolt to the specified torque setting (**see illustrations 4.9b and c**). Connect the hoses

and tighten the clamps securely. Also connect the wiring connectors, not forgetting the earth lead, where fitted. 13 Refill the cooling system (**see Chapter 1**).

7 Radiator - removal and installation

Removal

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

1 Remove the fairing side panels on TDM and XTZ models, and the fairing on TRX models (**see Chapter 8**). Remove the fuel tank, and on TDM and TRX models, the air filter housing (**see Chapter 4**). Drain the cooling system (**see Chapter 1**).

2 Trace the fan motor wiring and disconnect it at the connector (**see illustrations 4.3a and b**).

3 Slacken the clamps securing the radiator hoses and detach them from the radiator (**see illustrations**).

4 Unscrew the bolts securing the radiator, noting the arrangement of the collars and rubber grommets, and carefully manoeuvre



6.11 Fit the cover using a new O-ring



7.3a Detach the upper.

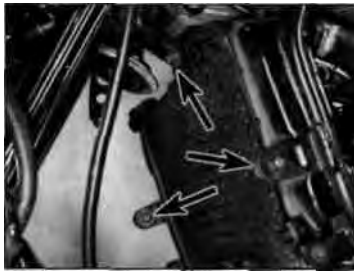


7.3b ... and lower radiator hoses (early TDM shown)...



7.3c ... and on TDM and TRX models the overflow hose (arrowed)

Cooling system 3*7



7.4a Radiator mounting bolts (arrowed) - 1991 to 1995 TDM models



7.4b Radiator mounting bolts (arrowed) - 1996-on TDM models and all TRX models (TRX shown)



7.4c Radiator mounting bolts (arrowed) - XTZ models. Note how the rubber damper locates in the bracket (A)

the radiator away from the machine, noting how it fits (see illustrations).

5 On TDM models, if required, unscrew the bolts securing the radiator stay to the frame and remove the stay.

6 If necessary, remove the cooling fan (see Section 4) from the radiator.

7 If required, remove the stone guard from the radiator. Check the stone guard and 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 renew them if necessary.

Installation

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

- Make sure the various collars and grommets are correctly installed with the mounting bolts.
- Make sure that the fan wiring is correctly connected.
- Ensure the coolant hoses are in good condition (see Chapter 1), and are securely retained by their clamps, using new ones if necessary.
- On completion refill the cooling system as described in Chapter 1.

8 Water pump - check, removal, and installation

§
||

Check

1 The water pump is located on the right-hand side of the engine. Visually check the area around the pump for signs of leakage.

2 To prevent leakage of water from the cooling system into the lubrication system and vice versa, two seals are fitted on the pump shaft. On the underside of the pump body there is a drainage hole (see illustration 8.12a). If either seal fails, this hole should allow the coolant or oil to escape and prevent the oil and coolant mixing.

3 If there is any leakage from the drainage hole, remove the pump and renew it - individual components (except O-rings and bolts) are not available.

Removal

4 Drain the coolant (see Chapter 1). Place a suitable container below the water pump to catch any residue as the water pump is removed. On XTZ models, remove the exhaust system (see Chapter 4). Also unscrew the bolts securing the right-hand frame downtube section and remove it.

5 Slacken the clamp securing the coolant hose to the pump cover and detach the hose (see illustration).

6 Unscrew the bolts securing the pump to the crankcase (see illustration). Carefully draw the pump from the crankcase, noting how it fits. It may be necessary to lever it out to overcome the O-rings on the pump body and on the joint pipe between the top of the pump housing and the union on the cylinder block.

Caution: A shim is fitted on the pump shaft between the circlip and the drive gear. The shim will probably stick to the gear, however great care must be taken as it is possible for the shim to slip down into the engine as the shaft is withdrawn from the gear.

Remove the O-ring from the rear of the pump body and from the joint pipe and discard them as new ones must be used. Note the position of each bolt as their lengths differ.

7 Unscrew the remaining bolts securing the pump cover and remove the cover (see illustration 8.6). Discard the cover O-ring as a new one must be used.

8 Wiggle the water pump impeller back-and-forth and in-and-out. If there is excessive movement the pump must be renewed. Rotate the impeller and check that it turns smoothly and freely. Also check for corrosion or a build-up of scale in the pump body and clean or renew the pump as necessary.

9 To remove the pump drive gear, first remove the front balancer shaft (see Chapter 2). Slide the gear out of its bore in the crankcase and lift it out, noting how it fits (see illustration).



8.5 Slacken the clamp (arrowed) and detach the hose



8.6 Water pump mounting bolts (A), cover bolts (A) and (B)



8.9 Water pump drive gear (arrowed)

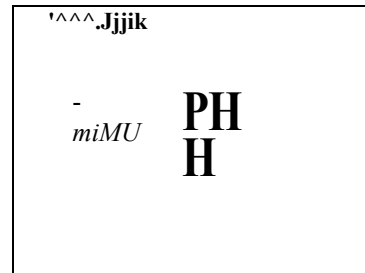
3»8 Cooling system



8.11a Fit the O-ring into the groove in the cover...



8.11b .. then fit the cover and its two bolts



8.12a Fit a new O-ring onto the body...

Installation

10 If removed, slide the shouldered side of the pump drive gear into its bore in the crankcase (see illustration 8.9). Install the front balancer shaft (see Chapter 2).

11 Install the new cover O-ring into its groove in the pump (see illustration). Fit the cover and secure it with the two bolts (see illustration).

12 Fit the new pump body O-ring and joint pipe O-ring (see illustration). Apply some grease to the shim to stick it in place, then slide it onto the pump shaft (see illustrations). Install the pump into the crankcase, making sure it locates correctly into the driven gear (see illustration). Install the bolts and tighten them to the torque setting specified at the beginning of the Chapter (see illustration 8.6). Make sure the different length bolts are in their correct locations.

13 Attach the coolant hose to the pump cover and secure it with its clamp (see illustration 8.5).

14 On XTZ models, install the frame downtube and tighten its bolts to the specified torque setting (see Chapter 2).

Also install the exhaust system (see Chapter 4).
15 Refill the cooling system (see Chapter 1).

9 Coolant hoses - removal and installation

Removal

1 Before removing a hose, 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 (see illustrations 6.3, 7.3a and b). The smaller-bore hoses are secured by spring clamps which can be expanded by squeezing their ears together with pliers (see illustration 7.3c).

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 peeled off in two pieces. Whilst this means replacing the hose, it is preferable to buying a new radiator.

4 The water pipe union on the front of the cylinder block can be removed by unscrewing the retaining bolts (see Chapter 2, Section 13). If it is removed, the O-rings must be renewed.

Installation

5 Slide the clamp onto the hose and then work it on to its respective union.

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.

7 If the water pipe union on the engine has been removed, fit new O-rings, then install the union and tighten the mounting bolts to the specified torque setting (see Chapter 2, Section 13).



8.12b ... then grease the shim ..



8.12c ... and slide it onto the shaft



8.12d Install the pump, making sure it locates correctly into the drive gear

Chapter 4

Fuel and exhaust systems

Contents

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Carburettor synchronisation	see Chapter 1	Fuel tank - cleaning and repair.....	3
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Fuel hoses - renewal	see Chapter 1		
Fuel level sender and gauge	see Chapter 9		

Degrees of difficulty

&	Fairly easy, suitable for beginner with some experience	Fairly difficult, suitable for competent DIY mechanic	Difficult, suitable for experienced mechanic	Very difficult, suitable for expert or professional
Easy, suitable for novice with little experience	>§ some ^S	J^ ^	^ 2j ^S	*J >jS

Specifications

Fuel	
Grade	Unleaded, minimum 91 RON (Research Octane Number)
Fuel tank capacity (including reserve)	
1991 to 1995 TDM models	18.0 litres
1996-on TDM models	20.0 litres
TRX models	18.0 litres
XTZ models	26.0 litres
Reserve	
1991 to 1995 TDM models	3.5 litres
1996-on TDM models	3.1 litres
TRX models	3.5 litres
XTZ models	5.0 litres

4*2 Fuel and exhaust systems

Carburettors

Type	
1991 to 1998 TDM models, all TRX and XTZ models	Mikuni BDST38
1999 TDM models	Mikuni BDSR38
ID mark	
1991 to 1995 TDM models	3VD 00
1996 to 1998 TDM models	4TX 00
1999 TDM models	4TX4
TRX models	4UN 00
XTZ models	3LD 00
Pilot screw setting (turns out)	
1991 to 1995 TDM models	3
1996-on TDM models	2
TRX models	2 1/2
XTZ models	2
Fuel level (see text)	
1991 to 1995 TDM models	7.4 to 8.4 mm above float chamber line
1996 to 1998 TDM models and TRX models	15.8to16.8mm below MIKUNI mark
1999 TDM models	3.4 to 4.4 mm below line
XTZ models	5.1 to 6.1 mm above float chamber line
Idle speed	see Chapter 1

Carburettor jet sizes

Main jet	
1991 to 1995 TDM models	140
1999 TDM models	147.5
All other models	142.5
Main air jet	
1991 to 1995 TDM models	50
1999 TDM models	65
All other models	60
Jet needle	
1991 to 1995 TDM models	5G52-3
1996 to 1998 TDM models and all TRX models	5E185-2/5
1999 TDM models	1 - 6DJP17; 2 - 6CL1
XTZ models	5C19-3
Needle jet	
1991 to 1995 TDM models and all XTZ models	Y-4
1996 to 1998 TDM models and all TRX models	Y-2
1999 TDM models	P-0
Pilot air jet	
XTZ models	60
1999 TDM models	87.5
All other models	70
Pilot jet	
1991 to 1995 TDM models	37.5
1996 to 1998 TDM models and all TRX models	45
1999 TDM models	17.5
XTZ models	42.5
Starter jet	
XTZ models	70
1999 TDM models	32.5
All other models	75

Fuel level sender

Resistance	
Fuel tank full	4 to 10 ohms @ 20°C
Fuel tank empty	90 to 100 ohms @ 20°C

Torque settings

Exhaust downpipe flange nuts	20 Nm
Exhaust clamp bolts	20 Nm
Silencer and collector box mounting bolts	24 Nm
Footrest bracket mounting bolts (XTZ models)	20 Nm

1 General information and precautions

General information

The fuel system consists of the fuel tank with internal filter, fuel tap, fuel pump, carburettors, fuel hoses and control cables.

On TDM models, a remote fuel tap is fitted for normal operation, while the filter is integral with the fuel outlet assembly from the tank. On TRX models, a vacuum-operated fuel tap with integral filter is mounted on the left-hand side of the fuel tank. On XTZ models, a fuel tap with integral filter is mounted on each side of the fuel tank.

Fuel is pumped to the carburettors by a vacuum-operated fuel pump on all TRX and XTZ models and 1991 to 1998 TDM models. The 1999 TDM model has an electrically-operated fuel pump.

The carburettors used on all models are CV types. There is a carburettor for each cylinder. For cold starting, a choke knob is connected to the carburettors by a cable. On 1991 to 1995 TDM models, the choke knob is mounted above the front sprocket cover; on 1996-on TDM models and TRX models it is mounted on the handlebars; on TRX models it is mounted on the frame between the fuel tank and the fairing. On 1996-on TDM and TRX models the carburettors are warmed by the engine's coolant.

Air is drawn into the carburettors via an air filter which is housed under the fuel tank.

The exhaust system is a two-into-two design.

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

Precautions

Ally flammable, so take extra ions 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

Warning: Petrol (gasoline) is

any fuel on your skin, rinse it off immediately with soap and water. When you perform any kind of work on the fuel system, wear safety glasses and have a fire extinguisher suitable for a class B type fire (flammable liquids) on hand.

Always perform service procedures in a well-ventilated area to prevent a build-up of fumes.

Never work in a building containing a gas appliance with a pilot light, or any other form of naked flame. Ensure that there are no naked light bulbs or any sources of flame or sparks nearby.

Do not smoke (or allow anyone else to smoke) while in the vicinity of petrol (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 safety dispose of the rag used.

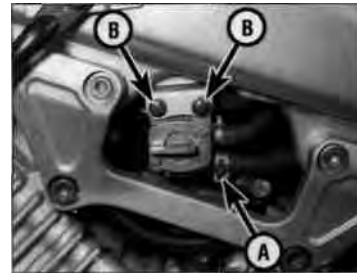
Any stored fuel that is drained off during servicing work must be kept in sealed containers that are suitable for holding petrol (gasoline), and clearly marked as such; the containers themselves should be kept in a safe place. Note that this last point applies equally to the fuel tank if it is removed 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.

2 Fuel tank and fuel tap(s) - removal and installation

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

A



2.2 Detach the lower hose (A), then unscrew the bolts (B) and displace the tap

Fuel tank - TDM models

Removal

1 Make sure the fuel cap is secure and the fuel tap is in the OFF position. On 1991 to 1995 models, remove the seat, the fairing side panels and the fairing (see Chapter 8). On 1996-on models, remove the seat, the fairing side panels and the side trim panels (see Chapter 8).

2 On 1991 to 1995 models, release the clamp securing the lower hose (to the fuel pump) on the remote fuel tap and detach the hose, then unscrew the bolts securing the tap and displace it (see illustration).

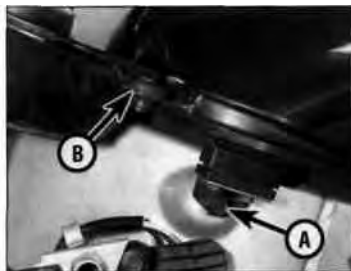
3 On 1996 to 1998 models, either proceed as described for the earlier models in Step 2, or close the tap on the fuel outlet assembly under the tank and detach the fuel hoses from the outlet, noting which fits where. Note that access may be restricted until the tank bolts have been removed and the tank can be raised at the rear.

4 On 1999 models, turn the fuel tap lever to the OFF position. Release the clamp securing the hose to the side of the fuel tap and detach the hose.

5 Unscrew the bolt securing the rear of the tank, then unscrew the bolt on each side at the front and release the trim panel from the lug (see illustrations). Raise the tank at the rear and release the clamp securing the breather hose to its union and detach the hose (see illustration). On 1991 to 1998



2.5a Unscrew the rear bolt (arrowed)...

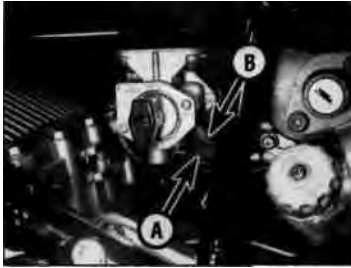


2.5b ... and the bolt on each side (A), and release the trim from the lug (B)



2.5c Detach the hose from the union (arrowed) and remove the tank

4»4 Fuel and exhaust systems



2.9a Detach the fuel hose (A), the vacuum hose (B)...

models, carefully lift the tank off the frame and remove it, bringing the remote fuel tap and hoses with it (where still attached), making sure the tap does not get snagged. On 1999 models, carefully lift the tank up to access the fuel level sender wiring; disconnect the wiring and remove the tank, making sure the tap does not get snagged.

6 Inspect the tank mounting rubbers for signs of damage or deterioration and renew them if necessary.

Installation

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

- a) *Make sure the hoses are properly attached and secured by their clamps.*
- b) *On 1996 to 1998 models, if the tap on the fuel outlet from the tank was turned OFF, do not forget to turn it back ON.*
- c) *Don't forget to reconnect the fuel level sender wiring on 1999 TDM models.*
- d) *Start the engine and check that there is no sign of fuel leakage, then shut it off.*

Fuel tank - TRX models

Removal

8 Make sure the fuel filler cap is secure and the fuel tap is in the ON or RES position. Remove the seat (see Chapter 8).

9 Release the clamps securing the fuel hose to the fuel pump and the vacuum hose to the fuel tap and detach the hoses (see illustration). Also release the clamp securing



2.9b ... and the breather hose (arrowed)

the breather hose to its union and detach the hose (see illustration).

10 Unscrew the nut and withdraw bolt securing the rear of the tank, then unscrew the bolt on each side at the front (see illustrations).

11 Carefully lift the tank off the frame and remove it.

12 Inspect the tank mounting rubbers for signs of damage or deterioration and renew them if necessary.

Installation

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

- a) *Make sure the hoses are properly attached and secured by their clamps.*
- b) *Start the engine and check that there is no sign of fuel leakage, then shut it off.*

Fuel tank - XTZ models

Removal

14 Make sure the fuel filler cap is secure and both fuel taps are in the OFF position. Remove the seat and the fairing side panels (see Chapter 8).

15 Release the clamp securing the fuel hose to each fuel tap and detach the hoses.

16 Unscrew the bolts securing the rear of the tank, then unscrew the bolt on each side at the front, and the top bracket-to-frame bolt (see illustrations).

17 Carefully lift the tank off the frame and remove it.



2.10a Remove the rear mounting bolt (arrowed)...

18 Inspect the tank mounting rubbers for signs of damage or deterioration and renew them if necessary.

Installation

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

- a) *Make sure the hoses are properly attached and secured by their clamps.*
- b) *Start the engine and check that there is no sign of fuel leakage, then shut it off.*

Fuel tap(s)

Removal

Note: *The tap should not be removed unnecessarily from the tank to prevent the possibility of damaging the O-ring or the filter.*

20 Remove the fuel tank as described above.

21 On 1991 to 1995 TDM models, connect a drain hose to the fuel outlet union on the remote tap and insert its end in a container suitable and large enough for storing the petrol. Turn the fuel tap to the RES position and allow the tank to drain. When the tank has drained, turn the tap to the OFF position.

22 On 1996 to 1998 TDM models, if the remote tap is still attached, connect a drain hose to the fuel outlet union on the remote tap and insert its end in a container suitable and large enough for storing the petrol. Turn the fuel tap to the RES position and allow the tank to drain. If the remote tap was left in situ, connect a drain hose to each union on the fuel outlet on the tank and insert their ends in a container suitable and



2.10b ... and the front mounting bolt (arrowed) on each side



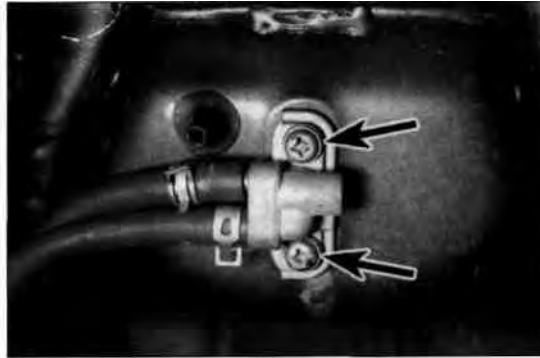
2.16a Remove the rear mounting bolts (arrowed)...



2.16b ... and the front mounting bolt (arrowed) on each side



2.26 Note which hose fits where before detaching them



2.27a Fuel outlet screws (arrowed) - 1991 to 1995 TDM models

large enough for storing the petrol. Turn the outlet tap to the ON position and allow the tank to drain. When the tank has drained, turn the tap to the OFF position.

23 On 1999 TDM models, connect a drain hose to the union on the fuel tap and insert its end in a container suitable and large enough for storing the petrol. Turn the tap ON and allow the tank to drain. When the tank has drained, turn the tap to the OFF position.

24 On TRX models, connect a drain hose to the fuel outlet union on the tap and insert its end in a container suitable and large enough for storing the petrol. Turn the fuel tap to the PRI position and allow the tank to drain. When the tank has drained, turn the tap back to the ON or RES position.

25 On XTZ models, connect a drain hose to the fuel outlet union on each tap and insert their ends in a container suitable and large enough for storing the petrol. Turn the fuel taps to the RES position and allow the tank to drain. When the tank has drained, turn the taps to the OFF position.

26 If the fuel tap has been leaking, tightening the assembly screws may help. Slacken all the

screws a little first, then tighten them evenly a little at a time to ensure the cover seats properly on the tap body. If leakage persists, the tap should be renewed, however nothing is lost by dismantling the tap for further inspection. Unscrew the screws and disassemble the tap, noting how the components fit. Inspect all components for wear or damage, and renew them as necessary, if available. If any of the components are worn or damaged beyond repair and are not available individually, a new tap must be fitted. On 1991 to 1998 TDM models, note which hose fits where on the remote tap (see illustration).

27 Remove the screws securing the tap to the tank and withdraw the tap assembly (see illustrations). Check the condition of the O-ring. If it is in good condition it can be reused, though it is better to use a new one. If it is in any way deteriorated or damaged it must be renewed.

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

29 On TRX models, the fuel tap is automatic, operated by a vacuum created when the engine is turned over. If it is faulty, it can be disassembled and inspected. The most likely problem is a hole or split in the diaphragm. Before removing and dismantling the tap, check that the vacuum hose is securely attached at both ends, and that there are no splits or cracks in the hose. If in doubt, attach a spare hose to the vacuum union on the tap and apply a vacuum to the hose. If fuel does not flow through the tap (make sure it is turned to ON or RES), remove it and disassemble it to check the diaphragm (the best way is to hold it up to the light, which will show through any splits or holes). Some individual components are available for the tap, but if the diaphragm is split the whole tap will probably have to be renewed - check with your dealer.

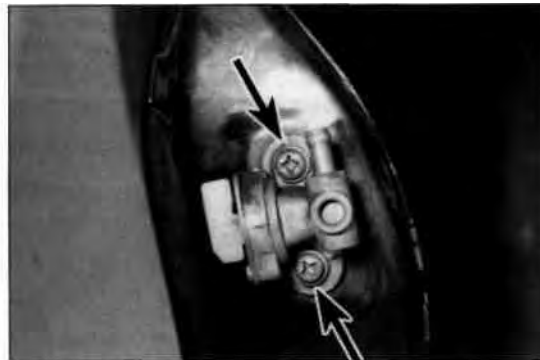
Installation

30 Installation is the reverse of removal. Use a new O-ring on the tap if required, and tighten the bolts securely.

31 Install the fuel tank (see above).



2.27b Fuel tap screws (arrowed) - TRX models



2.27c Fuel tap screws (arrowed) - XTZ models

4*6 Fuel and exhaust systems

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 Air filter housing - removal and installation

Removal

- 1 Remove the fuel tank (see Section 2).
- 2 Release the clamps securing the breather hose and the drain hose to the air filter housing and detach the hoses (see illustration). Depending on your model, it may be easier to detach the drain hose once the housing has been lifted off the carburetors.
- 3 On TDM and XTZ models, unscrew the bolt securing the front of the housing to the frame (see illustrations). On all models, slacken the clamp screws securing the housing to the carburettor intakes (see illustration).
- 4 Lift the housing up off the carburetors and remove it, on TRX models noting how the peg at the front on the right locates in the grommet on the frame (see illustration). On XTZ models, draw the intake ducts apart so that they clear the frame tube (see illustration).

Installation

- 5 Installation is the reverse of removal. Check the condition of the various hoses and their clamps and renew them if necessary.



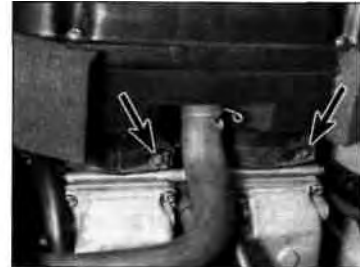
4.2 Drain hose (arrowed) - XTZ models



4.3a Air filter housing bolt (arrowed) - TDM models



4.3b Air filter housing bolt (arrowed) ■ XTZ models



4.3c Slacken the clamp screws (arrowed)...

5 Idle fuel/air mixture adjustment - general information

- 1 Due to the increased emphasis on controlling exhaust emissions, certain governmental regulations **have** been formulated which directly affect the carburation of this machine. The pilot screws can be adjusted, but the use of an exhaust gas analyser and an auxiliary tachometer capable of accurately displaying changes of 50 rpm is the only certain way to adjust the idle fuel/air mixture and be sure the machine doesn't exceed the emissions regulations.
- 2 The pilot screws are set to their correct position by the manufacturer and should not

be adjusted or removed unless it is necessary to do so during a carburettor overhaul. If the screws are to be removed, record the pilot screw's current setting by turning the screw it in until it seats lightly, counting the number of turns necessary to achieve this, then fully unscrew it. On installation, the screw is simply backed out the number of turns you've recorded. Note that for some markets, the pilot screws are sealed with a plug to prevent tampering.

- 3 If the engine runs extremely rough at idle or continually stalls, and if a carburettor overhaul does not cure the problem, take the motorcycle to a Yamaha dealer equipped with an exhaust gas analyser. They will be able to properly adjust the idle fuel/air mixture to achieve a smooth idle and restore low speed performance.



4.3d ... which on XTZ models are accessed from each side (arrow)



4.4a On TRX models, note how the peg locates in the grommet



4.4b On XTZ models, draw the ducts apart to clear the frame

6 Carburettor overhaul - general information

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

2 Keep in mind that many so-called carburettor problems are really not carburettor problems at all, but mechanical problems within the engine or ignition system malfunctions. Try to establish for certain that the carburettors are in need of maintenance before beginning a major overhaul.

3 Check the fuel tap and filter, the fuel and vacuum hoses, the intake manifold joint clamps, the air filter, the ignition system, the spark plugs, valve clearances and carburettor synchronisation before assuming that a carburettor overhaul is required.

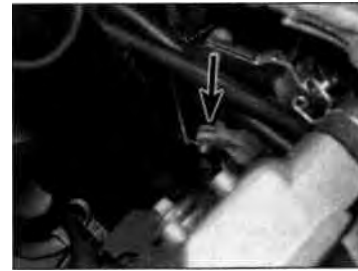
4 Most carburettor problems are caused by dirt particles, varnish and other deposits which build up in and block the fuel and air passages, especially if the motorcycle has been laid up for a time. Also, in time, gaskets and O-rings shrink or deteriorate and cause fuel and air leaks which lead to poor performance.

5 When overhauling the carburettors, disassemble them completely and clean the parts thoroughly with a carburettor cleaning solvent and dry them with filtered, unlubricated compressed air. Blow through the fuel and air passages with compressed air to force out any dirt that may have been loosened but not removed by the solvent. Once the cleaning process is complete, reassemble the carburettor using new gaskets and O-rings.

6 Before disassembling the carburettors, make sure you have all necessary O-rings and other parts, some carburettor cleaner, a supply of clean rags, some means of blowing out the carburettor passages and a clean place to work. It is recommended that only one carburettor be overhauled at a time to avoid mixing up parts.



7.2a Slacken the clamp screw (arrowed)...



7.2b ... and detach the cable end from the lever



7.4a Idle speed adjuster bolt (arrowed) -TDM models



7.4b Idle speed adjuster bolt (arrowed) -TRX models

7 Carburettors - removal and installation

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

Removal

1 Remove the fuel tank and the air filter housing (see Sections 2 and 4).

2 Slacken the choke outer cable bracket screw and free the cable from the bracket on the front of the carburettors, then detach the inner cable nipple from the choke linkage lever (see illustrations).

3 Detach the throttle cables from the carburettors (see Section 11, Steps 2 and 3).

If access is too restricted, detach them after the carburettors have been lifted off the cylinder head intakes.

4 On TDM and TRX models, unscrew the bolt securing the idle speed adjuster and feed it through to the base of the carburettors (see illustrations).

5 Release the clamp securing the drain hose to the bottom of each float chamber and detach the hoses (see illustration). Also release the clamp securing the fuel supply hose to the carburettors and detach the hose (see illustration); be careful to catch the small gauze filter fitted in the fuel supply hose union as the hose is detached (except 1999 TDM models).

6 On 1996-on TDM models and TRX models, disconnect the wiring connector from the throttle position sensor on the left-hand end of the carburettors (see illustration). Also



7.5a Detach the drain hoses (arrowed)...



7.5b ... and the fuel hose



7.6 Disconnect the throttle position sensor wiring connector (arrowed)

4*8 Fuel and exhaust systems



7.7a Slacken the upper or lower clamp screws as required (arrows)...



7.7b ... and remove the carburetors

clamp the two warmer system coolant hoses to prevent loss of coolant and disconnect the hose from the side of each carburettor.

7 Fully slacken the clamps on the cylinder head intake rubbers, then ease the carburetors off the intakes and remove them (see illustrations). To remove the carburetors with the rubbers, slacken the lower clamp bolts (which are more accessible). To leave the rubbers on the cylinder head, slacken the upper clamp bolts. **Note:** Keep the carburetors level to prevent fuel spillage from the float chambers and the possibility of the piston diaphragms being damaged.

Caution: Stuff clean rag into each cylinder head intake after removing the carburetors to prevent anything from falling in.

8 Place a suitable container below the float chambers, then slacken the drain screw on each chamber in turn and drain all the fuel from the carburetors (see illustration). Tighten the drain screws securely once all the fuel has been drained.

9 If necessary, slacken the clamps securing the intake rubbers and remove them, noting which way up and round they fit.

Installation

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

- a) Check for cracks or splits in the cylinder head intake rubbers, and renew them if necessary.
- b) Make sure the carburetors are fully engaged with the intake rubbers and the clamps are securely tightened.
- c) Make sure all hoses are correctly routed and secured and not trapped or kinked.
- d) Refer to Section 11 for installation of the throttle cables. Check the operation of the cables and adjust them as necessary (see Chapter 1).
- e) Refer to Section 12 for details of choke cable reconnection.
- f) Check idle speed and carburettor synchronisation and adjust as necessary (see Chapter 1).

disassembly, **1**

Carburetors cleaning and inspection

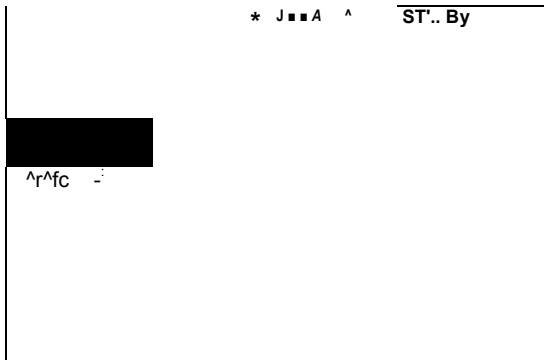
A Warning: Refer to the precautions given in Section 1 before starting work.

1991 to 1998 TDM models, all TRX and XTZ models

Disassembly

1 Remove the carburetors from the machine as described in the previous Section. **Note:** Do not separate the carburetors unless absolutely necessary; each carburettor can be dismantled sufficiently for all normal cleaning and adjustments while in place on the mounting brackets. Dismantle the carburetors separately to avoid interchanging parts.

2 Unscrew and remove the top cover retaining screws (see illustration). Lift off the cover and remove the spring from inside the piston, noting the spring seat fitted in the



7.8 Float chamber drain screw (arrowed)



8.2 Remove the screws (arrowed) and lift off the cover



8.3 Remove the air passage O-ring



8.4 Lift out the diaphragm/piston assembly

bottom of the spring (see illustrations 10.12b and a).

3 Remove the air passage O-ring and discard it as a new one should be used (see illustration).

4 Carefully peel the diaphragm away from its sealing groove in the carburettor and withdraw the diaphragm and piston assembly (see illustration).

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

5 Push the jet needle up from the bottom of the piston and withdraw it from the top, along

with the washer (see illustration). If the E-clip is removed from the needle, note which notch it is fitted into.

6 Remove the screws securing the float chamber to the base of the carburettor and remove the float chamber, noting how it fits (see illustration). Remove the rubber gasket and discard it as a new one must be used.

7 Carefully prise the float assembly out of the carburettor body, noting how it fits (see illustration). Remove the O-ring and discard it as a new one must be used. If required, withdraw the float pivot pin and remove the float and needle valve, then unhook the

needle valve from the tab on the float, noting how it fits (see illustration).

8 Unscrew and remove the starter jet, then remove the main jet holder, noting how it fits (see illustration). Remove the main jet - it is a push fit. Discard the O-ring as a new one should be used.

9 Unscrew and remove the pilot jet (see illustration 8.8).

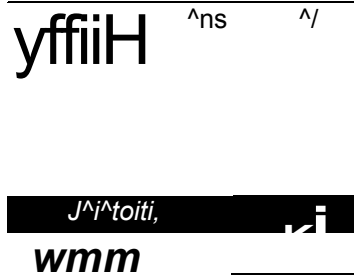
10 Unscrew the bolt securing the jet housing and remove the collar (see illustration). Remove the jet housing and discard its rubber gasket as a new one should be used. Push on the needle jet and withdraw the piston guide



8.5 Remove the jet needle and its washer



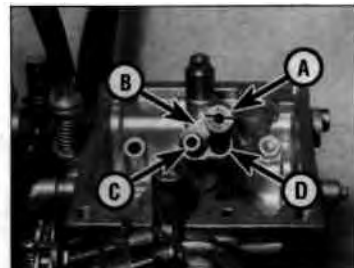
8.7a Carefully prise out the float assembly



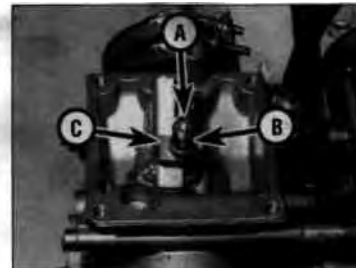
8.6 Remove the screws (arrowed) and lift off the float chamber



8.7b Withdraw the pivot pin and separate the float, needle valve and seat



8.8 Starter jet (A), main jet holder (B), main jet (C), pilot jet (D)



8.10a Unscrew the bolt (A), remove the collar (B), and lift off the jet housing (C)

Chapter 5

Ignition system

Contents

General information	1	Neutral switch - check and replacement	see Chapter 9
Ignitor unit - check, removal and installation	5	Pick-up coil - check and replacement	4
Ignition (main) switch - check, removal and installation	see Chapter 9	Sidestand switch - check and replacement	see Chapter 9
Ignition HT coils - check, removal and installation	3	Spark plugs - gap check and replacement	see Chapter 1
Ignition system - check	2	Throttle position sensor (1996-on TDM and TRX) - check, adjustment and replacement	7
Ignition timing - general information and check	6		

Degrees of difficulty

Easy , suitable for novice with little experience	Fairly easy , suitable for beginner with some experience JS	Fairly difficult , suitable for competent DIY mechanic IJS	Difficult , suitable for experienced DIY mechanic >Q	Very difficult , suitable for expert DIY or professional 2^
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Specifications

General information

Cylinder numbering	
Left	1
Right	2
Spark plugs	see Chapter 1

Ignition timing

At idle	10° BTDC
Full advance	
1991 to 1995 TDM models	42° BTDC @ 5000 rpm
XTZ models	43° BTDC @ 6000 rpm
1996-on TDM models and TRX models	not available

Pick-up coil

Resistance	
1991 to 1995 TDM models and XTZ models	184 to 276 ohms @ 20°C
1996-on TDM models and TRX models	192 to 288 ohms @ 20°C

Ignition HT coils

Primary winding resistance	
1991 to 1995 TDM models and all XTZ models	2.38 to 3.22 ohms @ 20°C
1996-on TDM models and all TRX models	3.10 to 4.60 ohms @ 20°C
Secondary winding resistance (without plug cap)	
1991 to 1995 TDM models and all XTZ models	12.0 to 18.0 K-ohms @ 20°C
1996-on TDM models and all TRX models	10.4 to 15.6 K-ohms @ 20°C
Spark plug cap resistance	10 K-ohms @ 20°C
Minimum spark gap (see Section 2)	6 mm

5*2 Ignition system

1 General information

All models are fitted with a fully transistorised electronic ignition system, which due to its lack of mechanical parts is totally maintenance free. The system comprises a rotor, pick-up coil, ignitor unit and ignition HT coil(s) (refer to the wiring diagrams at the end of Chapter 9 for details). All TRX models and 1996-on TDM models are fitted with two HT coils, while all other models have one coil supplying both cylinders. The TRX models and 1996-on TDM models are also fitted with a throttle position sensor.

The ignitor triggers, which are on the alternator rotor on the left-hand end of the crankshaft, magnetically operate the pick-up coil as the crankshaft rotates. The pick-up coil sends a signal to the ignitor unit which then supplies the ignition HT coil(s) with the power necessary to produce a spark at the plugs. The ignitor incorporates an electronic advance system controlled by signals generated by the ignition triggers and the pick-up coil.

The ignitor is linked to the clutch and sidestand cut-off switches. This safety circuit prevents the bike being started in gear unless the clutch lever is pulled in, and prevents the bike being ridden with the sidestand down.

Because of their nature, the individual ignition system components can be checked but not repaired. If ignition system troubles occur, and the faulty component can be isolated, the only cure for the problem is to renew the part. 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.

Note that there is no provision for adjusting the ignition timing on these models.

2 Ignition system - check

A **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 either 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 As no means of adjustment is available, any failure of the system can be traced to failure of a system component or a simple wiring fault. Of the two possibilities, the latter is by far the most likely. In the event of failure, check the system in a logical fashion, as described below.

2 Disconnect the HT leads from the spark plugs. Connect each lead to a spare spark plug and lay each plug on the engine with the threads contacting the engine (see illustration). If necessary, hold each spark plug with an insulated tool.

A **Warning: Do not remove the sparkplugs from the engine to perform this check - atomised fuel being pumped out of an open spark plug hole could ignite, causing severe injury!**

3 Having observed the above precautions, 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 each plug electrode. If the spark appears thin or yellowish, or is non-

existent, further investigation **will be** necessary. Before proceeding further, turn the ignition OFF.

4 The ignition system must be able to produce a spark which is capable of jumping a particular size gap. A healthy system should produce a spark capable of jumping at least 6 mm. A simple testing tool can be made to 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.

rem
TSP



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 a spark plug cap or bare HT lead end can be connected to its end. Make sure the gap between the two nail ends is the same as specified.

5 Connect one of the spark plug HT leads 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. On 1996-on TDM models and TRX models,



2.2 Earth the spark plug and operate the starter - bright blue sparks should be visible



2.5 Connect the tester as shown - when the starter is operated sparks should jump between the nails



3.4a Ignition coil - 1991 to 1995 TDM models



3.4b Ignition coil - TRX models



3.4c Ignition coil - XTZ models

repeat the test for the other coil. 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 will be necessary. 6 Ignition faults can be divided into two categories, namely those where the ignition system has failed completely, and those which are due to a partial failure. 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 9).

- b) Faulty HT lead or spark plug cap, faulty sparkplug, dirty, worn or corroded plug electrodes, or incorrect gap between electrodes.
 c) Faulty ignition (main) switch or engine kill switch (see Chapter 9).
 d) Faulty neutral, clutch or sidestand switch, and on XTZ models, diode (see Chapter 9).
 e) Faulty pick-up coil or damaged rotor triggers.
 f) Faulty ignition HT coils).
 g) Faulty ignitor unit.

7 If the above checks don't reveal the cause of the problem, have the ignition system tested by a Yamaha dealer equipped with diagnostic testing equipment.

3 Ignition HT coils - check, removal and installation

Check

1 The ignition HT coil(s) can be checked visually (for cracks and other damage) and the primary and secondary coil resistance can be measured with a multimeter. If the coil is undamaged, and if the resistance readings are as specified at the beginning of the Chapter, it is probably capable of proper operation, although note that sometimes a fault is only evident when the coil is under load and the engine running at high speed.

2 Remove the left-hand side cover (XTZ models) or the seat (all other models) (see Chapter 8).

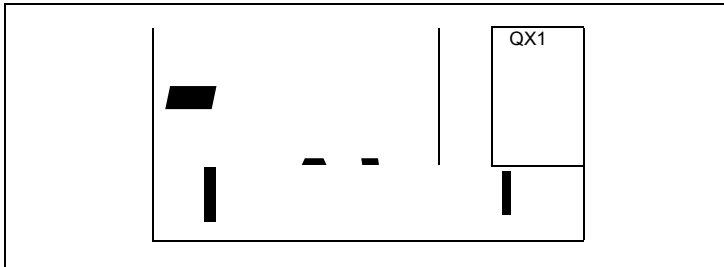
3 Disconnect the battery negative (-ve) lead.

4 On TDM and TRX models, the coil(s) is/are mounted on the inside of the frame behind the steering head - remove the fuel tank and the air filter housing for access (see Chapter 4) (see illustrations). On XTZ models, the coil is mounted underneath the rear of the fuel tank - remove the tank for access (see Chapter 4) (see illustration).

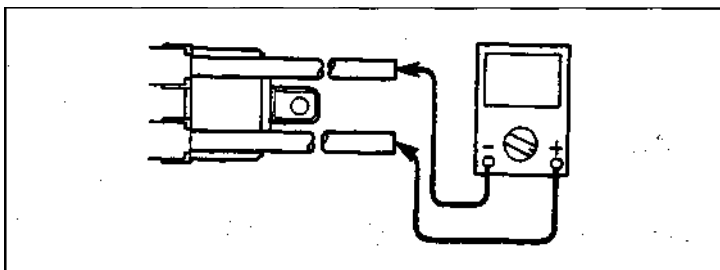
5 Disconnect the primary circuit electrical connectors from the coil and the HT leads from the spark plugs. Mark the locations of all wires and leads before disconnecting them.

6 Set the meter to the ohms x 1 scale and measure the resistance between the primary circuit terminals on the coil (see illustration). This will give a resistance reading of the primary windings of the coil and should be consistent with the value given in the Specifications at the beginning of the Chapter.

7 To check the condition of the secondary windings, unscrew the spark plug caps from the HT leads and set the meter to the K ohm scale. On 1991 to 1995 TDM models and XTZ models, connect one meter probe to one HT lead end and the other probe to the other HT lead end (see illustration). On 1996-on TDM models and TRX models, connect the positive (+ve) meter probe to the HT lead end and the negative (-ve) probe to the red/black wire

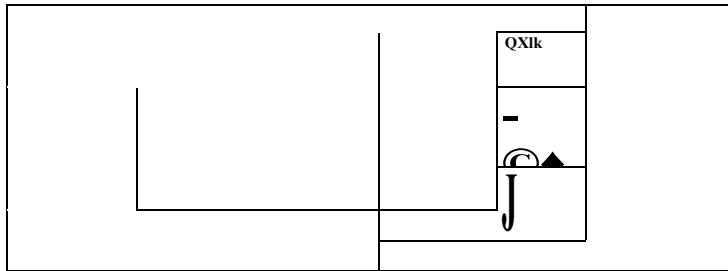


3.6 To test the coil primary resistance, connect the multimeter leads between the primary circuit terminals on the coil



3.7a Coil secondary resistance test -1991 to 1995 TDM and all XTZ models

5*4 Ignition system



3.7b Coil secondary resistance test - 1996-on TDM and all TRX models



3.8 Measure the resistance of the spark plug cap

primary circuit terminal (see illustration). If the reading obtained is not within the range shown in the Specifications, it is likely that the coil is defective.

8 If the reading is as specified, measure the resistance of the spark plug cap by connecting the meter probes between the HT lead socket in the cap and the spark plug contact in the cap (see illustration). If the reading obtained is not as specified, renew the spark plug caps.

9 Should any of the above checks not produce the expected result, have your findings confirmed by a Yamaha dealer. If the coil is confirmed to be faulty, it must be renewed; the coil is a sealed unit and cannot therefore be repaired.

Removal

10 Remove the left-hand side cover (XT2 models) or the seat (all other models) (see Chapter 8). Disconnect the battery negative (-ve) lead.

11 On TDM and TRX models, the coil/s is/are mounted on the inside of the frame behind the steering head - remove the fuel tank and the air filter housing for access (see Chapter 4) (see illustrations 3.4a and b). On XTZ models, the coil is mounted underneath the rear of the fuel tank - remove the tank for access (see Chapter 4) (see illustration 3.4c).

12 Disconnect the primary circuit electrical connectors from the coil and disconnect the HT lead(s) from the spark plug(s). Mark the

locations of all wires and leads before disconnecting them.

13 Unscrew the two bolts or screws securing each coil, noting any spacers, and on TRX models the earth wire secured by one of the screws, and remove the coils (see illustrations 3.4a, b and c). Note the routing of the HT leads.

Installation

14 Installation is the reverse of removal. Make sure the wiring connectors and HT leads are securely connected.

Pick-up coil - check and replacement

Check

1 On TDM and TRX models remove the seat, and on XTZ models remove the left-hand side cover (see Chapter 8). Disconnect the battery negative (-ve) lead.

2 On TRX models, remove the side covers (see Chapter 8).

3 Trace the pick-up coil/alternator wiring from the top of the alternator cover and disconnect it at the connector with the white/green and white/red (early TDM models) or green/white and blue/yellow (all other models) wires (see illustrations). Using a multimeter set to the ohms x 100 scale, measure the resistance between the terminals on the pick-up coil side of the connector.

4 Compare the reading obtained with that given in the Specifications at the beginning of this Chapter. The pick-up coil must be renewed if the reading obtained differs greatly from that given, particularly if the meter indicates a short circuit (no measurable resistance) or an open circuit (infinite, or very high resistance).

5 If the pick-up coil is thought to be faulty, first check that this is not due to a damaged or broken wire from the coil to the connector; pinched or broken wires can usually be repaired.

Replacement

6 The pick-up coil is wired integrally with the alternator stator, which means that the stator must be removed and renewed along with the coil if the coil is faulty. However it is worth checking with a Yamaha dealer to see if the coil can be obtained separately and wired into the loom to avoid the extra expense of paying for a stator as well.

7 Refer to Chapter 9 for details of alternator stator/pick-up coil assembly removal.

5 Ignitor unit - check, removal and installation

Check

1 If the tests shown in the preceding or following Sections have failed to isolate the



4.3a Pick-up coil wiring connector (arrowed) - TOM models



4.3b Pick-up coil wiring connector (arrowed) - TRX models



4.3c Pick-up coil wiring connector (arrowed) - XTZ models

Ignition system 5»5



5.3a Ignitor unit - TDM and TRX models



5.3b Ignitor unit - XTZ models



5.4 Disconnect the wiring connectors (arrowed)

cause of an ignition fault, it is possible that the ignitor unit itself is faulty. No test details are available with which the unit can be tested on home workshop equipment. Take the machine to a Yamaha dealer for testing.

Removal

2 On TDM and TRX models remove the seat, and on XTZ models remove the left-hand side cover and right-hand fairing side panel (see Chapter 8). Disconnect the battery negative (-ve) lead.

3 On TDM and TRX models the ignitor is mounted under the seat, and on XTZ models it is mounted in the fairing (see illustrations).

4 Disconnect the wiring connectors from the ignitor unit (see illustration).

5 Remove the screws securing the ignitor unit and remove the unit.

Installation

6 Installation is the reverse of removal. Make sure the wiring connectors are correctly and securely connected.

6 Ignition timing - general information and check

General information

1 Since no provision exists for adjusting the ignition timing and since no component is subject to mechanical wear, there is no need for regular checks; only if investigating a fault such as a loss of power or a misfire, should the ignition timing be checked.

2 The ignition timing is checked dynamically (engine running) using a stroboscopic lamp. The inexpensive neon lamps should be adequate in theory, but in practice may produce a pulse of such low intensity that the timing mark remains indistinct. If possible, one of the more precise xenon tube lamps should be used, powered by an external source of the appropriate voltage.

Note: Do not use the machine's own battery as an incorrect reading may result from stray impulses within the machine's electrical system.

Check

3 Warm the engine up to normal operating temperature then stop it.

4 Unscrew the timing inspection plug from the alternator cover (see illustration). Discard the cover O-ring as a new one must be used.

5 The timing mark on the alternator rotor which indicates the firing point at idle speed for the no. 1 cylinder is a 'I' mark. The static timing mark with which this should align is the notch in the threads for the inspection plug on the alternator cover (see illustration).

6 Connect the timing light to the no. 1 cylinder HT lead as described in the manufacturer's instructions.

[JfJJJM] The timing marks can be "highlighted with white paint

HIUT to make them more visible under the stroboscope light.

7 Start the engine and aim the light at the static timing mark.

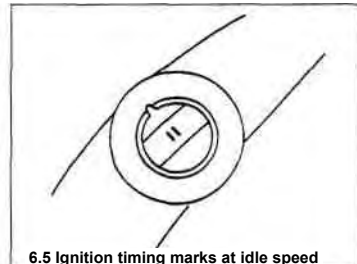
8 With the machine idling at the specified speed, the static timing mark should lie between the two vertical lines 'I'.

9 Slowly increase the engine speed whilst observing the 'I' mark. The mark should move clockwise, increasing in relation to the engine speed until it reaches full advance (no identification mark).

10 As already stated, there is no means of adjustment of the ignition timing on these machines. If the ignition timing is incorrect, or suspected of being incorrect, one of the



6.4 Unscrew the timing inspection plug (arrowed)



6.5 Ignition timing marks at idle speed

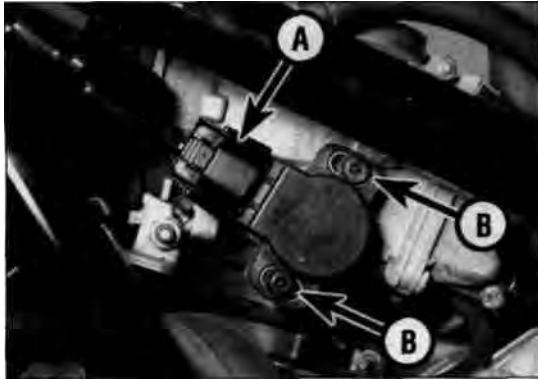
ignition system components is at fault, and the system must be tested as described in the preceding Sections of this Chapter. 11 When the check is complete, install the timing inspection plug using a new O-ring and tighten it securely.

7 Throttle position sensor (1996- % on TDM and TRX)- check, < adjustment and replacement S*

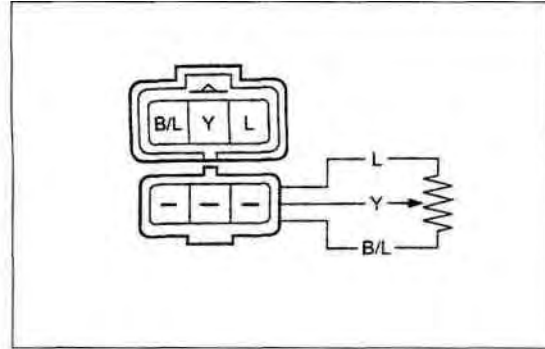
1 The throttle position sensor is located on the side of the left-hand carburettor and is keyed to the end of the throttle operating shaft. The sensor provides the ignitor unit with information relating to throttle opening and the ignitor is thus able to set the ignition timing accordingly to produce the best running conditions and cleaner exhaust emissions. Not surprisingly it is essential that the throttle position sensor should be set up correctly. Do not tamper with the sensor's position unless it has been disturbed during carburettor overhaul or poor running problems have been experienced.

2 When the engine is running, the throttle position sensor performs its own self-diagnosis in the event of failure or faulty wiring. When this diagnosis occurs, the tachometer will be seen to display zero rpm for 3 seconds, then 3000 rpm for 2.5 seconds, then the actual engine speed for 3 seconds, whereupon it will repeat the cycle until the engine is switched off.

5*6 Ignition system



7.3 Throttle position sensor wiring connector (A) and mounting screws (B)



7.4 Throttle position sensor wiring connector terminals

Bit Black and blue
Y Yellow

L Blue
B/L

Check

3 Remove the fuel tank and the air filter housing (see Chapter 4). The throttle sensor is mounted on the outside of the left-hand carburettor (see illustration).

4 Make sure that the ignition is OFF, then disconnect the throttle sensor's wire connector. Using a multimeter set on the K-ohms range, measure the resistance between the blue and black/blue wire terminals on the throttle sensor half of the connector; 3.5 to 6.5 K-ohms should be shown (see illustration). Now measure the resistance between the yellow and black/blue wire terminals on the same half of the connector; whilst rotating the throttle grip slowly the resistance should vary between 0 to 5 K-ohms \pm 1.5 K-ohm. If either test does not produce the correct readings the throttle sensor should be renewed.

5 If the fault cannot be traced to the throttle sensor, check all three wires between the ignitor and throttle sensor for continuity. Check for continuity between one end to the

other on each wire. If no continuity is indicated, this is probably due to a damaged or broken wire between the connectors; pinched or broken wires can usually be repaired. If the wiring and connectors are good, check the adjustment of the sensor as described below.

6 If the sensor is suspected of being faulty, take it to a Yamaha dealer for further testing. If it is confirmed to be faulty, it must be renewed; the sensor is a sealed unit and cannot therefore be repaired. If the sensor is good, have the ignitor checked by the dealer.

Adjustment

7 Before adjusting the sensor, check the idle speed and carburettor synchronisation (see Chapter 1).

8 Turn the ignition switch ON, then disconnect and reconnect the sensor wiring connector. This sets the ignitor unit to sensor adjustment mode.

9 Slacken the sensor mounting screws and rotate the sensor until the tachometer needle

reads 4000 rpm. If the tachometer reads either 1000 rpm or 8000 rpm, the angle of the sensor is either too narrow or too wide. Adjust it as required until the reading is 4000 rpm, then tighten the screws.

10 To come out of the adjustment mode, start the engine or simply turn the ignition switch OFF.

Replacement

11 Remove the carburettors (see Chapter 4).

12 The throttle sensor is mounted on the outside of the left-hand carburettor (see illustration 7.3). Disconnect the wiring connector, then unscrew the sensor mounting screws and remove the sensor, noting how it fits. Retrieve the seal from behind the sensor as it is withdrawn. On TRX models and 1991 to 1998 TDM models the sensor mounts on a plate which is itself secured to the carburettor body by two screws.

13 Install the sensor and lightly tighten the screws. After installing the carburettors follow the adjustment procedure above to set the correct sensor position.

Chapter 6

Frame, suspension and final drive

Contents

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Degrees of difficulty

Easy, suitable for
novice with little
experience

fe *

Fairly easy, suitable for
beginner with some
experience gS

Fairly difficult,
suitable for competent
DIY mechanic

■ I

JJS

Difficult, suitable for
experienced DIY
mechanic

Very difficult,
suitable for expert DIY
or professional

5

2^

Specifications

Front forks

Fork oil type	
1996-on TDM models	Suspension oil 01
All other models	10W fork oil
Fork oil capacity	
1991 to 1995 TDM models	395 cc
1996-on TDM models	515 cc
TRX models	483 cc
XT2 models	669 cc
Fork oil level*	
1991 to 1995 TDM models	151 mm
1996-on TDM models, TRX models and XTZ models	130 mm
Fork spring free length 1991 to 1995 TDM models	
Standard	427 mm
Service limit	406 mm
1996-on TDM models	
Standard	505 mm
Service limit	500 mm
TRX models	
Standard	385 mm
Service limit	381 mm
XTZ models	
Standard	544.5 mm
Service limit	517 mm
Fork tube runout limit	0.2 mm

*Oil level is measured from the top of the tube with the fork spring removed and the leg fully compressed.

6*2 Frame, suspension and final drive

Rear suspension

Shock absorber spring free length TDM

models	
Main spring	144 mm
Sub spring	69 mm
TRX models	220.5 mm
XTZ models	240 mm
Swingarm - XTZ models	
Side clearance	0.4 to 0.7 mm
Bearing spacer length (right-hand)	90.95 to 91.10 mm
Bearing spacer length (left-hand)	80.95 to 81.10 mm
Washer thickness	1.9 to 2.0 mm

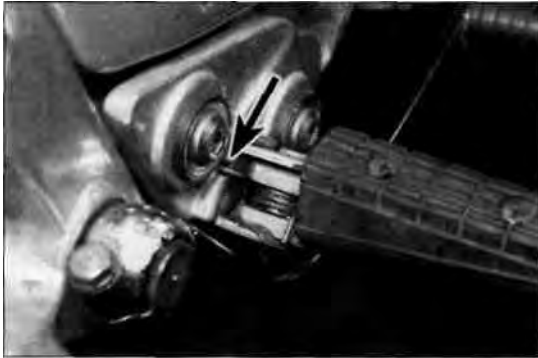
Final drive chain

Chain size	
TDM and TRX models	525
XTZ model	520
No. of links	
TDM model	114
TRX model	110
XTZ model	112
Chain freeplay and lubricant	see Chapter 1
Chain stretch limit (10-link length)	
1991 to 1995 TDM models	150 mm
1996-on TDM models	159 mm
TRX models	155 mm
XTZ models	150 mm

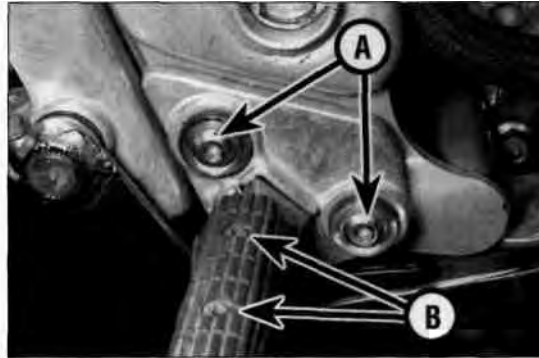
Torque settings

Footrest bracket bolts - TDM and TRX models	30 Nm
Footrest bracket bolts - XTZ models	
Front	45 Nm
Rear	20 Nm
Brake pedal pivot bolt - TRX models	35 Nm
Handlebar holder clamp bolts - TDM models	23 Nm
Handlebar holder clamp bolts - XTZ models	20 Nm
Handlebar retaining bolt - TRX models	23 Nm
Handlebar holder positioning bolt - TRX models	10 Nm
Handlebar holder clamp bolt - TRX models	17 Nm
Fork clamp bolts	
TDM and XTZ models	23 Nm
TRX models	
Top yoke	23 Nm
Bottom yoke	30 Nm
Fork top bolt	
TDM models	24 Nm
TRX and XTZ models	23 Nm
Fork damper rod bolt - TDM and TRX models	30 Nm
Fork damper rod bolt - XTZ models	62 Nm
Steering stem nut	
1991 to 1995 TDM models	110 Nm
1996-on TDM models	108 Nm
TRX models	110 Nm
Steering stem bolt (XTZ models)	80 Nm
Rear shock absorber mounting bolt nuts - TDM models	64 Nm
Rear shock absorber mounting bolt nuts - TRX models	40 Nm
Rear shock absorber mounting bolt nuts - XTZ models	35 Nm
Suspension linkage bolt nuts - TRX models	48 Nm
Suspension linkage bolt nuts - XTZ models	59 Nm
Swingarm pivot bolt nut	
TDM and XTZ models	90 Nm
TRX models	125 Nm
Rear brake torque arm nuts - TRX models	30 Nm
Front sprocket nut	70 Nm
Rear sprocket nuts	
TDM and TRX models	60 Nm
XTZ models	55 Nm
Gearchange linkage arm pinch bolt	12 Nm
Outer sprocket cover bolts	5 Nm

Frame, suspension and final drive 6x3



3.1a Note how the spring end (arrowed) locates



3.1b Footrest bracket bolts (A), footrest rubber screws (B)

1 General information

TDM models use a twin spar box-section aluminium frame which uses the engine as a stressed member.

TRX models use a trellis-type steel tube frame which uses the engine as a stressed member.

XTZ models use a cradle-type steel frame.

Front suspension is by a pair of oil-damped telescopic forks. On XTZ models, the forks have a conventional damper system, while TDM and TRX models have a cartridge damper. On TDM and TRX models the forks are adjustable for pre-load and rebound damping.

At the rear, an aluminium swingarm acts on a single shock absorber, on TRX and XTZ models via a three-way linkage. The shock absorber is adjustable for spring pre-load on all models, for rebound damping on TDM models, and for both rebound and compression damping on TRX models. On TRX models, the shock absorber has a remote reservoir.

The drive to the rear wheel is by chain.

2 Frame - inspection and repair

1 The frame should not require attention unless accident damage has occurred. In most cases, frame renewal is the only satisfactory remedy for such damage. A few frame specialists have the jigs and other equipment necessary for straightening the frame to the required standard of accuracy, but even then there is no simple way of assessing to what extent the frame may have been over stressed.

2 After the machine has accumulated a lot of miles, the frame should be examined closely

for signs of cracking or splitting at the welded joints. Loose engine mount bolts can cause ovaling or fracturing of the mounting tabs. Minor damage can often be repaired by welding, depending on the extent and nature of the damage. This is, however, a job for a frame specialist, especially where an aluminium frame is concerned. 3 Remember that a frame which is out of alignment will cause handling problems. If misalignment is suspected as the result of an accident, it will be necessary to strip the machine completely so the frame can be thoroughly checked.

Footrests, brake pedal and gearchange lever - removal and installation

Footrests

Removal - front footrests

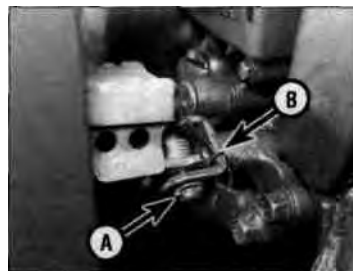
1 On TDM models, remove the rubber cap from the back of the footrest bracket, then unscrew the nut and separate the footrest from the bracket, noting how the return spring end locates in the bracket (**see illustration**). For easier access to the nut, first unscrew the

two bolts securing the bracket and remove it (**see illustration**). The footrest rubber can be renewed by removing the two screws that secure it to the footrest.

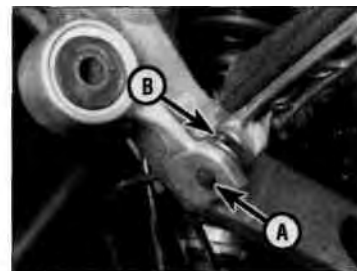
2 On TRX models, unscrew the nut from the back of the footrest bracket and separate the peg from the bracket. The footrest rubber can be renewed by removing the two screws that secure it to the footrest. For easier access to the nut, first remove the brake pedal or gearchange lever (**see below**), then unscrew the bolts securing the footrest bracket and displace it.

3 On XTZ models, remove the split pin and washer (where fitted) from the bottom of the footrest pivot pin, then withdraw the pivot pin and remove the footrest (**see illustration**). Note the fitting of the return spring. The footrest rubber can be renewed by removing the two bolts that secure it to the peg. **Removal - rear footrests**

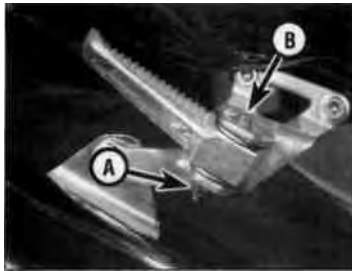
4 On 1991 to 1995 TDM models, remove the split pin from the bottom of the footrest pivot pin, then withdraw the pivot pin and remove the footrest (**see illustration**). Note the fitting of the detent plate, ball and spring, and take care that they do not spring out when removing the footrest. Also note the collar for the pivot pin. The footrest rubber can be



3.3 Remove the split pin (A) and withdraw the pivot pin, noting how the spring ends locate (B)



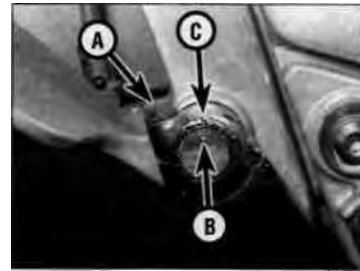
3.4 Remove the split pin (A) and withdraw the pivot pin, noting how the detent plate and ball fit (B)



3.6 Unscrew the nut (A) and withdraw the bolt (B)



3.7 Remove the split pin (arrowed) and withdraw the pivot pin



3.9a Remove the pinch bolt (A) and slide the pedal off the shaft. Note the alignment of the punch mark (B) with the notch (C)

renewed by removing the two screws that secure it to the footrest.

5 On 1996-on TDM models, unscrew the nut from the bottom of the footrest pivot bolt, then withdraw the bolt and remove the footrest. Note the fitting of the detent plates, ball and spring, and take care that they do not spring out when removing the footrest. Also note the collar for the pivot bolt. The footrest rubber can be renewed by removing the two screws that secure it to the footrest.

6 On TRX models, unscrew the nut from the bottom of the footrest pivot bolt, then withdraw the bolt and remove the footrest. Note the fitting of the detent plates, ball and spring, and take care that they do not spring out when removing the footrest (see illustration). Also note the collar for the pivot bolt.

7 On XTZ models, remove the split pin and washer (where fitted) from the bottom of the footrest pivot pin, then withdraw the pivot pin and remove the footrest (see illustration). The footrest rubber can be renewed by removing the washer and drawing the rubber off the footrest. If it is stuck fast, slit it with a sharp knife.

Installation

8 Installation is the reverse of removal. On TDM and TRX models, if removed, tighten the front footrest bracket bolts to the torque setting specified at the beginning of the chapter.

Brake pedal

Removal

9 On TDM models, note the alignment of the notch in the top of the pedal with the punch mark on the shaft, then unscrew and remove the pinchbolt and slide the arm off the shaft (see illustration). If required, unhook the brake pedal return spring and the brake light switch spring from the bracket on the inside of the pedal shaft, then remove the split pin from the clevis pin securing the master cylinder pushrod to the bracket (see illustration). Remove the clevis pin and separate the pushrod from the bracket, then draw the shaft assembly out of the frame.

10 On TRX models, unhook the brake pedal return spring and the brake light switch spring from the bracket on the pedal. Remove the split pin from the clevis pin securing the brake pedal to the master cylinder pushrod (see illustration). Remove the clevis pin and separate the pushrod from the pedal. Unscrew the pedal pivot bolt and remove the pedal. If required, remove the screw securing the spring bracket to the inside of the pedal and remove the bracket.

11 On XTZ models, unhook the brake pedal return spring and the brake light switch spring from the bracket on the pedal. Remove the split pin from the clevis pin securing the brake

pedal to the master cylinder pushrod. Remove the clevis pin and separate the pushrod from the pedal. Remove the split pin holding the pedal pivot in the frame and remove the pedal. Discard the split pin as a new one must be used.

Installation

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

- a) Apply molybdenum disulphide grease to the brake pedal pivot, or on TDM models, the unsplined section of the shaft.
- b) On TRX models, tighten the pedal pivot bolt securely.
- c) Use a new split pin on the clevis pin securing the brake pedal to the master cylinder pushrod, and on XTZ models on the brake pedal pivot.
- d) Check the operation of the rear brake light switch (see Chapter 1).

Gearchange lever

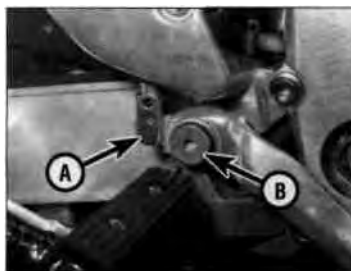
Removal

13 On TDM and XTZ models, unscrew the bolts securing the outer front sprocket cover and remove the cover (see illustration).

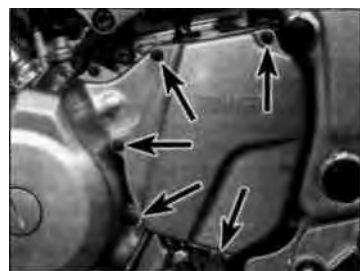
14 To remove the lever on its own, slacken the gearchange lever linkage rod locknuts, then unscrew the rod and separate it from the



3.9b Unhook the springs and separate the pushrod from the bracket (arrowed)



3.10 Unhook the springs at the back, then remove the clevis pin (A) and unscrew the pivot bolt (B)



3.13 Sprocket cover bolts (arrowed)

3.14a Slacken the locknuts (arrowed) and thread the rod out of the lever and arm

lever and the arm (the rod is reverse-threaded on one end and so will simultaneously unscrew from both lever and arm when turned in the one direction) (see illustration). Note the how far the rod is threaded into the lever and arm as this determines the height of the lever relative to the footrest. Unscrew the pivot bolt and remove the lever, noting the arrangement of the washers (see illustrations).

15 To remove the lever with the linkage rod and arm as an assembly, first note the alignment of the punch mark on the gearchange shaft with the slit in the linkage arm, then unscrew the linkage arm pinchbolt and slide the arm off the shaft (see illustrations). Now unscrew the lever pivot bolt and remove the lever and linkage assembly, noting how it fits (see illustrations 3.14b and c).

Installation

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

- a) Apply molybdenum disulphide oil to the gear lever pivot
- b) Align the punch mark on the shaft with the slit in the clamp as noted on removal (see illustrations 3.1 Sa and bj).
- c) Tighten the gearchange lever pivot bolt securely.
- d) Adjust the gear lever height as required by screwing the rod in or out of the lever and arm. Tighten the locknuts securely (see illustration 3.14a).



4.2 Sidestand pivot bolt (arrowed) - TDM models

3.14b Unscrew the pivot bolt.



3.15a Linkage arm/shaft alignment -TDM models

3.14c . and remove the lever, noting the washers



3.15b Linkage arm/shaft alignment -TRX models

4 Sidestand - removal and installation

1

- 1 Support the bike using an auxiliary stand.
- 2 On TDM and XTZ models, unhook the stand springs, then counter-hold the pivot bolt and unscrew the nut on the inside of the bracket (see illustration). Withdraw the pivot bolt and remove the stand, noting how it locates against the sidestand switch plunger.
- 3 On TRX models, unhook the stand springs, then unscrew the retaining bolt (see illustration). Slide the stand off its pivot, noting how it fits. If required, counter-hold the pivot piece and unscrew the nut

4.3 Sidestand retaining bolt (arrowed) ■



TRX models

securing it in the bracket, then withdraw the pivot.

4 On installation apply grease to the pivot and a suitable non-permanent thread locking compound to the bolt threads. Tighten the nut/bolt securely. Reconnect the sidestand spring and check that it holds the stand securely up when not in use - an accident is almost certain to occur if the stand extends while the machine is in motion.

5 Check the operation of the sidestand switch (see Chapter 1).

Handlebars and levers - removal and installation

Handlebars

Removal

Note: The handlebars can be displaced from the top yoke without having to remove any of the lever or switch assemblies. On TRX models, the handlebars can be removed from the handlebar holders which clamp around the top of the forks, leaving the holders in place.

1 Displace the front brake master cylinder and reservoir (see Chapter 7). There is no need to disconnect the hydraulic hose. Keep the reservoir upright to prevent possible fluid leakage and make sure no strain is placed on the hydraulic hose(s).

2 Displace the throttle cable housing from the handlebars (see Chapter 4). There is no need

6*6 Frame, suspension and final drive



5.3 Clutch switch wiring connector (arrowed) - TDM models



5.5a On TDM models, remove the blanking caps



5.5b Handlebar clamp bolts (arrowed) - TDM models

to detach the cables from the carburetors.

3 Either remove the clutch lever (see below), or detach the clutch cable from the lever (see Chapter 2). Disconnect the clutch switch wiring connector (see Chapter 9) (**see illustration**).

4 Displace the handlebar switches (see Chapter 9). There is no need to disconnect the wiring connectors.

5 On TDM models, lever out the handlebar holder clamp bolt blanking caps (**see illustration**). On TDM and XTZ models, unscrew the handlebar holder clamp bolts and remove the handlebars, noting how the choke knob fits, where appropriate (**see illustrations**).

6 On TRX models, to remove the handlebar

and leave the holder in place, remove the blanking cap from the inner end of the handlebar, then unscrew the retaining bolt and slide the bar out of the holder, noting how it locates (**see illustration**). 7 On TRX models, to remove the handlebar and holder together, remove the blanking cap from the holder positioning bolt, then unscrew the bolt (**see illustration**). Slacken the handlebar holder clamp bolt, then ease the handlebar holder up and off the fork. **Installation**

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

a) On TDM models, align the mark on the front of the handlebars with the mating

surfaces of the holder (**see illustration**).

Make sure the handlebars are centrally positioned. Install the holder clamp with the arrow pointing up, then tighten the front clamp bolt first, followed by the rear bolt, to the torque setting specified at the beginning of the Chapter (**see illustrations**).

b) On XTZ models, make sure the handlebars are centrally positioned. Install the holder clamp with the punch mark pointing forward, then tighten the front clamp bolt first, followed by the rear bolt, to the torque setting specified at the beginning of the Chapter.

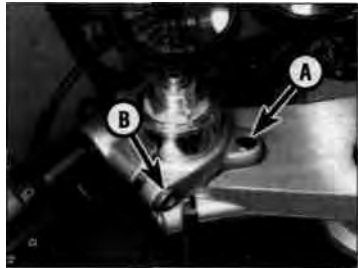
c) On TRX models, if separated, make sure the flat on the inner end of the handlebar



5.5c Handlebar clamp bolts - XTZ models



5.6 Remove the cap to access the bolt



5.7 Remove the cap and unscrew the positioning bolt (A), then slacken the clamp bolt (B)



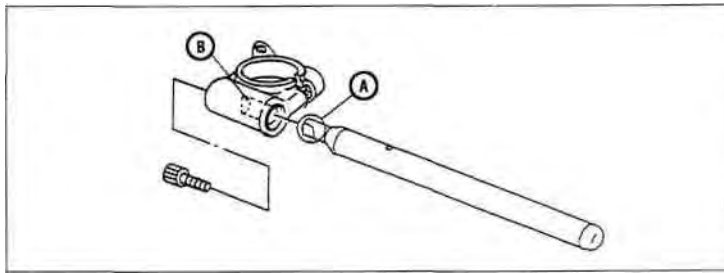
5.8a Align the mark (arrowed) with the clamp mating surfaces



5.8b Fit the clamps with the arrow pointing up...



5.8c ... and tighten the bolts as described to the specified torque



5.8d Ensure that the flat (A) aligns with the cut-out (B)

aligns correctly with the corresponding cut-out in the holder (see illustration). Tighten the retaining bolts, positioning bolts and clamp bolts to the torque settings specified at the beginning of the Chapter. Tighten the positioning bolt before the clamp bolt.

d) Refer to the relevant Chapters as directed for the installation of the handlebar mounted assemblies

e) Do not forget to reconnect the front brake light switch and clutch switch wiring connectors.

Clutch lever

9 On XTZ models, remove the hand guard (see illustration).

10 Slacken the clutch cable adjuster locking and thread the adjuster fully into the bracket to provide maximum freeplay in the cable (see illustration). Unscrew the lever pivot bolt locknut, then withdraw the pivot bolt and remove the lever, detaching the cable nipple via the slots in the adjuster and locking. On TRX models, note the collar for the pivot bolt.

11 Installation is the reverse of removal. Apply grease to the pivot bolt shaft, or on TRX models to the collar, and the contact areas between the lever and its bracket, and to the clutch cable nipple. Adjust the clutch cable freeplay (see Chapter 1).

Front brake lever

12 On XTZ models, remove the hand guard (see illustration 5.9).

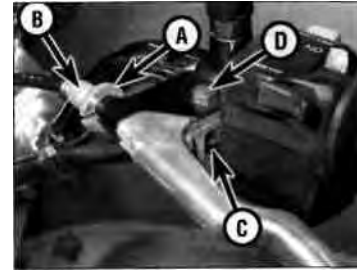
13 On TDM models, remove the cap from the end of the master cylinder pushrod in the lever, then remove the E-clip, the nut, the spring and the plate (see illustration).

14 Unscrew the lever pivot bolt locknut, then withdraw the pivot bolt and remove the lever (see illustration).

15 Installation is the reverse of removal. Apply grease to the pivot bolt shaft and the contact areas between the lever and its bracket. On TDM models, locate the master cylinder pushrod through the pivot in the lever, and install the plate, the spring, the nut, the E-clip and the cap.



5.9 Handguard retaining screw - XTZ models



5.10 Slacken the locking (A) and turn the adjuster (B) fully in, then unscrew the nut (C) and withdraw the pivot bolt (D) to free the lever

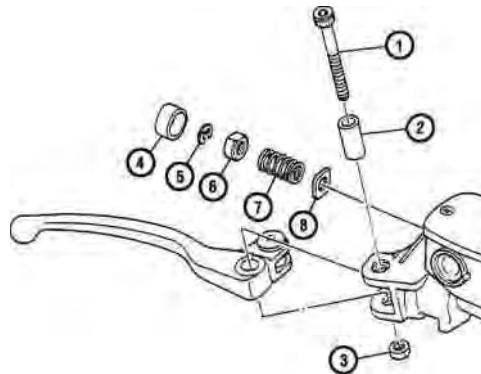
Forks - removal and installation

Removal

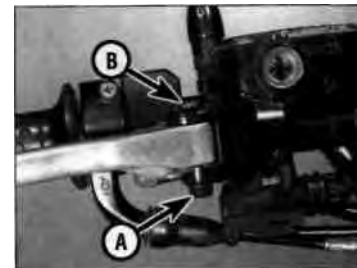
Caution: Although not strictly necessary, before removing the forks it is recommended that the fairing panels and/or fairing are removed (see Chapter 8). This will prevent accidental damage to the paintwork.

- 1 Remove the front wheel (see Chapter 7).
- 2 Remove the front mudguard (see Chapter 8).

- 1 Pivot bolt
- 2 Collar
- 3 Nut
- 4 Cap
- 5 E-clip
- 6 Nut
- 7 Spring
- 8 Plate



5.13 Brake lever components - TDM models

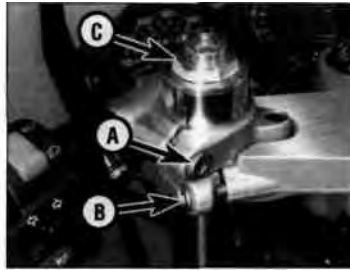


5.14 Unscrew the nut (A) and withdraw the bolt (B)

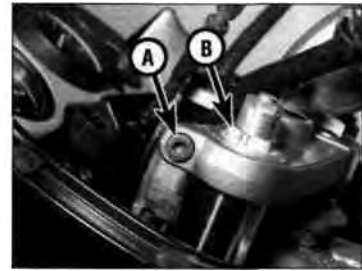
6*8 Frame, suspension and final drive



6.3 Brake hose clamp bolt (arrowed)



6.4 Handlebar holder clamp bolt (A), fork clamp bolt (B), fork top bolt (C)



6.5 Slacken the fork clamp bolt (A), and if required the fork top bolt (B)

3 Unscrew the brake hose clamp bolt from each fork slider (**see illustration**). If not already done, displace the front brake calipers (see Chapter 7). There is no need to disconnect the hydraulic hoses. Release the speedometer cable from any guides, and loosen any cable ties around the top of the fork tubes.

4 On TRX models, slacken the handlebar holder clamp bolts (**see illustration**).

5 Slacken the fork clamp bolts in the top yoke

(**see illustration**). If the forks are to be disassembled, or if the fork oil is being changed, it is advisable to slacken the fork top bolts at this stage.

6 Note the alignment or amount of protrusion of the tops of the fork tubes with the top yoke. Slacken but do not remove the fork clamp bolts in the bottom yoke, and remove the forks by twisting them and pulling them downwards (**see illustrations**).

sides. On TDM and XTZ models, the tops of the tubes should be flush with the top of the top yoke. On TRX models, the top of the fork tube should protrude 18.5 mm above the top of the handlebar holder.

8 Tighten the fork clamp bolts in the bottom yoke to the torque setting specified at the beginning of the Chapter (**see illustration 6.6a**). If the fork legs have been dismantled or if the fork oil has been changed, the fork top bolts should now be tightened to the specified torque setting. Now tighten the fork clamp bolts in the top yoke, and on TRX models the handlebar holder clamp bolts, to the specified torque settings (**see illustration and 6.4**).

9 Install the front wheel (see Chapter 7), the front mudguard (see Chapter 8), and the brake calipers (see Chapter 7). Fit the brake hose clamps onto the mudguard (**see illustration 6.3**). On all models except the 1999 TDM, make sure the speedometer cable is routed through its guide(s). On 1999 TDM models make sure that the speedometer sensor lead is well secured by its ties.

10 Check the operation of the front forks and brakes before taking the machine out on the road.



6.6a Slacken the bottom yoke fork clamp bolts (arrowed)...



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

Installation

7 Remove all traces of corrosion from the fork tubes and the yokes. Slide the forks up through the bottom yoke, then install the wiring ties where appropriate onto the forks (**see illustration 6.6b**). Slide the forks up into the top yoke. Check that the amount of protrusion of the fork tube above the top yoke is as noted on removal and equal on both

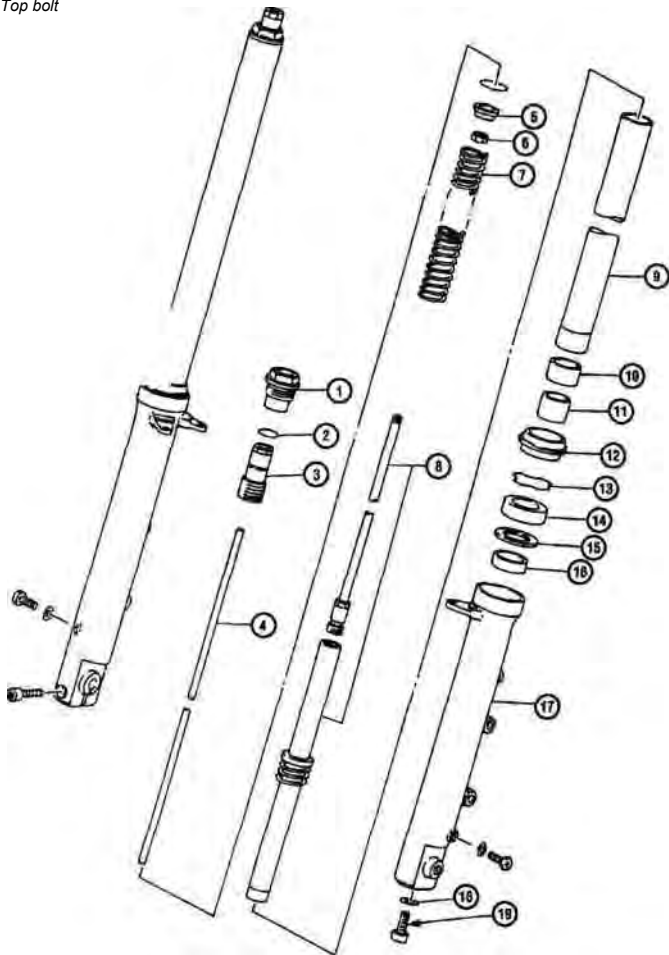


6.6b ... and remove the forks



6.8 Tighten the various clamp bolts to their specified torque settings

7 Top bolt



- 2 O-ring
- 3 Pre-load adjuster
- 4 Damping adjuster rod
- 5 Spring seat
- 6 Locknut
- 7 Spring
- 8 Damper
- 9 Fork tube
- 1 Bottom bush
- 1 Damper rod seat
- 1 Dust seal
- 1 Retaining clip
- 1 Oil seal
- 7 Washer
- 7 Top bush i
- 1 Fork slider 1
- 1 Sealing washer
- 1 Damper rod bolt J^_

7.1 Front fork components -1991 to 1995 TDM models

7 Forks - disassembly, inspection and reassembly j^ X

1991 to 1995 TDM models

Disassembly

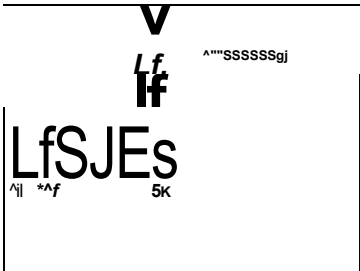
- 1 Always dismantle the fork legs separately to avoid interchanging parts and thus causing an accelerated rate of wear. Store all components in separate, clearly marked containers (see illustration).
- 2 Before dismantling the fork, it is advised that the damper rod bolt be slackened at this stage. Compress the fork tube in the slider so that the spring exerts maximum pressure on the damper rod head, then have an assistant slacken the damper rod bolt in the base of the fork slider (see illustration).
- 3 If the fork top bolt was not slackened with the fork in situ, carefully clamp the fork tube in a vice equipped with soft jaws, taking care not to overtighten or score its surface, and slacken the top bolt.
- 4 Unscrew the fork top bolt from the top of the fork tube (see illustration). The bolt can remain threaded on the pre-load adjuster, but remove it by holding the adjuster and unscrewing it if required (see illustration).
- 5 Carefully clamp the fork slider in a vice and slide the fork tube down into the slider a little way (wrap a rag around the top of the tube to minimise oil spillage) while, with the aid of an assistant if necessary, keeping the damper rod fully extended. Counter-hold the pre-load adjuster and thread the locknut to the base of its threads (see illustration). Now counter-



7.4a Unscrew the top bolt from the fork tube...



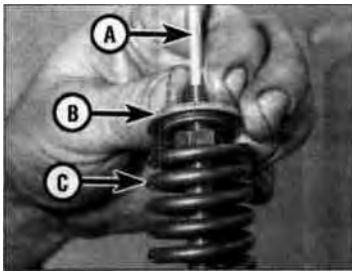
7.4b ... and thread it off the adjuster if required



7.5 Remove the pre-load adjuster as described

7.2 Slacken the damper rod Allen bolt

6»10 Frame, suspension and final drive



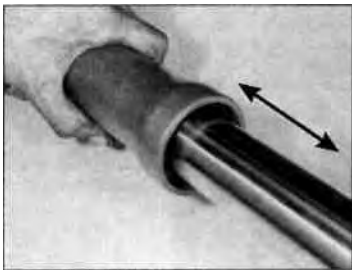
7.6 Withdraw the damping adjuster rod (A), then remove the spring seat (B) and withdraw the spring (C)

hold the locknut and thread the pre-load adjuster (with the top bolt if not removed) off the damper rod.

6 Remove the damping adjuster rod from the centre of the damper rod, then remove the spring seat and withdraw the spring from the tube, noting which way up it fits (see illustration).

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

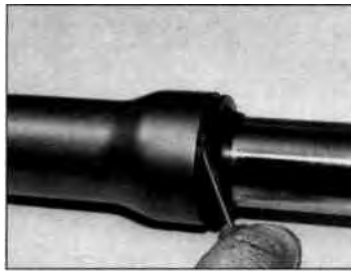
8 Remove the previously slackened damper rod bolt and its copper sealing washer from the bottom of the slider. Discard the sealing washer as a new one must be used on



7.12 To separate the inner and outer fork tubes, pull them apart firmly several times - the slide-hammer effect will pull the tubes apart



7.13 The oil seal (1), washer (2), top bush (3) and bottom bush (4) will come out with the fork tube



7.10 Prise out the dust seal using a flat-bladed screwdriver

reassemble. If the damper rod bolt was not slackened before dismantling the fork, use the Yamaha service tool (90890-01447) to prevent the damper rod from turning. This tool is passed down through the fork tube and engages the damper rod head; a similar tool can be easily made in the home workshop.

9 Invert the fork and withdraw the damper rod from inside the fork tube (see illustration 7.20a).

10 Carefully prise out the dust seal from the top of the slider to gain access to the oil seal retaining clip (see illustration). Discard the dust seal as a new one must be used.

11 Carefully remove the retaining clip, taking care not to scratch the surface of the tube (see illustration).

12 To separate the tube from the slider it is necessary to displace the top bush and oil seal. The bottom bush should not pass through the top bush, and this can be used to good effect. Push the tube gently inwards until it stops against the damper rod seat. Take care not to do this forcibly or the seat may be damaged. Then pull the tube sharply outwards until the bottom bush strikes the top bush. Repeat this operation until the top bush and seal are tapped out of the slider (see illustration).

13 With the tube removed, slide off the oil seal, washer and top bush, noting which way up they fit (see illustration). Discard the oil seal as a new one must be used. **Caution: Do not remove the bottom bush from the tube unless it is to be renewed.**



7.11 Prise out the retaining clip using a flat-bladed screwdriver

14 Tip the damper rod seat out of the slider, noting which way up it fits.

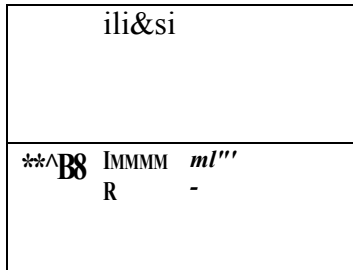
Inspection

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

16 Check the fork tube for runout (bending) using V-blocks and a dial gauge, or have it done by a dealer (see illustration). Yamaha do not specify a runout limit, but if the tube is bent it should be renewed.

17 Check the spring for cracks and other damage. Measure the spring free length and compare the measurement to the specifications at the beginning of the Chapter. If it is defective or sagged below the service limit, renew the springs in both forks. Never renew only one spring. Also check the rebound spring on the damper.

18 Examine the working surfaces of the two bushes; if worn or scuffed they must be renewed. To remove the bottom bush from the fork tube, prise it apart at the slit using a flat-bladed screwdriver and slide it off (see illustration). Make sure the new one seats properly.



7.16 Check the fork tube for runout using V-blocks and a dial gauge



7.18 Prise off the bottom bush using a flat-bladed screwdriver



7.20a Slide the damper into the tube..



7.20b . and fit the seat onto its bottom end



7.21 Apply a thread locking compound to the damper rod bolt and use a new sealing washer

19 Check the damper rod assembly for damage and wear, and renew it if necessary. Holding the outside of the damper, pump the rod in and out of the damper. If the rod does not move smoothly in the damper it must be renewed.

Reassembly

20 Insert the damper rod into the fork tube and slide it into place so that it projects fully from the bottom of the tube, then install the seat on the bottom of the damper rod, making sure the projection in the base of the seat locates with the flat on the bottom of the damper (see illustrations).

21 Oil the fork tube and bottom bush with the specified fork oil and insert the assembly into the slider. Fit a new copper sealing washer to the damper rod bolt and apply a few drops of a suitable non-permanent thread locking compound, then install the bolt into the bottom of the slider (see illustration). Tighten the bolt to the specified torque setting. If the damper rod rotates inside the tube, wait until the fork is fully reassembled before tightening the bolt.

22 Push the fork tube fully into the slider, then oil the top bush and slide it down over the tube (see illustration). Press the bush squarely into its recess in the slider as far as possible, then install the oil seal washer with its flat side facing up (see illustration). Either use the Yamaha service tool or a

suitable piece of tubing to tap the bush fully into place; the tubing must be slightly larger in diameter than the fork tube and slightly smaller in diameter than the bush recess in the slider. Take care not to scratch the fork tube during this operation; it is best to make sure that the fork tube is pushed fully into the slider so that any accidental scratching is confined to the area above the oil seal.

23 When the bush is seated fully and squarely in its recess in the slider, (remove the washer to check, wipe the recess clean, then reinstall the washer), install the new oil seal. Smear the seal's lips with fork oil and slide it over the tube so that its markings face upwards and drive the seal into place as

HINT Place the old oil seal on top of the new one to protect it when driving the seal into place.

described above until the retaining clip groove is visible above the seal (see illustration).

24 Once the seal is correctly seated, fit the retaining clip, making sure it is correctly located in its groove (see illustration).

25 Lubricate the lips of the new dust seal then slide it down the fork tube and press it into position (see illustration).

26 Slowly pour in the specified quantity of the specified grade of fork oil and pump the fork and damper rod at least ten times each to



7.22a Install the top bush ...



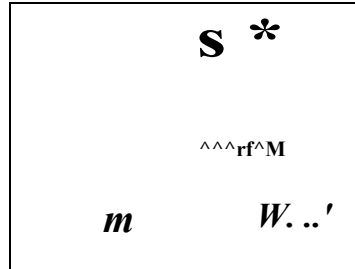
7.22b ... followed by the washer



7.23 Make sure the oil seal is the correct way up



7.24 Install the retaining clip...

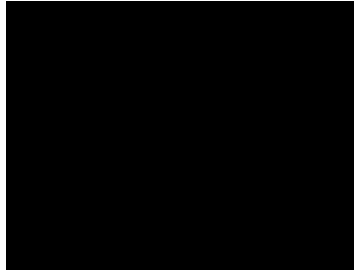


7.25 ... followed by the dust seal

6»12 Frame, suspension and final drive



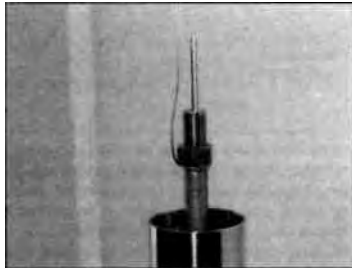
7.26a Pour the oil into the top of the tube



7.26b Measure the oil level with the fork held vertical



7.27a Insert the damping adjuster rod



7.27b Tie a piece of wire around the base of the locknut to keep the damper rod extended...

distribute it evenly (see illustration); wait ten minutes then measure the oil level and adjust as necessary by adding or subtracting oil. Fully compress the fork tube and damper rod into the slider and measure the fork oil level from the top of the tube (see illustration). Add or subtract fork oil until it is at the level specified at the beginning of the Chapter. 27 Fit the damping adjuster rod into the damper rod (see illustration). It is advisable to tie a piece of wire around the locknut so that it can be used to hold the damper rod out when installing the spring - otherwise the rod



7.27c ... and install the spring

will settle down into the fork and will be inaccessible with the spring installed (see illustration). Clamp the slider in a vice via the brake caliper mounting lugs, taking care not to overtighten and damage them. Pull the fork tube and damper rod out of the slider as far as possible then install the spring with its closer-wound coils at the top (see illustration). Fit the spring seat, with its shouldered side fitting down into the top of the spring (see illustration 7.6). 28 Fit a new O-ring onto the fork top bolt. Thread the pre-load adjuster (with the top bolt

if it wasn't removed) onto the damper rod as far as it will go, then counter-hold it and tighten the locknut securely against it (see illustration and 7.5). If it was removed, thread the top bolt onto the pre-load adjuster (see illustration 7.4b).

29 Withdraw the tube fully from the slider and carefully screw the top bolt into the fork tube making sure it is not cross-threaded (see illustration). **Note:** The top bolt can be tightened to the specified torque setting at this stage if the tube is held between the padded jaws of a vice, but do not risk distorting the tube by doing so. A better method is to tighten the top bolt when the fork leg has been installed and is securely held in the triple clamps.

This makes it unnecessary to remove the tool from the bolt whilst threading it in Use a ratchet-type tool when installing the fork top bolt.

Tip

making it easier to maintain a downward pressure on the spring.

If the damper rod Allen bolt requires tightening, clamp the fork slider between the padded jaws of a vice and have an assistant compress the tube into the slider so that



7.28 Thread the pre-load adjuster onto the damper rod and tighten the locknut against it



7.29 Thread the top bolt into the fork tube

maximum spring pressure is placed on the damper rod head - tighten the damper Allen bolt to the specified torque setting (see illustration 7.2).

30 Install the forks (see Section 6). Set the spring pre-load adjuster as required (see Section 12).

1996-on TDM models and TRX models

Disassembly

31 Always dismantle the fork legs separately to avoid interchanging parts and thus causing an accelerated rate of wear. Store all components in separate, clearly marked containers (see illustration).

32 Before dismantling the fork, it is advised that the damper rod bolt be slackened at this stage. Compress the fork tube in the slider so that the spring exerts maximum pressure on the damper rod head, then have an assistant slacken the damper rod bolt in the base of the fork slider (see illustration 7.2).

33 If the fork top bolt was not slackened with the fork in situ, carefully clamp the fork tube in a vice equipped with soft jaws, taking care not to overtighten or score its surface, and slacken the top bolt (see illustration 7.4).

34 The fork top bolt comes as an assembly with the pre-load adjuster and damping adjuster rod. Unscrew the fork top bolt from the top of the fork tube and lift it out until the damping adjuster rod is clear.

35 Slide the fork tube down into the slider. On TDM models withdraw the spring seat and spring from the tube. On TRX models withdraw the washer, spacer, spring seat and the spring from the tube. Note which way up the spring is fitted.

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

37 Remove the previously slackened damper rod bolt and its copper sealing washer from the bottom of the slider. Discard the sealing washer as a new one must be used on reassembly. If the damper rod bolt was not slackened before dismantling the fork, use the Yamaha service tool (TDM models - pt. nos. 90890-01465 and 90890-01326, TRX models - pt. nos. 90890-01388 and 90890-01326) to prevent the damper rod from turning. This tool is passed down through the fork tube and engages the damper rod head; a similar tool can be easily made in the home workshop.

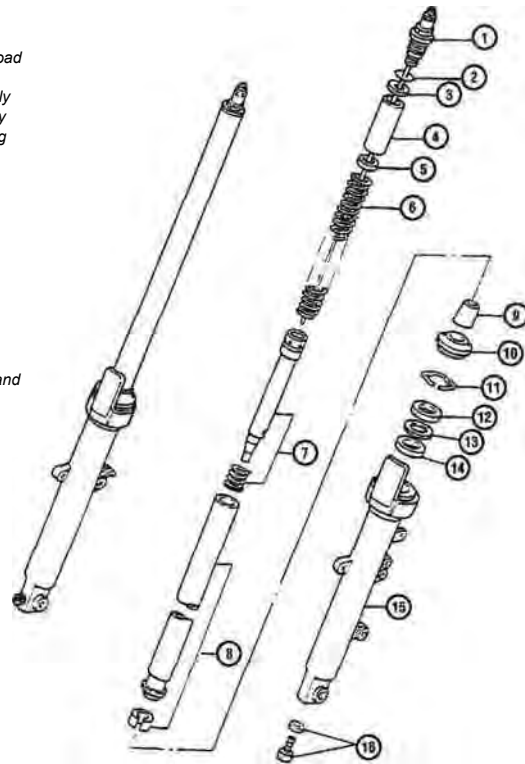
38 Invert the fork and withdraw the damper rod from inside the fork tube (see illustration). If required, slide the rebound spring off the damper rod.

39 Carefully prise out the dust seal from the top of the slider to gain access to the oil seal retaining clip (see illustration 7.10). Discard the dust seal as a new one must be used.

40 Carefully remove the retaining clip, taking care not to scratch the surface of the tube (see illustration 7.11).

41 To separate the tube from the slider it is

- 1 Top bolt and preload adjuster O-ring
- 2 Washer - TRX only
- 3 Spacer - TRX only
- 4 Spring seat
- 5 Spring
- 6 Damper rod and rebound spring
- 7 Fork tube and bottom bush
- 8 Damper rod seat
- 9 Dust seal
- 10 Retaining clip
- 11 Oil seal
- 12 Washer
- 13 Top bush
- 14 Slider
- 15 Damper rod bolt and sealing washer



7.31 Front fork components - 1996-on TDM models and TRX models

necessary to displace the top bush and oil seal. The Check the fork seal seat for nicks, gouges and bottom bush should not pass through the top bush, scratches. If damage is evident, leaks will occur. and this can be used to good effect. Push the tube Also check the oil seal washer for damage or gently inwards until it stops against the damper rod distortion and renew it if necessary. seat. Take care not to do this forcibly or the seat 45 Check the fork tube for runout (bending) using may be damaged. Then pull the tube sharply V-blocks and a dial gauge, or have it done by a outwards until the bottom bush strikes the top bush. dealer (see illustration 7.16). Yamaha do not Repeat this operation until the top bush and seal specify a runout limit, but if the tube is bent it are tapped out of the slider (see illustration 7.12). should be renewed.

42 With the tube removed, slide off the oil seal, washer and top bush, noting which way up they fit (see illustration 7.13). Discard the oil seal as a new one must be used. **Caution: Do not remove the bottom bush from the tube unless it is to be renewed.**

43 Tip the damper rod seat out of the slider, noting which way up it fits.

Inspection

44 Clean all parts in solvent and blow them dry with compressed air, if available. Check the fork tube for score marks, scratches, flaking of the chrome finish and excessive or abnormal wear. Look for dents in the tube and renew the tube in both forks if any are found.



7.38 Withdraw the damper rod and rebound spring from the tube

6»14 Frame, suspension and final drive

46 Check the spring for cracks and other damage. Measure the spring free length and compare the measurement to the specifications at the beginning of the Chapter. If it is defective or sagged below the service limit, renew the springs in both forks. Never renew only one spring. Also check the rebound spring on the damper.

47 Examine the working surfaces of the two bushes; if worn or scuffed they must be renewed. To remove the bottom bush from the fork tube, prise it apart at the slit using a flat-bladed screwdriver and slide it off (see illustration 7.18). Make sure the new one seats properly.

48 Check the damper rod for damage and wear, and renew it if necessary. **Reassembly**

49 If removed, slide the rebound spring onto the damper rod. Insert the damper rod into the fork tube and slide it into place so that it projects fully from the bottom of the tube, then fit the seal onto the bottom of the damper rod (see illustrations 7.38 and 7.20b).

50 Oil the fork tube and bottom bush with the specified fork oil and insert the assembly into the slider. Fit a new copper sealing washer to the damper rod bolt and apply a few drops of a suitable non-permanent thread locking compound, then install the bolt into the bottom of the slider (see illustration 7.21). Tighten the bolt to the specified torque setting. If the damper rod rotates inside the tube, use the tool described in Step 37 to hold the damper rod.

51 Push the fork tube fully into the slider, then oil the top bush and slide it down over the tube (see illustration 7.22a). Press the bush squarely into its recess in the slider as far as possible, then install the oil seal washer (see illustration 7.22b). Either use the Yamaha service tool or a suitable piece of tubing to tap the bush fully into place; the tubing must be slightly larger in diameter than the fork tube and slightly smaller in diameter than the bush recess in the slider. Take care not to scratch the fork tube during this operation; it is best to make sure that the fork tube is pushed fully into the slider so that any accidental scratching is confined to the area above the oil seal.

52 When the bush is seated fully and squarely in its recess in the slider, (remove the washer to check, wipe the recess clean, then reinstall the washer), install the new oil seal. Smear the seal's lips with lithium-based grease and slide it over the tube so that its markings face upwards and drive the seal into place as described above until the retaining clip groove is visible above the seal (see illustration 7.23).

nwrcra	Place the old oil seal on top
HilUT	of the new one to protect it when driving the seal into place.

53 Once the seal is correctly seated, fit the retaining clip, making sure it is correctly located in its groove (see illustration 7.24).

54 Lubricate the lips of the new dust seal then slide it down the fork tube and press it into position (see illustration 7.25).

55 Slowly pour in the specified quantity of the specified grade of fork oil and pump the fork at least ten times to distribute it evenly (see illustration 7.26a); the oil level should also be measured and adjustment made by adding or subtracting oil. Fully compress the fork tube into the slider and measure the fork oil level from the top of the tube (see illustration 7.26b). Add or subtract fork oil until it is at the level specified at the beginning of the Chapter.

56 Clamp the slider upright in a soft-jawed vice using the brake caliper mounting lugs, taking care not to overtighten and damage them. Pull the fork tube out of the slider as far as possible then install the spring and the spring seat. On TRX models fit the spacer and the washer.

57 Apply a smear of fork oil or grease to the new top bolt O-ring. Install the top bolt assembly, making sure the bottom of the damping adjuster rod locates correctly into the hole in the top of the damper rod, and thread the bolt into the top of the fork tube (see illustration 7.29).

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

Keep the fork tube fully extended whilst pressing on the spring. Screw the top bolt carefully into the fork tube making sure it is not cross-threaded.

Note: The top bolt can be tightened to the specified torque setting at this stage if the tube is held between the padded jaws of a vice, but do not risk distorting the tube by doing so. A better method is to tighten the top bolt when the fork has been installed in the bike and is securely held in the bottom yoke.

58 Install the forks (see Section 6).



XTZ models

Disassembly

59 Always dismantle the fork legs separately to avoid interchanging parts and thus causing an accelerated rate of wear. Store all components in separate, clearly marked containers (see illustration).

60 Slacken the clamps securing the fork gaiter and slide the gaiter off the top of the fork.

61 Before dismantling the fork, it is advised that the damper rod bolt be slackened at this stage. Compress the fork tube in the slider so that the spring exerts maximum pressure on the damper rod head, then have an assistant slacken the damper rod bolt in the base of the fork slider (see illustration 7.2). If an assistant is not available, clamp the brake caliper mounting lugs in a soft-jawed vice to support the fork.

62 If the fork top bolt was not slackened with the fork in situ, carefully clamp the fork tube in a vice equipped with soft jaws, taking care not to overtighten or score its surface, and slacken the top bolt.

63 Unscrew the fork top bolt from the top of the fork tube.

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

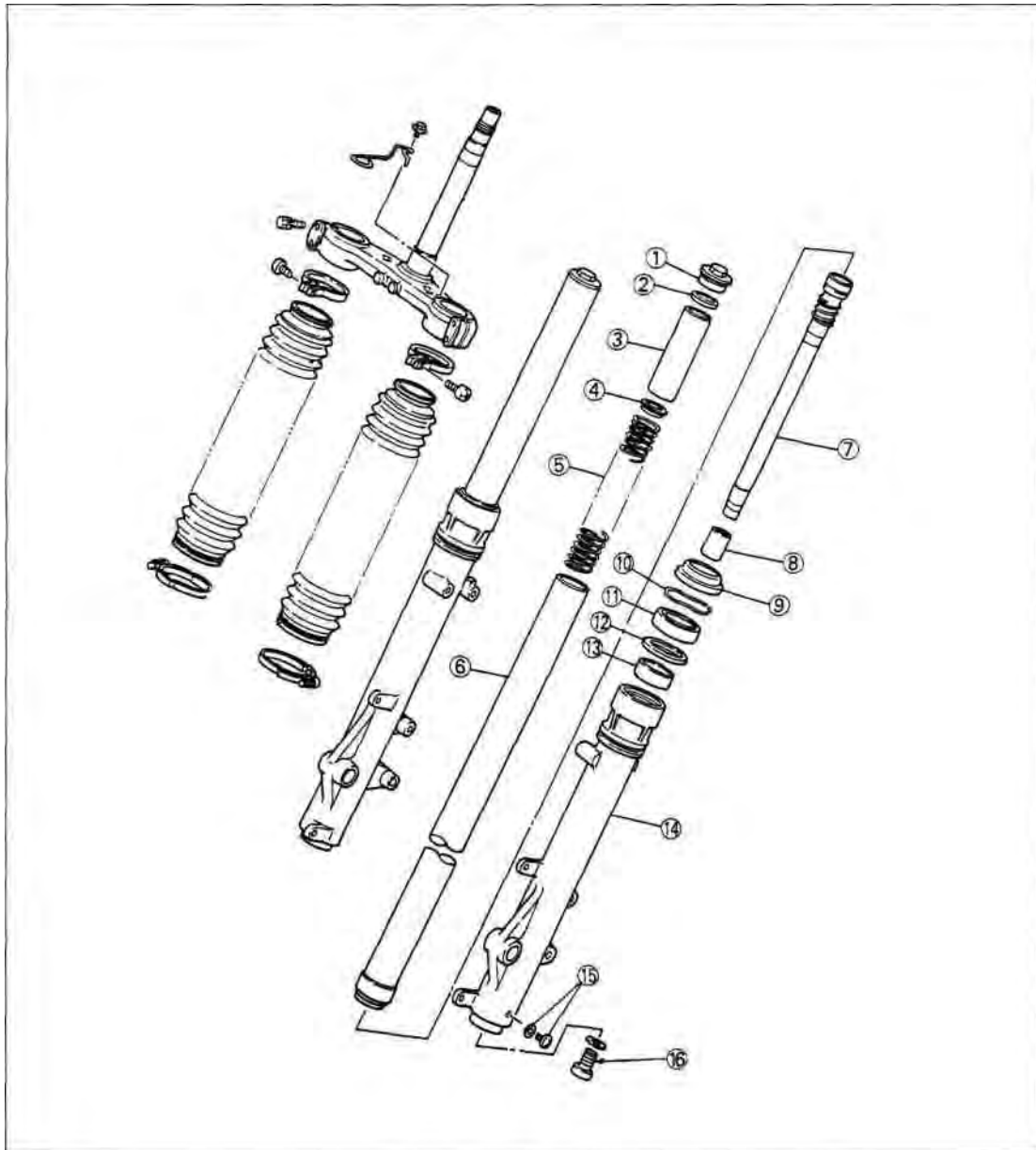
64 Slide the fork tube down into the slider and withdraw the spacer, spring seat and the spring from the tube. Note which way up the spring is fitted.

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

66 Remove the previously slackened damper rod bolt and its copper sealing washer from the bottom of the slider. Discard the sealing washer as a new one must be used on reassembly. If the damper rod bolt was not slackened before dismantling the fork, use the Yamaha service tool (pt. nos. 90890-01326 and 90890-01327) to prevent the damper rod from turning. This tool is passed down

Use a ratchet-type tool when installing the fork top bolt. This makes it unnecessary to remove the tool from the bolt whilst threading it in making it easier to maintain a downward pressure on the spring.

Frame, suspension and final drive 6*15



6

7.59 Front fork components - XTZ models

- | | | |
|-----------------------------|---------------------------------|---|
| 1 Top bolt | 7 Damper rod and rebound spring | 13 Top bush |
| 2 O-ring | 8 Damper rod seat | 14 Slider |
| 3 Spacer | 9 Dust seal | 15 Oil drain screw and sealing washer -
1989-94 models |
| 4 Spring seat | 10 Retaining clip | 16 Damper rod bolt and sealing washer |
| 5 Spring | 11 Oil seal | |
| 6 Fork tube and bottom bush | 12 Washer | |

6x16 Frame, suspension and final drive

through the fork tube and engages the damper rod head; a similar tool can be easily made in the home workshop.

67 Invert the fork and withdraw the damper rod from inside the fork tube (see illustration 7.38). If required, slide the rebound spring off the damper rod.

68 Carefully prise out the dust seal from the top of the slider to gain access to the oil seal retaining clip (see illustration 7.10). Discard the dust seal as a new one must be used.

69 Carefully remove the retaining clip, taking care not to scratch the surface of the tube (see illustration 7.11).

70 To separate the tube from the slider it is necessary to displace the top bush and oil seal. The bottom bush should not pass through the top bush, and this can be used to good effect. Push the tube gently inwards until it stops against the damper rod seat. Take care not to do this forcibly or the seat may be damaged. Then pull the tube sharply outwards until the bottom bush strikes the top bush. Repeat this operation until the top bush and seal are tapped out of the slider (see illustration 7.12).

71 With the tube removed, slide off the oil seal, washer and top bush, noting which way up they fit (see illustration 7.13). Discard the oil seal as a new one must be used. **Caution: Do not remove the bottom bush from the tube unless it is to be renewed.**

72 Tip the damper rod seat out of the slider, noting which way up it fits.

Inspection

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

74 Check the fork tube for runout (bending) using V-blocks and a dial gauge, or have it done by a dealer (see illustration 7.16). Yamaha do not specify a runout limit, but if the tube is bent it should be renewed.

75 Check the spring for cracks and other damage. Measure the spring free length and compare the measurement to the specifications at the beginning of the Chapter. If it is defective or sagged below the service limit, renew the springs in both forks. Never renew only one spring. Also check the rebound spring.

76 Examine the working surfaces of the two bushes; if worn or scuffed they must be renewed. To remove the bottom bush from the fork tube, prise it apart at the slit using a flat-bladed screwdriver and slide it off (see illustration 7.18). Make sure the new one seats properly.

77 Check the damper rod for damage and wear, and renew it if necessary.

Reassembly

78 If removed, slide the rebound spring onto the rod. Insert the damper rod into the fork tube and slide it into place so that it projects fully from the bottom of the tube, then fit the seat onto the bottom of the damper rod (see illustration 7.38 and 7.20b).

79 Oil the fork tube and bottom bush with the specified fork oil and insert the assembly into the slider. Fit a new copper sealing washer to the damper rod bolt and apply a few drops of a suitable non-permanent thread locking compound, then install the bolt into the bottom of the slider (see illustration 7.21). Tighten the bolt to the specified torque setting. If the damper rod rotates inside the tube, use the tool described in Step 66 to hold the damper rod.

80 Push the fork tube fully into the slider, then oil the top bush and slide it down over the tube (see illustration 7.22a). Press the bush squarely into its recess in the slider as far as possible, then install the oil seal washer (see illustration 7.22b). Either use the Yamaha service tool or a suitable piece of tubing to tap the bush fully into place; the tubing must be slightly larger in diameter than the fork tube and slightly smaller in diameter than the bush recess in the slider. Take care not to scratch the fork tube during this operation; it is best to make sure that the fork tube is pushed fully into the slider so that any accidental scratching is confined to the area above the oil seal.

81 When the bush is seated fully and squarely in its recess in the slider, (remove the washer to check, wipe the recess clean, then reinstall the washer), install the new oil seal. Smear the seal lips with lithium-base grease and slide it over the tube so that its markings face upwards and drive the seal into place as described above until the retaining clip groove is visible above the seal (see illustration 7.23).

Place the old oil seal on top

HINT of the new one to protect it when driving the seal into place.

82 Once the seal is correctly seated, fit the retaining clip, making sure it is correctly located in its groove (see illustration 7.24).

83 Lubricate the lips of the new dust seal then slide it down the fork tube and press it into position (see illustration 7.25).

84 Slowly pour in the specified quantity of the specified grade of fork oil and pump the fork at least ten times to distribute it evenly (see illustration 7.26a); the oil level should also be measured and adjustment made by adding or subtracting oil. Fully compress the fork tube into the slider and measure the fork oil level from the top of the tube (see illustration 7.26b). Add or subtract fork oil until it is at the level specified at the beginning of the Chapter.

85 Clamp the slider in a soft-jawed vice using the brake caliper mounting lugs, taking care not to overtighten and damage them. Pull the fork tube out of the slider as far as possible then install the spring, the spring seat, with its shouldered side fitting down into the top of the spring, and the spacer.

86 Apply a smear of grease to the new top bolt O-ring and thread the bolt into the top of the fork tube.

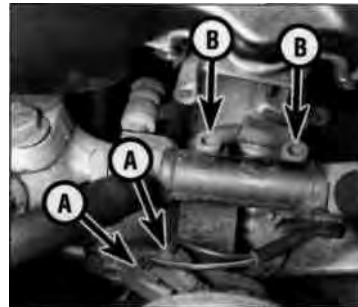
A **Warning: It will be necessary to compress the spring by pressing it down using the top bolt to engage the threads of the top bolt with the fork tube. This is a potentially dangerous operation and should be performed with care, using an assistant if necessary. Wipe off any excess oil before starting to prevent the possibility of slipping.** Keep the fork tube fully extended whilst pressing on the spring. Screw the top bolt carefully into the fork tube making sure it is not cross-threaded. **Note: The top bolt can be tightened to the specified torque setting at this stage if the tube is held between the padded jaws of a vice, but do not risk distorting the tube by doing so (see Tool Tip). A better method is to tighten the top bolt when the fork has been installed in the bike and is securely held in the bottom yoke.**

87 Install the forks (see Section 6).

8 Steering stem - removal and installation

Removal

- 1 Remove the front forks (see Section 6).
- 2 On TDM models, displace the handlebars from the top yoke (see Section 5), then disconnect the horn wiring connectors and unscrew the bolts securing the front brake hose/horn bracket to the bottom yoke (see illustration). On 1996-on models, unscrew the bolts securing the choke knob and the cable guide to the top yoke.



8.2 Disconnect the horn wiring connectors (A), then unscrew the bolts (B) and displace the brake hose union/horn assembly

Frame, suspension and final drive 6*17



8.3 Disconnect the horn wiring connectors, then unscrew the bolts (arrowed) and displace the brake hose/horn assembly



8.4a Free the cable and wiring from the guides (arrowed) on the top yoke ...

3 On TRX models, disconnect the horn wiring connectors and unscrew the bolts securing the front brake hose/horn bracket to the bottom yoke (see illustration).

4 On XTZ models, displace the handlebars from the top yoke (see Section 5). Slip the cables and wiring out of the guides on the top yoke, and unscrew the bolts securing the front brake hose and the cable guide to the bottom yoke (see illustrations).

5 Unscrew the steering stem nut or bolt and remove it along with its washer, where fitted (see illustration). Lift the top yoke off the steering stem and place it aside, making sure no strain is placed on the ignition switch wiring (see illustration). On TRX models the yoke should be supported so that the master cylinder reservoir remains upright and so that no strain is placed on the hydraulic hoses.

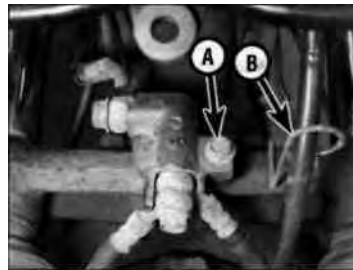
6 On TDM and TRX models, remove the tabbed lockwasher, noting how it fits, then unscrew and remove the locknut using either a C-spanner, a peg spanner or a drift located in one of the notches (see illustration). Remove the washer.

7 Supporting the bottom yoke, unscrew the adjuster nut using either a C-spanner, a peg-spanner or a drift located in one of the notches, then remove the adjuster nut and the bearing cover from the steering stem.

8 Gently lower the bottom yoke and steering stem out of the frame.

9 Remove the upper bearing from the top of the steering head. Remove all traces of old grease from the bearings and races and check them for wear or damage as described in Section 9. **Note:** Do not attempt to remove the outer races from the frame or the lower bearing from the steering stem unless they are to be renewed.

8.4b ... and displace the brake hose



union (A) and guide (B) from the bottom yoke by unscrewing the bolts



bolt...



8.5b ... and lift off the top yoke



8.6 Remove the lockwasher, then unscrew the locknut (arrowed)

6*18 Frame, suspension and final drive



8.12 Align the adjuster nut and locknut so that the lockwasher tabs fit into the notches in both



8.13 Tighten the steering stem nut or bolt to the specified torque

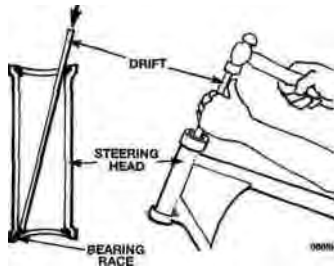
Installation

10 Smear a liberal quantity of lithium-based grease on the bearing races in the frame. Also work some grease well into both the upper and lower bearings.

11 Carefully lift the steering stem/bottom yoke up through the steering head. Fit the upper bearing into the top of the steering head, then install the bearing cover. Thread the adjuster nut onto the steering stem and adjust the bearings as described in Chapter 1.

12 On TDM and TRX models, install the washer and the locknut. On 1991 to 1995 TDM models the tapered side of the locknut must face down. Tighten the locknut finger-tight, then tighten it further until its notches align with those in the adjuster nut. If necessary, counter-hold the adjuster nut and tighten the locknut using a C-spanner or drift until the notches align, but make sure the adjuster nut does not turn as well. Install the tabbed lockwasher so that the tabs fit into the notches in both the locknut and adjuster nut (see illustration).

13 Fit the top yoke onto the steering stem (see illustration 8.5b), then install the washer (where fitted) and steering stem nut or bolt and tighten it finger-tight (see illustration 8.5a). Temporarily install one of the forks to



9.4 Drive the bearing outer races out with a drift as shown

align the top and bottom yokes, and secure it by tightening the bottom yoke clamp bolt only. Now tighten the steering stem nut or bolt to the torque settings specified at the beginning of the Chapter (see illustration).

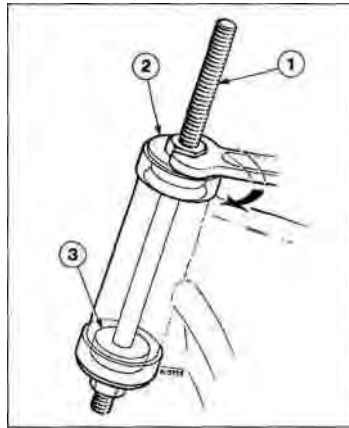
14 Install the remaining components in a reverse of the removal procedure.

15 Carry out a check of the steering head bearing freeplay as described in Chapter 1, and if necessary re-adjust.

9 Steering head bearings - inspection and replacement

Inspection

1 Remove the steering stem (see Section 8).



9.6 Drawbolt arrangement for fitting steering stem bearing outer races

- 1 Long bolt or threaded bar
- 2 Thick washer
- 3 Guide for lower race

2 Remove all traces of old grease from the bearings and races and check them for wear or damage.

3 The outer races should be polished and free from indentations. Inspect the bearing rollers for signs of wear, damage or discoloration, and examine the bearing roller retainer cage for signs of cracks or splits. Spin the bearings by hand. They should spin freely and smoothly. If there are any signs of wear on any of the above components both upper and lower bearing assemblies must be renewed as a set. Only remove the races if they need to be renewed - do not re-use them once they have been removed.

Replacement

4 The outer races are an interference fit in the steering head and can be tapped from position with a suitable drift (see illustration). Tap firmly and evenly around each race to ensure that it is driven out squarely. It may prove advantageous to curve the end of the drift slightly to improve access.

5 Alternatively, the races can be removed using a slide-hammer type bearing extractor; these can often be hired from tool shops.

6 The new outer races can be pressed into the head using a drawbolt arrangement (see illustration), or by using a large diameter tubular drift which bears only on the outer edge of the race. Ensure that the drawbolt washer or drift (as applicable) bears only on the outer edge of the race and does not contact the working surface. Alternatively, have the races installed by a Yamaha dealer equipped with the bearing race installing tools.

[tftftfgg] Installation of new bearing UWilifii outer races is made much

HiNT

easier if the races are left overnight in the freezer. This causes them to contract slightly making them a looser fit. Alternatively, use a freeze spray.



9.7a Remove the lower bearing and grease seal only if they are being renewed

7 The lower bearing should only be removed if a new one is being fitted (see illustration). To remove the lower bearing from the steering stem, use two screwdrivers placed on opposite sides of the race to work it free. If the bearing is firmly in place it will be necessary to use a bearing puller (see illustration), or in extreme circumstances to split the bearing's inner section using an angle grinder. Take the steering stem to a Yamaha dealer if required. Check the condition of the dust seal that fits under the lower bearing and renew it if it is worn, damaged or deteriorated. 8 Fit the new lower bearing onto the steering stem. A length of tubing with an internal diameter slightly larger than the steering stem will be needed to tap the new bearing into position (see illustration). Ensure that the drift bears only on the inner edge of the bearing and does not contact the rollers. 9 Install the steering stem (see Section 8).

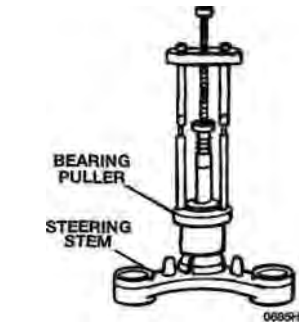
10 Rear shock absorber - removal, inspection and installation

A *Warning: Do not attempt to disassemble this shock absorber. It is nitrogen-charged under high pressure. Improper disassembly could result in serious injury. Instead, take the shock to a Yamaha dealer or suspension specialist with the proper equipment to do the job.*

Removal

TDM models

- 1 Place the machine on an auxiliary stand. Position a support under the rear wheel so that it does not drop when the shock absorber is removed, but also making sure that the weight of the machine is off the rear suspension so that the shock is not compressed.
- 2 Remove the seat (see Chapter 8).
- 3 Unscrew the nut and withdraw the bolt



9.7b It is best to remove the lower bearing using a puller

securing the bottom of the shock absorber to the swingarm (see illustrations).

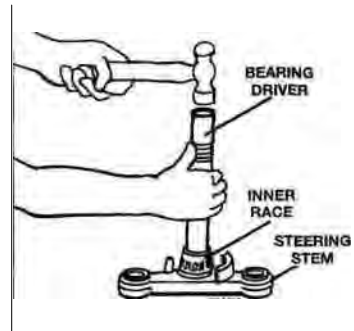
- 4 Unscrew the nut on the shock absorber upper mounting bolt (see illustration). Support the shock absorber and withdraw the upper mounting bolt, then manoeuvre the shock down and out of the bottom of the machine (see illustration).

TRX and XTZ models

- 5 Place the machine on an auxiliary stand. Position a support under the rear wheel so



10.3a Unscrew the nut (arrowed).



9.8 Drive the new bearing on using a suitable bearing driver or a length of pipe that bears only against the inner race and not against the rollers or cage

that it does not drop when the shock absorber is removed, but also making sure that the weight of the machine is off the rear suspension so that the shock is not compressed.

- 6 Remove the seat (see Chapter 8). If required for improved clearance, also remove the exhaust system (see Chapter 4). On XTZ models, remove the fuel tank (see Chapter 4), and where fitted, remove the rubber boot from around the shock absorber lower mounting.
- 7 Unscrew the nut and withdraw the bolt

10.4b ... then support the shock and withdraw the bolt

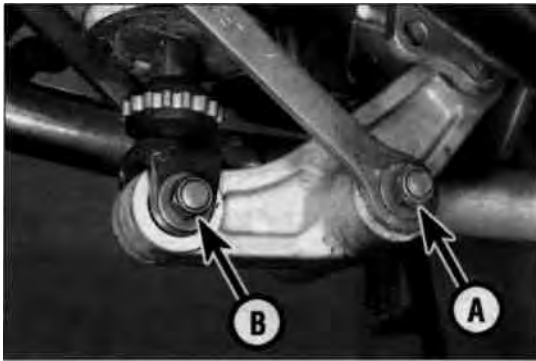


. and withdraw the bolt

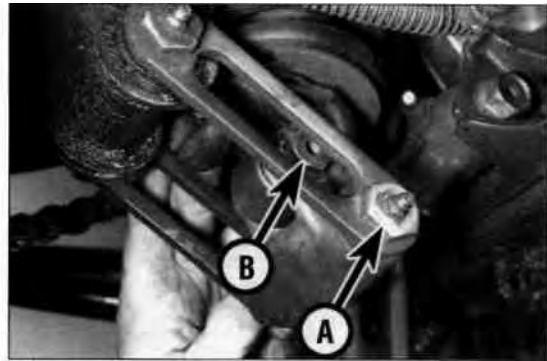


10.4a Unscrew the nut (arrowed).





10.7a Linkage rod to linkage arm bolt (A), shock absorber lower mounting bolt (B) - TRX models



10.7b Linkage rod to linkage arm bolt (A), shock absorber lower mounting bolt (B) - XTZ models

securing the linkage rods to the linkage arm (see illustrations). Unscrew the nut and withdraw the bolt securing the bottom of the shock absorber to the suspension linkage arm. Swing the linkage rods rearwards and the linkage arm down.

8 On TRX models, slacken the clamp screw securing the reservoir to its holder and free the hose from its clip on the frame (see illustrations). Slip the reservoir out and feed it through to the shock absorber.

9 Unscrew the nut on the shock absorber upper mounting bolt (see illustrations).

10 Support the shock absorber and withdraw

10.8a Slacken the clamp screw (arrowed) and

the upper mounting bolt, then manoeuvre the shock down and out of the bottom of the machine, on TRX models feeding the reservoir through as you do.

Inspection

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

12 Inspect the damper rod for signs of bending, pitting and oil leakage (see illustration).

13 Inspect the pivot hardware at the top and bottom of the shock for wear or damage.

10.8b .. and release the hose from its clip

Installation

14 Installation is the reverse of removal. Apply molybdenum disulphide grease to the shock absorber and linkage rod pivot points. Install the bolts and nuts finger-tight only until all components are in position, then tighten the nuts to the torque settings specified at the beginning of the Chapter.

11 Rear suspension linkage (TRX §» and XTZ models) - removal, inspection and installation **1**

Removal

1 Place the machine on an auxiliary stand. Position a support under the rear wheel so that it does not drop when the shock absorber lower mounting bolt is removed, but also making sure that the weight of the machine is off the rear suspension so that the shock is not compressed.
2 Remove the seat (see Chapter 8). If required for improved clearance, also remove the exhaust system (see Chapter 4). On XTZ models, where fitted, remove the rubber boot from around the shock absorber lower mounting.



free the reservoir...



(arrowed)



10.9a Shock absorber upper mounting bolt (arrowed) - TRX models



10.9b Shock absorber upper mounting bolt (arrowed) - XTZ models



10.12 Look for cracks, pitting and oil leakage on the damper rod (arrowed)

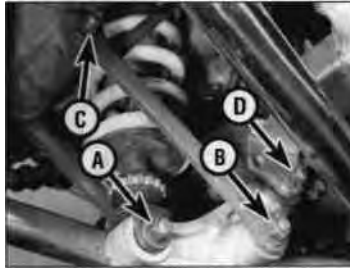
3 Unscrew the nuts and withdraw the bolts securing the shock absorber and the linkage rods to the linkage arm (see illustrations). Note which bolts fit where.

4 Unscrew the nut and withdraw the bolt securing the linkage rods to the swingarm and remove the rods.

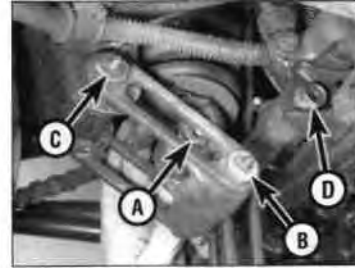
5 Unscrew the nut and withdraw bolt securing the linkage arm to the frame and remove the linkage arm, noting which way round it fits.

Inspection

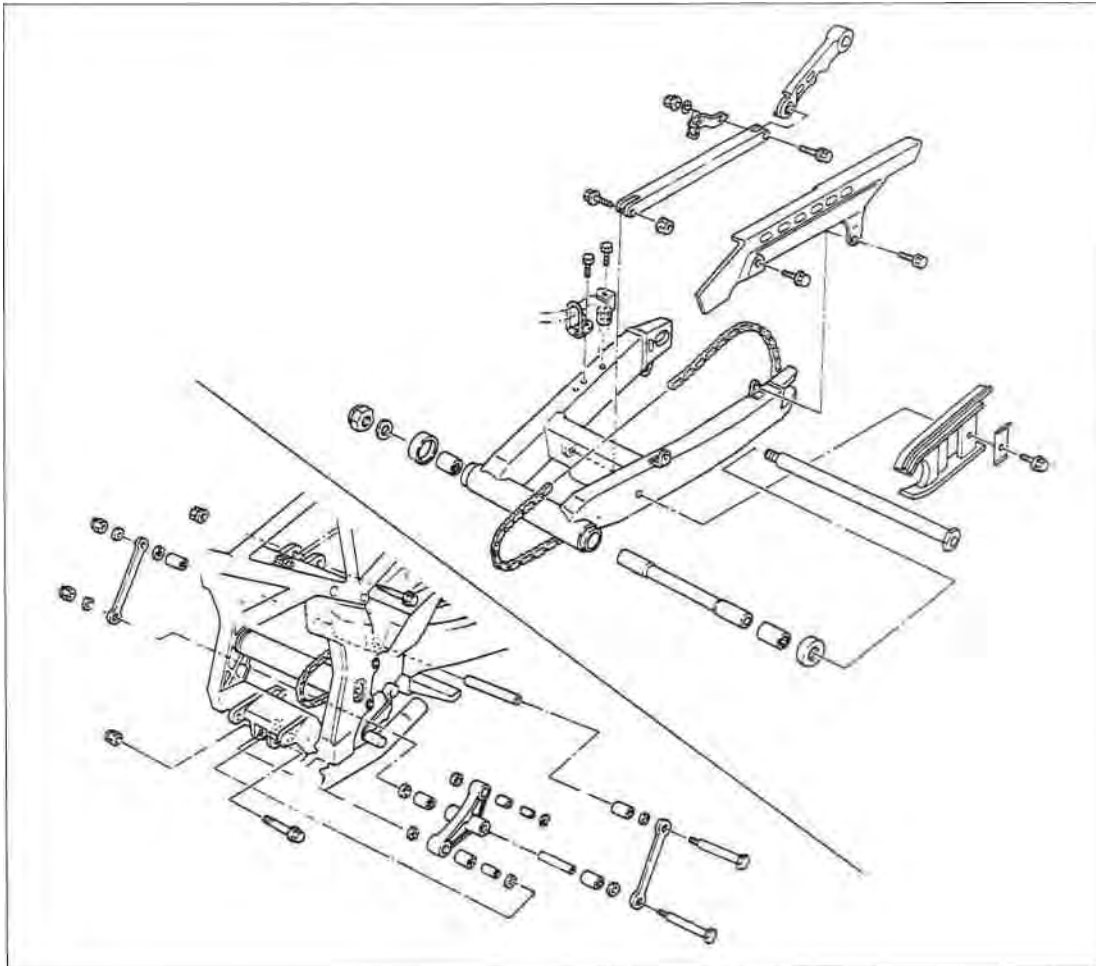
6 Withdraw the inner sleeves and lever out the grease seals from the linkage arm and swingarm, noting their different sizes (see illustrations). Thoroughly clean all



11.3a Shock absorber to linkage arm bolt (A), linkage rod to linkage arm bolt (B), linkage rod to swingarm bolt (C), linkage arm to frame bolt (D) - TRX models

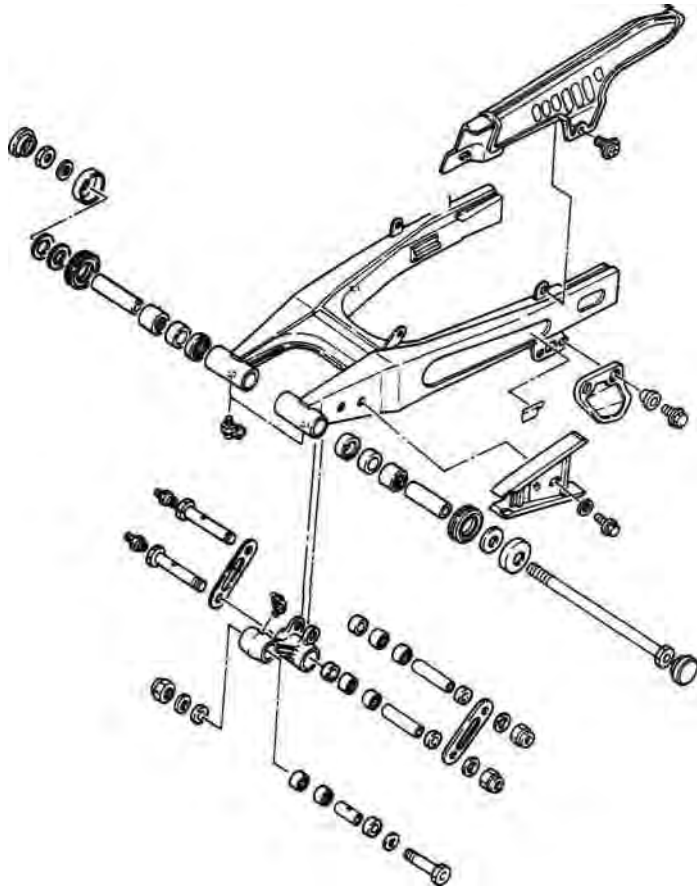


11.3b Shock absorber to linkage arm bolt (A), linkage rod to linkage arm bolt (B), linkage rod to swingarm bolt (C), linkage arm to frame bolt (D) - XTZ models



11.6a Suspension linkage and swingarm assembly - TRX models

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11.6b Suspension linkage and swingarm assembly - XTZ models

components, removing all traces of dirt, corrosion about one inch longer than the combined width of and grease. On XTZ models make sure that the linkage piece and one bearing. Also required are grease nipple passages in the linkage arm and suitable nuts and two large and robust washers pivot bolts are clear.

7 Inspect all components closely, looking for housing. In the case of the threaded rod, fit one nut obvious signs of wear such as heavy scoring, or to one end of the rod and stake it in place for convenience.

8 Check the condition of the needle roller bearings in the linkage arm and swingarm. 11 Fit one of the washers over the bolt or rod so that it rests against the head or staked nut, then pass

9 Worn bearings can be drifted out of their bores, the assembly through the relevant bore. Over the but note that removal will destroy them; new projecting end place the bearing, which should be components should be obtained before work greased to ease installation, followed by the commences. The new ones should be pressed or remaining washer and nut.

drawn into their bores rather than driven into 12 Holding the bearing to ensure that it is kept position. In the absence of a press, a suitable square, slowly tighten the nut so that the bearing is drawbolt arrangement can be made up as drawn into its bore.

10 Obtain a long bolt or a length of threaded arrangement and, if necessary, repeat the procedure rod from a local engineering works or some to fit the other bearings. other supplier. The bolt or rod should be

14 Lubricate the needle roller bearings and the spacers with molybdenum disulphide grease (TRX models) or lithium-based grease (XTZ models) and install the inner sleeves.

15 Check the condition of the grease seals and renew them if they are damaged or deteriorated. Press the seals squarely into place.

Installation

16 Installation is the reverse of removal. Apply molybdenum disulphide grease (TRX models) or lithium-based grease (XTZ models) to the pivot points. Install the bolts and nuts finger-tight only until all components are in position, then tighten the nuts to the torque settings specified at the beginning of the Chapter.

12 Suspension - adjustments %

Front forks

1 On XTZ models, the front forks are not adjustable.

2 On TDM and TRX models, spring pre-load is adjusted using a suitable spanner on the adjuster flats on the top of the forks (see illustration). The amount of pre-load is indicated by lines on the adjuster. There are five lines on TDM models and eight on TRX models. The standard position is with the fifth (1991 to 1995 TDM models), third (1996-on TDM models) or sixth (TRX models) line just visible above the top bolt hex. Turn the adjuster clockwise to increase pre-load and anti-clockwise to decrease it. Always make sure both adjusters are set equally.

3 On TDM models, rebound damping is adjusted using a screwdriver in the slot in the adjuster protruding from the pre-load adjuster (see illustration 12.2). The amount of damping is indicated by the number of clicks when turned anti-clockwise from the fully screwed-in position. There are six positions on 1991 to 1995 TDM models, and five on 1996-on TDM models. The standard position is four clicks out. Turn the adjuster clockwise



12.2 Spring pre-load adjuster (A), rebound damping adjuster (B) - TDM and TRX models

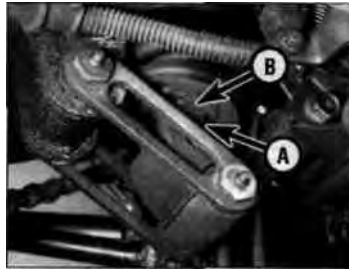
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12.9 Compression damping adjuster-TRX models

the shock absorber reservoir (see illustration). Turn the adjuster clockwise to increase damping and anti-clockwise to decrease it. To establish the current setting, turn the adjuster in (clockwise) until it stops, counting the number of clicks, then reset it as required by turning it out. There are twenty positions. The standard position is ten clicks out.

10 On XTZ models, pre-load adjustment is made by slackening the locknut on the base of the shock absorber, then turning the adjuster nut clockwise (as you look up at it from the bottom) to increase pre-load and anti-clockwise to decrease it (see illustration). Refer to the diagram for the standard, maximum and minimum settings (see illustration). Tighten the locknut securely after adjustment.

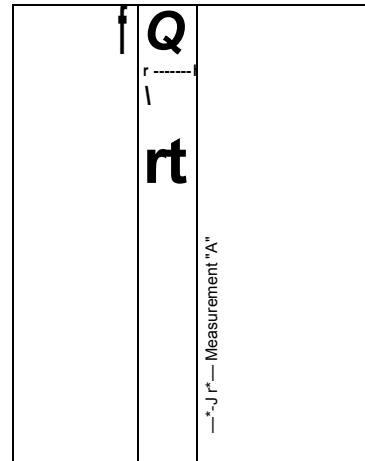


12.10a Slacken the locknut (A) and turn the adjuster (B) as required ...

13 Swingarm-removal and installation

Removal

- 1 Remove the rear wheel (see Chapter 7).
- 2 On XTZ models, the swingarm side clearance should be measured prior to removal. Push the swingarm to one side of the frame, then slip a feeler gauge between the frame and the swingarm on the side from which the swingarm was pushed and measure the clearance. If it is greater than specified, refer to Section 14.
- 3 On TDM models, unscrew the bolt which secures the caliper bracket to the swingarm and remove the bracket (see Chapter 7,



12.10b ... and according to the specified settings

- Standard length, A = 5.4 mm
- Minimum length, A = 5.4 mm
- Maximum length, A = 15.4 mm

Section 12, Step 2). Unscrew the bolts securing the hose guide to the swingarm, noting how they also secure the rear mudguard (see illustration).

4 On TRX models, unscrew the bolt securing each brake hose guide to the swingarm (see illustration). Remove the split pin from the bolt securing the brake torque arm to the swingarm, then unscrew the nut, withdraw the bolt and detach the arm (see illustration).

5 On XTZ models, unscrew the bolt securing each brake hose guide to the underside of the swingarm (see illustration). Disconnect the brake hose from the rear caliper (see Chapter 7) and remove the caliper. Feed the hose through its guide on the inside of the swingarm and support it with its end upright.

6 Unscrew the bolts securing the chain guard to the swingarm and remove the guard, on TDM models along with the rear mudguard, noting how they fit (see illustration).



13.3 Unscrew the bolts (arrowed) and detach the hose guide



13.4a Unscrew the bolts (arrowed) and detach the hose guides



13.4b Detach the torque arm by removing the bolt (arrowed)



13.5 Unscrew the bolts (arrowed) and detach the hose



13.6 Chainguard/rear mudguard bolts (arrowed) - TDM shown

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13.9a Remove the blanking caps if fitted ...



13.9b ... then unscrew the swingarm nut (arrowed) - TDM shown



13.10 Withdraw the pivot bolt and remove the swingarm - TDM shown

7 On TDM models, unscrew the nut and withdraw the bolt securing the bottom of the shock absorber to the swingarm (see illustrations 10.3a and b).

8 On TRX and XTZ models, remove the rear shock absorber (see Section 10). If required, remove the linkage rods from the swingarm (see Section 11).

9 Where fitted, remove the blanking cap from each end of the swingarm pivot (see illustration). Unscrew the nut on the end of the swingarm pivot bolt and remove the washer, where fitted (see illustration).

10 Support the swingarm, then withdraw the pivot bolt and remove the swingarm (see

illustration). Knock the pivot bolt through using a drift if required.

11 Remove the chain slider from the front of the swingarm if necessary, noting how it fits (see illustration). If it is badly worn or damaged, it should be renewed.

12 Inspect all components for wear or damage as described in Section 14.

Installation

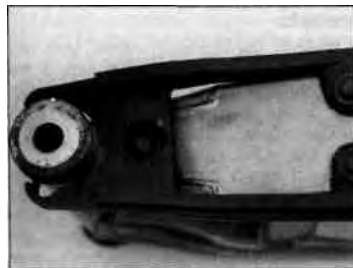
13 If removed, install the chain slider and tighten its bolt(s) securely (see illustration 13.11).

14 Remove the cap and washer (where fitted) from each side of the swingarm, and withdraw

the bearing spacer(s) (see illustrations).

Lubricate the seals (XTZ models) and bearings with molybdenum disulphide grease (TRX models) or lithium-based grease (XTZ models). Also grease the collar(s) and swingarm pivot. Re-install the washers and caps.

15 Offer up the swingarm, and have an assistant hold it in place (see illustration). Make sure the drive chain is looped over the front of the swingarm. Slide the pivot bolt through the swingarm. Slide the pivot bolt through the swingarm (see illustration 13.10), on TDM models making sure the flats on the head of the pivot bolt locate correctly with the flats in the frame (see illustration). Install the



13.11 Remove the chain slider if required



13.14a Remove the cap and washer (where fitted)...



13.14b ... then withdraw the collar...



13.14c ... and grease the bearings and other components as described



13.15a Do not forget to loop the chain over the swingarm



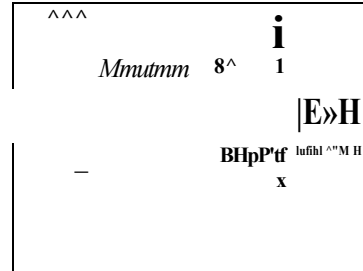
13.15b On TDM models, make sure the bolt head flats locate correctly



13.15c Fit the nut (with its washer, where fitted)...



13.15d ... and tighten it to the specified torque



13.17a On TDM models, locate the chainguard as shown ...

nut with its washer, where fitted and tighten the nut to the torque setting specified at the beginning of the Chapter (see illustrations). On TRX and XTZ models it may be necessary to counter-hold the bolt head to prevent it from turning. Where removed, fit the blanking caps (see illustration 13.9a).

16 Install the rear shock absorber (see Section 10) and on TRX and XTZ models the suspension linkage rods, if removed (see Section 11).

17 Install the chainguard, along with the rear fender on TDM models, making sure it locates correctly over the lugs on the swingarm (see illustrations).

18 On TDM models, fit the caliper bracket onto the swingarm and loosely install the bolt (see illustration). Fit the brake hose guide onto the swingarm (see illustration 13.3).

19 On TRX models, fit the brake torque arm onto the swingarm, then install the bolt and tighten the nut to the specified torque setting (see illustration 13.4b). Fit a new split pin onto the bolt. Fit the brake hose guides onto the swingarm (see illustration 13.4a).

20 On XTZ models, feed the brake hose through its guide on the inside of the swingarm and install it onto the caliper (see Chapter 7); note that the rear brake hydraulic system will require topping up and bleeding of air. Fit the brake hose guides onto the underside of the swingarm (see illustration 13.5).

21 Install the rear wheel (see Chapter 7), not

forgetting to tighten the caliper bracket bolt on TDM models.

22 Check and adjust the drive chain slack (see Chapter 1). Check the operation of the rear suspension before taking the machine on the road.

14 Swingarm - inspection and bearing replacement

Inspection

1 Thoroughly clean all components, removing all traces of dirt, corrosion and grease (see illustrations 11.6a and b).

2 Inspect all components closely, looking for obvious signs of wear such as heavy scoring, and cracks or distortion due to accident damage. Any damaged or worn component must be renewed.

3 Check the swingarm pivot bolt 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 measure the runout using a dial gauge. Yamaha do not specify a maximum runout limit but if it is obviously bent it must be renewed.

Bearing replacement - TDM and TRX models

4 Remove the cap and washer (where fitted)

from each side of the swingarm (see illustration 13.14a).

5 Withdraw the bearing spacer (see illustration 13.14b) and clean all old grease off the spacer and the two needle roller bearings in the swingarm. If the bearings do not run smoothly and freely they must be renewed (see illustration 13.14c). Refer to *Tools and Workshop Tips* (Section 5) in the Reference section for details of using a drawbolt tool or bearing extractor with slide-hammer attachment to remove the bearings and install new ones.

6 Lubricate the bearings and the spacer with molybdenum disulphide grease. Install the caps and washers (where fitted) on the swingarm ends

Bearing replacement - XTZ models

7 Remove the cap and washer (and any shims, where fitted) from each side of the swingarm (see illustration 13.14a). Lever out the grease seal on each side of each swingarm pivot.

8 Withdraw the bearing spacers, noting their different length (see illustration 13.14b). Clean all old grease off the spacers, the two needle roller bearings and the two plain bushes in the swingarm. Examine the bearings and the bushes; if the bearings do not run smoothly and freely and the bushes are scored or worn they must all be renewed. Refer to *Tools and Workshop Tips* (Section 5)



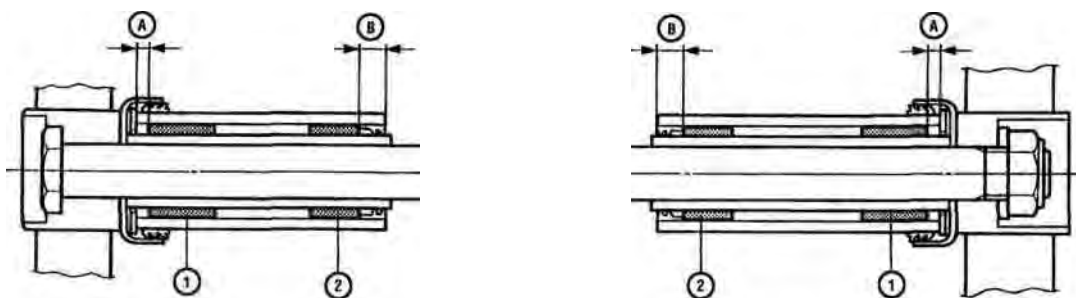
13.17b ... then fit the mudguard...



13.17c ... not forgetting the collars



13.18 Locate the caliper bracket and loosely install the bolt



14.8 Swingarm bearing (1) and bush (2) installed depth
 A 4 mm B 8 mm

in the Reference section for details of using a drawbolt tool or bearing extractor with slide-hammer attachment to remove the bearings and bushes and install new ones. When installing the new components note that they must be positioned to a specific depth in the swingarm housings (see illustration).

9 Measure the length of each bearing spacer and the thickness of each washer and compare them to the specifications, renewing any component that is worn. **Note:** Worn components will increase swingarm sideplay.

10 Although it is possible to measure the swingarm sideplay with all components assembled on the bike it is preferably to calculate sideplay by direct measurement of the individual components. Done this way, you will be able to install any shims required as the swingarm is refitted. You will need a vernier gauge to do this accurately. Measure the width of the swingarm mounting boss on the engine and call this dimension A. Record the lengths of the two spacers measured in Step 9 as dimensions B and C. Now measure the overall length of the swingarm (from the outside of one bearing housing to the outside of the other) and record this as dimension D. Record the thicknesses of the two washers (added together) measured in Step 9 and record this as dimension E. Compute swingarm sideplay by subtracting the swingarm width and washer thicknesses from the boss width and spacer lengths, thus:

$$\text{Sideplay} = (A + B + C) - (D + E)$$

If the sideplay is within the limit of 0.4 to 0.7 mm no shims are required. If sideplay exceeds 0.7 mm, fit one or two shims as required to bring sideplay within the specified limit. Shims are available in 0.3 mm thicknesses. The shims should be fitted between the cap and washer; if two shims are required fit one on each side, whereas if only one shim is required fit this on the right-hand side.

11 Press the grease seals into their locations in each side of the swingarm bearing

housings, renewing them if they are damaged or deteriorated.

12 Lubricate the bearings, bushes and spacers with lithium-based grease. Do not forget to install the bearing spacer between the bearings in the swingarm. Install the washers, shims (where fitted) and caps on the outer ends of the swingarm.

15 Drive chain - removal, cleaning and installation

Endless type chain

Note: An endless chain has no riveted (soft) link - all links and pins are the same. The chain fitted as original equipment and supplied as a spare part from Yamaha dealers is of the endless type.

Warning: NEVER install a drive chain which uses a clip-type master (split) link.

Removal

1 Remove the swingarm (see Section 13). Note that if the front sprocket is being removed, the sprocket nut should be slackened before removing the swingarm, so that the rear brake can be used so stop the sprocket turning (see Section 16).

2 On TDM and XTZ models, unscrew the bolts securing the outer front sprocket cover and remove the cover (see illustration). Unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the inner sprocket cover, on TDM models noting the clip secured by the top rear bolt, and remove the cover (see illustration).

3 On TRX models, unscrew the gearchange



15.2a Unscrew the bolts (arrowed) and remove the cover

15.2c Unscrew the bolts (arrowed) and remove the inner cover



15.2b Linkage arm/shaft alignment - TDM models





15.3 Linkage arm/shaft alignment -TRX models

lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the outer front sprocket cover and remove the cover, then unscrew the bolts securing the inner sprocket cover, noting the clip secured by the top rear bolt, and remove the cover.

4 Slip the chain off the front sprocket and remove it from the bike.

Cleaning and wear check

5 Soak the chain in paraffin (kerosene) for approximately five or six minutes. **Caution: Don't use gasoline (petrol), solvent or other cleaning fluids. Don't use high-pressure water. Remove the chain, wipe it off, then blow dry it with compressed air immediately. The entire process shouldn't take longer than ten minutes - if it does, the O-rings in the chain rollers could be damaged.**

6 Once the chain has been cleaned and dried, check it for wear by measuring a 10-link length with the chain taught; anchor one end of the chain and hold the other end tensioned whilst the measurement is taken (see illustration). Compare the result the wear limits at the beginning of this Chapter. Note that chains do not wear evenly, so take measurements at various points in the chain's run.

Installation

7 Installation is the reverse of removal. On completion adjust and lubricate the chain

following the procedures described in Chapter 1.

Riveted link type chain

Removal

Note: The riveted (soft) link can be identified by its identification markings on the side plate and usually slightly different colour. Also the staked ends of the link's two pins look as if they have been deeply centre-punched, instead of peened over as with all other pins.

8 Locate the joining link in a suitable position to work on by rotating the back wheel; midway between the sprockets is ideal.

9 Slacken the drive chain as described in Chapter 1.

10 Split the chain at the joining link using an approved chain breaker tool intended for motorcycle use. There are a number of types available for motorcycle use and it is important to follow carefully the instructions supplied with the tool - see *Tools and Workshop Tips* in the Reference section for a typical example. Remove the chain from the bike, noting its routing through the swingarm. **Cleaning and wear check**

11 See Steps 5 and 6.

Installation

Warning: NEVER install a drive chain which uses a clip-type master (split) link. If you do not have access to a chain riveting tool, have the chain fitted by a Yamaha dealer.

12 Remove the engine sprocket cover as described in Steps 2 or 3, as applicable.

13 Thread the chain into position, making sure that it takes the correct route around the swingarm and sprockets and leave the two ends in a convenient place to work on. Obtain a new soft link - never attempt to reuse an old link.

14 Install the new soft link complete with an O-ring on each of its pins through the chain ends from the inside of the chain. Install an O-ring over the pin ends and fit the side plate with its identification marks facing out; use the chain tool to press the side plate into position.

15 Stake the new link pins using the chain riveting tool, following carefully the instructions of both the chain manufacturer and the tool manufacturer. Refer to *Tools and Workshop Tips* in the Reference section for

chain riveting details using a typical commercially available tool.

16 After riveting, check the soft link pin ends for any signs of cracking. If there is any evidence of cracking, the soft link, O-rings and side plate must be removed and the procedure repeated with a new soft link.

17 Install the sprocket cover in a reverse of the removal procedure. Adjust and lubricate the chain following the procedures described in Chapter 1.

16 Sprockets- check and replacement

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Check

1 On TDM and XTZ models, unscrew the bolts securing the outer front sprocket cover and remove the cover (see illustration 15.2a). Unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration 15.2b). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the inner sprocket cover, on TDM models noting the clip secured by the top rear bolt, and remove the cover (see illustration 15.2c).

2 On TRX models, unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration 15.3). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the outer front sprocket cover and remove the cover, then unscrew the bolts securing the inner sprocket cover, noting the clip secured by the top rear bolt, and remove the cover.

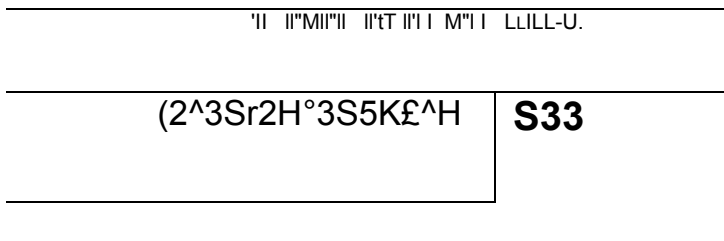
3 Check the wear pattern on both sprockets (see illustration 1.7 in Chapter 1). If the sprocket teeth are worn excessively, renew the chain and both sprockets as a set. Whenever the sprockets are inspected, the drive chain should be inspected also (see Chapter 1). If you are renewing the chain, renew the sprockets as well.

4 Adjust and lubricate the chain following the procedures described in Chapter 1. **Caution: Use only the recommended lubricant.**

Replacement

Front sprocket

5 On TDM and XTZ models, unscrew the bolts securing the outer front sprocket cover and remove the cover (see illustration 15.2a). Unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration 15.2b). If



15.6 Check the amount of stretch by measuring a 10-link length as shown

Frame, suspension and final drive 6*29



16.7 Bend back the lockwasher tab(s) (arrowed), then unscrew the nut



16.8 Slide the sprocket off the shaft and remove it



16.10a Fit a new lockwasher.



16.10b ... make sure the nut is the correct way round ...



16.10c ... and tighten it to the specified torque



16.10d Bend the tabs up against the nut

no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the inner sprocket cover, on TDM models noting the clip secured by the top rear bolt, and remove the cover (see illustration 15.2c).

6 On TRX models, unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration 15.3). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the outer front sprocket cover and remove the cover, then unscrew the bolts securing the inner sprocket cover, noting the clip secured by the top rear bolt, and remove the cover.

7 Bend down the tab(s) on the sprocket nut lockwasher (see illustration). Have an assistant apply the rear brake, then unscrew the nut and remove the washer. Refer to Chapter 1 and adjust the chain so that it is fully slack.

8 Slide the sprocket and chain off the shaft and slip the sprocket out of the chain (see illustration). If there is not enough slack on the chain to remove the sprocket, disengage the chain from the rear wheel.

9 Engage the new sprocket with the chain and slide it on the shaft (see illustration 16.8). Take up the slack in the chain (see Chapter 1).

10 Slide on a new lockwasher, then fit the nut with its recessed side facing in and tighten it to the torque setting specified at the beginning of the Chapter, using the method employed on removal to prevent the sprocket from turning (see illustrations). Bend up one of the pre-formed tabs of the lockwasher against the nut flats (see illustration).

11 On TDM and XTZ models, install the inner sprocket cover, on TDM models not forgetting the clip secured by the top rear bolt, and tighten the bolts securely (see illustration 15.2c). Align the split in the gearchange linkage arm clamp with the punch mark on the shaft, then fit the arm on the shaft and tighten the pinchbolt to the specified torque setting (see illustration 15.2b). Install the outer sprocket cover and tighten its bolts to the specified torque (see illustration 15.2a).

12 On TRX models, install the inner sprocket cover, not forgetting the clip secured by the top rear bolt, and tighten the bolts securely. Install the outer sprocket cover and tighten its bolts to the specified torque. Align the split in the gearchange linkage arm clamp with the punch mark on the shaft, then fit the arm on the shaft and tighten the pinchbolt to the specified torque setting (see illustration 15.3).

Rear sprocket

13 Remove the rear wheel (see Chapter 7).

14 On XTZ models, bend back the locking tabs on the sprocket nut lockplates.

15 Unscrew the nuts securing the sprocket to the hub assembly (see illustration). Remove the sprocket, noting which way round it fits.

16 Install the sprocket onto the hub with the stamped mark facing out. On XTZ models, install the lockplates, noting that new ones should be used. Tighten the nuts evenly and in a criss-cross sequence to the torque setting specified at the beginning of the Chapter. On XTZ models, bend the tabs of the lockplates up against the nut flats.

17 Install the rear wheel (see Chapter 7).



16.15 Unscrew the nuts (arrowed) and remove the sprocket



17.2 Lift the sprocket coupling out of the wheel...



17.3 ... and remove the rubber dampers



17.5 Fit the spacer into the bearing if it was removed

17 Rear sprocket coupling/rubber dampers - check and replacement

1 Remove the rear wheel (see Chapter 7).
Caution: Do not lay the wheel down on the disc as it could become warped. Lay the wheel on wooden blocks so that the disc is off the ground.

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2 Lift the sprocket coupling out of the wheel leaving the rubber dampers in position in the wheel (see illustration). Note the spacer inside the coupling - it should be a tight fit but remove it if it is likely to drop out. Check the coupling for cracks or any obvious signs of damage. Also check the sprocket studs for wear or damage.

3 Lift the rubber damper segments from the wheel and check them for cracks, hardening and

general deterioration (see illustration). Renew the rubber dampers as a set if necessary.

4 Checking and replacement procedures for the sprocket coupling bearing are described in Chapter 7.

5 Installation is the reverse of removal. Make sure the spacer is still correctly installed in the coupling, or install it if it was removed (see illustration).

6 Install the rear wheel (see Chapter 7).

Chapter 7

Brakes, wheels and tyres

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Degrees of difficulty

Easy, suitable for novice with little experience	jk «F» gjj	Fairly easy, suitable for beginner with some experience ^	jk for §§ some ^	Fairly difficult, suitable for competent DIY mechanic	5^ jS	Difficult, suitable for experienced mechanic	jk DTV 5j <S	Very difficult, suitable for expert DIY or professional	*k «J» >jS
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Specifications

Brakes	
Brake fluid type.....	DOT 4
Brake pad friction material wear limit	
TDM and TRX models	0.5 mm
XTZ models	1.5 mm
Front caliper bore ID	
1991 to 1995 TDM models	45.40 mm
1996-on TDM models	
Upper bore	33.96 mm
Lower bore	30.23 mm
TRX models	32.10 mm
XTZ models	27.00 mm
Front disc thickness	
Standard	4.0 mm
Service limit	3.5 mm
Front disc maximum runout	0.2 mm
Front master cylinder bore ID	
TDM and TRX models	15.8 mm
XTZ models	14.0 mm
Rear caliper bore ID	
TDM and TRX models	42.8 mm
XTZ models	27.0 mm
Rear disc minimum thickness	
Standard	5.0 mm
Service limit	4.5 mm
Rear disc maximum runout	0.15 mm
Rear master cylinder bore ID	14.0 mm

7»2 Brakes, wheels and tyres

Wheels

Wheel runout (max)	
Axial (side-to-side)	
TDM and XTZ models.....	0.5 mm
TRX models.....	2.0 mm
Radial (out-of-round)	
TDM and XTZ models.....	1.0 mm
TRX models.....	2.0 mm

Tyres

Tyre pressures	see <i>Daily (pre-ride) checks</i>
Tyre sizes*	
1991 to 1995 TDM models	
Front	110/80-18 58H, tubeless
Rear.....	150/70-17 69H, tubeless
1996-on TDM models	
Front	110/80-ZR18, tubeless
Rear.....	150/70-ZR17, tubeless
TRX models	
Front	120/60-ZR17, tubeless
Rear.....	160/60-ZR17, tubeless
XTZ models	
Front	90/90-21 54H, tubed
Rear.....	140/80-17 69H, tubed

*Refer to the owners handbook or the tyre information label on the swingarm for approved tyre brands.

Torque settings

Brake pad retaining pins - XTZ models	18 Nm	
Brake caliper mounting bolts		
1991 to 1995 TDM models.....	35 Nm	
1996-on TDM models and TRX models.....	40 Nm	
XTZ models.....	35 Nm	
Brake hose banjo bolts		
1991 to 1995 TDM models	26 Nm	
1996-on TDM models and TRX models	30 Nm	
XTZ models.....	25 Nm	
Brake disc bolts		
TDM models and XTZ models	20 Nm	
TRX models	23 Nm	
Front brake master cylinder clamp bolts		
TDM models	9 Nm	
TRX and XTZ models	10Nm	
Rear brake master cylinder bolts		
TDM and TRX models.....	23 Nm	
XTZ models.....	20 Nm	
Brake caliper bleed valves		6 Nm
Front wheel axle		
TDM models.....	58 Nm	
TRX models.....	65 Nm	
Front wheel axle clamp bolt		
TDM models	19Nm	
TRX models.....	20 Nm	
Front wheel axle nut - XTZ models	110 Nm	

1 General information

TDM and TRX models are fitted with cast alloy wheels designed for tubeless tyres only. XTZ models are fitted with spoked wheels designed for tubed tyres only. Both front and rear brakes are hydraulically operated disc brakes.

On TDM and TRX models, the front brakes are twin opposed-piston calipers, and the rear brake is a single opposed piston caliper. On XTZ models, both front and rear brakes are twin piston sliding calipers.

A **Warning: Disc brake components rarely require disassembly. Do not disassemble components unless absolutely necessary. If a hydraulic brake**

line is loosened, the entire system must be disassembled, drained, cleaned and then properly filled and bled upon reassembly. 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.



2.1a Remove the pad cover...



2.1b ... then remove the retaining clips .



2.1c ... and withdraw the pad pins



2.1 d Remove the pad spring ...



2.1 e ... and lift out the pads

2 Brake pads - replacement

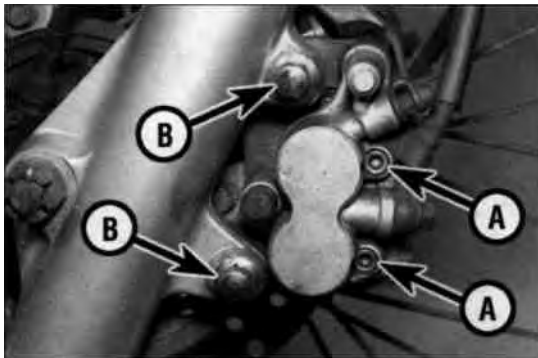
A *Warning: The dust created by the brake system may contain asbestos, which is harmful to*

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.

1 On TDM and TRX models, where fitted, remove the pad cover from the top of the caliper (see illustration). Remove the pad pin retaining clips, then withdraw the pad pins from the caliper, noting how they locate

against the pad spring (see illustrations). Remove the spring, noting how it fits, then lift out the pads (see illustrations). Where fitted, remove the shims from the back of the pads, noting how they fit.

2 On XTZ models, slacken the pad retaining pins, then unscrew the caliper mounting bolts and slide the caliper off the disc (see illustrations). Unscrew the pad retaining pins



2.2a Slacken the pad retaining pins (A), then unscrew the caliper mounting bolts (B)...



2.2b ... and slide the caliper off the disc

7»4 Brakes, wheels and tyres



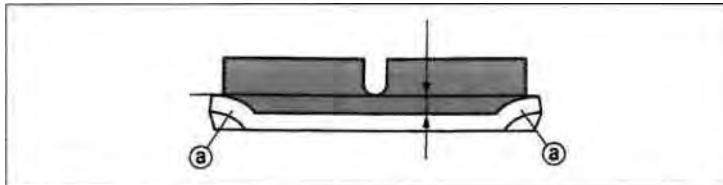
2.2c Remove the pad pins...



2.2d .. and lift out the pads, noting how they fit



2.2e Slide the bracket out of the caliper



2.3a Pad wear indicator tangs (a) and minimum friction material limit (arrowed) ■ and TRX

and withdraw them (see illustration). Remove the inner pad, noting how it locates against the guide pin on the caliper bracket, then remove the outer pad, noting how it sits in the caliper bracket (see illustration). Where fitted, remove the shims from the back of the pads, noting how they fit. Separate the bracket from the caliper, noting how it fits (see illustration). Remove the pad spring if required, noting how it fits (see illustration 2.11a).

3 Inspect the surface of each pad for contamination and check that the friction material has not worn level with or beyond the wear indicator tangs or groove (see Chapter 1) (see illustrations). Yamaha also specify a minimum friction material thickness (see

Specifications) which should correspond with the tang height or groove depth on genuine Yamaha pads. It is strongly advised that the pads are renewed well before the wear indicators or minimum amount of friction material is reached. The pads should also be renewed if they are fouled with oil or grease, or heavily scored or damaged by dirt and debris; it is not possible to degrease the friction material. Always renew both pads in the caliper and renew the pads in each front caliper at the same time. 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 grooves in

TDM

the friction material and dig out any embedded particles of foreign matter. Any areas of glazing may be removed using emery cloth.

5 Check the condition of the brake disc(s) (see Section 4).

6 Remove all traces of corrosion from the pad pins. Inspect the pins for signs of damage and renew them if necessary.

7 On XTZ models, clean the old grease off the caliper slider pins on the bracket and check the rubber boots in the caliper (see illustration 2.2e). If they are damaged or deteriorated, they should be renewed.

8 Push the pistons as far back into the caliper as possible using hand pressure or a piece of wood as leverage. Due to the increased friction material thickness of new pads, it may be necessary to remove the master cylinder reservoir cover and diaphragm and siphon out some fluid.

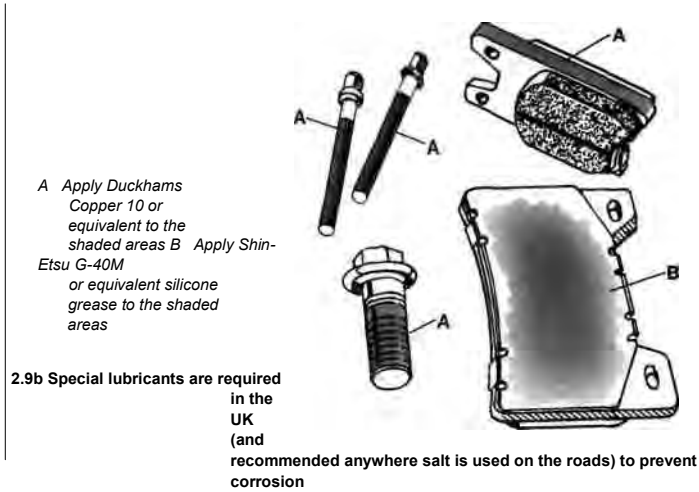
9 Where removed, fit the shims onto the back of the pads, making sure the arrow points in the direction of normal disc rotation (see illustration). The following step is necessary on UK models, and anywhere else where salt is used on the roads, to ensure that the pads move freely in the calipers. Apply a thin film of Duckhams Copper 10 or equivalent to the



2.3b Pad friction material showing wear limit groove - XTZ models



2.9a Fit the shim onto the back of the pad, making sure the arrow points in the direction of normal disc rotation



following areas before installing the pads (see illustrations):

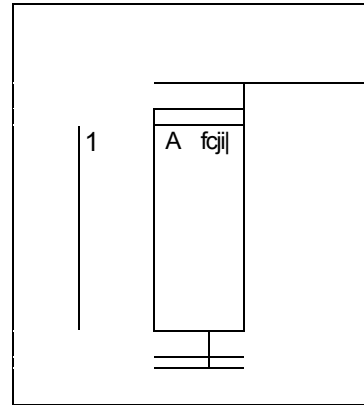
- a) To the edges of the metal backing on the brake pads.
- b) To the pad retaining pins.
- c) To the areas of the caliper where the pads rub.
- d) To the threads of the caliper mounting bolts.
- e) To the surfaces of the slider pins on XTZ models.

Caution: Don't use too much Copper 10 and make sure it doesn't contact the brake discs or the pad friction surfaces.

Apply a thin film of Shin-Etsu G-40M or equivalent silicone grease to the following:

- f) Exposed areas of the caliper pistons

g) The areas of the pad backing plates that contact the pistons.



2.9c Apply the recommended lubricants to the pad friction areas inside the caliper and to the exposed portion of the caliper pistons

A Duckhams Copper 10 B Shin-Etsu G-40M or equivalent silicone grease



2.10 Clip the cover onto the caliper, making sure it is secure

illustration 2.2e). Fit the outer pad, making sure it locates correctly (see illustration),

Is, insert the pads into the caliper so that the friction material faces the disc (see illustration 2.1e). Fit the pad spring onto the pads, making sure the arrow (where present) or the longer outer tabs point in the direction of normal disc rotation (see illustration 2.1d). Install the pad pins, making sure they pass through the hole in each pad and locate correctly onto the pad spring, then fit the retaining clips (see illustrations 2.1c and b). Where fitted, install the caliper cover (see illustration).

11 On XTZ models, if removed, fit the pad spring into the caliper, making sure the larger tabs point to the outside of the caliper (see illustration). Apply the specified grease (see Step 9) to the slider pins on the bracket and slide the bracket into the caliper (see



2.11a Install the pad spring as shown



2.11 b Locate the outer pad into the caliper as shown

7*6 Brakes, wheels and tyres



2.11c Slide the caliper onto the disc .



2.11d .. and tighten the mounting bolts ...



2.11e ... and the pad pins to the specified torque

then fit the inner pad, locating the cutout against the guide (see illustration 2.2d). Install the pad pins, making sure they pass through the hole in each pad, and tighten them finger-tight (see illustration 2.2c). Install the brake caliper and tighten its bolts to the torque setting specified at the beginning of the Chapter, then tighten the pad retaining pins to the specified torque (see illustrations).

12 Top up the master cylinder reservoir if necessary (see Daily (pre-ride) checks), and refit the reservoir cover and diaphragm.

13 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.

Brake calipers - removal, overhaul and installation

A *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 clean brake fluid only on the internal parts. Brake cleaner or denatured alcohol can be used on external parts.*

Removal

1 On XTZ models, if removing the rear brake caliper, unscrew the bolts securing the rear

caliper shield and remove the shield (see illustration). If the brake pads are being removed from the calipers, slacken the pad retaining pins now (see illustration 2.2a).

2 If the calipers are just being displaced and not completely removed or overhauled, do not disconnect the brake hose. If the calipers are being overhauled, unscrew the brake hose banjo bolt (see illustration). Note the alignment of the hose on the caliper and separate the hose from the caliper. On the rear caliper on TDM models, counter-hold the hose nut and unscrew the locknut and separate the hose from the hose joint in the caliper (see illustration). Plug the hose end or wrap a plastic bag tightly around it to minimise fluid loss and prevent dirt entering the system. Discard the banjo bolt 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.

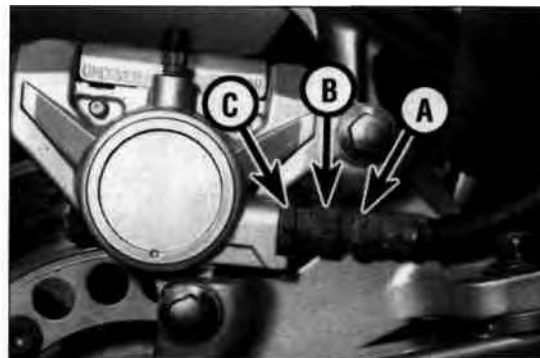
3 Unscrew the caliper mounting bolts, and



3.1 Unscrew the bolts (arrowed) and remove the shield

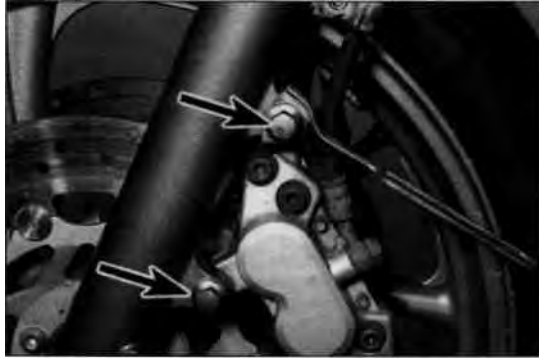


3.2a Unscrew the brake hose banjo bolt (arrowed), noting its alignment



3.2b Counter-hold the hose nut (A) and unscrew the locknut (B) from the hose joint (C)

Brakes, wheels and tyres 7*7



3.3a Unscrew the caliper mounting bolts (arrowed) . . .



3.3b . . . and slide the caliper off the disc

slide the caliper off the disc (see illustrations).

4 If the calipers are being overhauled, remove the brake pads (see Section 2). If the calipers are just being displaced, the pads can be left in place.

Overhaul

5 Clean the exterior of the caliper with brake system cleaner or denatured alcohol. On XTZ models, if not already done, separate the caliper bracket from the caliper, noting how it fits (see illustration 2.2e).

6 Displace the pistons as far as possible from the caliper body, either by pumping them out by operating the front brake lever or rear brake pedal (as applicable), or by forcing them out using compressed air. If the compressed air method is used, place a wad of rag between the pistons and the caliper to act as a cushion, then use compressed air directed into the fluid inlet to force the pistons out of the body. Use only low pressure to ease the pistons out and make sure the 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. On opposed piston calipers there is not enough room to remove the pistons from both sides at the same time, so block one side in their

bore using a piece of wood and displace the opposite side first, then remove the seals (see below), reinstall the removed pistons and block them using the wood while removing the other side. Now remove the wood and the first pistons, which can now be easily removed. 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.

A **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: On TDM and TRX models, do not attempt to remove the caliper body bolts and separate the caliper halves.

7 Using a wooden or plastic tool, remove the dust seals from the caliper bores (see illustration). Discard them as new ones must be used on installation. If a metal tool is being used, take great care not to damage the caliper bores.

8 Remove and discard the piston seals in the same way.

9 Clean the pistons and bores 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.

10 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.

11 Lubricate the new piston seals with clean brake fluid and install them in their grooves in the caliper bores. Note that on some models different 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. The same applies when fitting the new dust seals and pistons.

12 Lubricate the new dust seals with clean brake fluid and install them in their grooves in the caliper bores.

13 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.

Installation

14 Install the brake pads (see Section 2).

15 Install the caliper on the brake disc making sure the pads sit squarely either side of the disc (see illustration 3.3b).

16 Install the caliper mounting bolts, and tighten them to the torque setting specified at the beginning of the Chapter (see illustration). On XTZ models, if the pads were removed, now tighten the pad retaining pins to the specified torque (see illustration 2.2a).

17 If removed, connect the brake hose to the caliper, using new sealing washers on each T side of the banjo fittings (see illustration 7.4). Align the hose as noted on removal (see illustration 3.2a). Tighten the banjo bolt to the torque setting specified at the beginning of the Chapter. On the rear caliper on TDM models, fit the hose against the hose joint and tighten the locknut onto the hose, counter-



3.7 Use a plastic or wooden tool (such as a pencil) to remove the seals



3.16 Tighten the caliper mounting bolts to the specified torque



4.2 Set up a dial gauge with the probe contacting the brake disc, then rotate the wheel to check for runout

holding the hose nut to prevent the hose twisting (see illustration 3.2b). Do not overtighten the locknut. 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 8.

18 On XTZ models, install the rear brake caliper shield.

19 Check for leaks and thoroughly test the operation of the brake before riding the motorcycle.

4 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 renewed.

2 To check disc runout, position the bike on an auxiliary stand and support it so that the wheel is raised off the ground. On XTZ models, remove the front disc covers (see illustration 11.5). Mount a dial gauge on a fork slider or on the swingarm, 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 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, renew them (see Section 13) and repeat this check. If the disc runout is still excessive, it will have to be renewed, 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 (see



4.3 Using a micrometer to measure disc thickness

illustration). If the thickness of the disc is less than the service limit, it must be renewed.

Removal

4 Remove the wheel (see Section 11 (front) or 12 (rear)).

Caution: Do not lay the wheel down and allow it to rest on the disc or sprocket - they 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 disc to the wheel, so it can be installed in the same position. Unscrew the disc retaining bolts, loosening them a little at a time in a criss-cross pattern to avoid distorting the disc, then remove the disc from the wheel (see illustration).

Installation

6 Install the disc on the wheel, making sure the marked side is on the outside. Align the previously applied matchmarks (if you're reinstalling the original disc).

7 Apply a suitable non-permanent thread locking compound to the disc bolts, then install the bolts and tighten them in a criss-cross pattern evenly and progressively to the torque setting specified at the beginning of the Chapter. Clean off all grease from the brake disc(s) using acetone or brake system cleaner. If a new brake disc has been installed, remove any protective coating from its working surfaces.

8 Install the wheel (see Section 11 or 12).

9 Operate the brake lever or pedal several times to bring the pads into contact with the



5.3a On TDM and XTZ models, slacken the reservoir cover screws (arrowed)



4.5 Unscrew the bolts (arrowed) and remove the disc - TDM rear disc shown

disc. Check the operation of the brakes carefully before riding the bike.

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 8), and the hydraulic hoses 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 obtain a new piston/seal kit. Also, you will need some new DOT 4 brake fluid, some clean rags and internal circlip pliers. **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 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 XTZ models, remove the hand guard. On TDM and XTZ models, loosen, but do not remove, the screws holding the reservoir cover in place (see illustration). On TRX models, remove the reservoir cap clamp and partially unscrew the cap (see illustration).



5.3b On TRX models, remove the clamp (arrowed) and partially unscrew the cap

Brakes, wheels and tyres 7*9



5.4a Brake switch wiring connector (arrowed) - TDM models



5.4b Brake switch wiring connectors (arrowed) - TRX models



5.6a Brake hose banjo bolt (arrowed) - TDM models



5.6b Brake hose banjo bolt (arrowed) - TRX models



5.7a Reservoir mounting bolt...



5.7b ... and hose clamp - TRX models

4 On TDM and TRX models, disconnect the brake light switch wiring connector(s) (**see illustrations**). On XTZ models, remove the switch from the brake lever bracket.

5 Remove the front brake lever (see Chapter 6). On TDM and XTZ models, remove the rear view mirror.

6 Unscrew the brake hose banjo bolt and separate the hose(s) from the master cylinder, noting the alignment (**see illustrations**). Discard the sealing washers as they must be renewed. Wrap the end(s) of the hose(s) in a clean rag and suspend in an upright position or bend down carefully and place the open end(s) in a clean container. The objective is to prevent excessive loss of

brake fluid, fluid spills and system contamination.

7 On TRX models, unscrew the bolt securing the reservoir to the bracket, then release the clamp securing the reservoir hose to the union on the master cylinder (**see illustrations**). Remove the reservoir cap and lift off the diaphragm plate and the rubber diaphragm. Drain the brake fluid from the reservoir into a suitable container, then detach the reservoir hose from its union on the master cylinder. Wipe any remaining fluid out of the reservoir with a clean rag.

8 Unscrew the master cylinder clamp bolts, then lift the master cylinder away from the handlebar (**see illustrations**).

9 On TDM and XTZ models, remove the reservoir cover retaining screws and lift off the cover, the diaphragm plate and the rubber diaphragm. Drain the brake fluid from the reservoir into a suitable container. Wipe any remaining fluid out of the reservoir with a clean rag.

10 If required, on TDM and TRX models, remove the brake light switch (see Chapter 9).

Overhaul

11 On TDM models, thread the adjuster off the pushrod and remove the spring (where fitted), the nut and the plate.

12 Carefully remove the dust boot from the master cylinder (**see illustration**).



5.8a Master cylinder clamp bolts (arrowed) - TRX models



5.8b Master cylinder clamp bolts (arrowed) - XTZ models



5.12 Remove the rubber boot from the end of the master cylinder piston ...

7*10 Brakes, wheels and tyres



5.13a ... then depress the piston and remove the circlip using a pair of internal circlip pliers



5.13b Lay out the internal parts as shown, even if new parts are being used, to avoid confusion on reassembly



5.24 Align the clamp mating surfaces with the punch mark on the handlebar (arrowed)

13 Using circlip pliers, remove the circlip and slide out the washer and pushrod (TDM models), the piston assembly and the spring, noting how they fit (see illustration). Lay the parts out in the proper order to prevent confusion during reassembly (see illustration).

14 On TRX models, remove the fluid reservoir hose union rubber cap, then remove the circlip and detach the union from the master cylinder. Discard the O-ring as a new one must be used. Inspect the reservoir hose for cracks or splits and renew if necessary.

15 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.

16 Check the master cylinder bore for corrosion, scratches, nicks and score marks. If damage or wear is evident, the master cylinder must be renewed. 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.

17 The dust boot, circlip, piston, seal, primary cup and spring are only available as a kit. Use all of the new parts, regardless of the apparent condition of the old ones. If the seal and cup are not already on the piston, fit them according to the layout of the old piston assembly.

18 Install the spring in the master cylinder. On TDM models the spring's tapered end faces in, and on TRX and XTZ models its tapered end faces out.

19 Lubricate the piston, seal and cup with clean brake fluid. Install the assembly into the master cylinder, making sure it is the correct way round (see illustration 5.13b). Make sure the lips on the cup do not turn inside out when they are slipped into the bore. On TDM models slide in the pushrod with its washer. Depress the piston and install the new circlip, making sure that it locates in the master cylinder groove (see illustration 5.13a).

20 Install the rubber dust boot, making sure

the lip is seated correctly in the groove (see illustration 5.12).

21 On TRX models, fit a new O-ring onto the reservoir hose union, then press the union into the master cylinder and secure it with the circlip. Fit the rubber cap over the circlip.

22 Inspect the reservoir cover rubber diaphragm and renew it if it is damaged or deteriorated.

Installation

23 If removed, on TDM and TRX models, install the brake light switch (see Chapter 9).

24 Attach the master cylinder to the handlebar and, where marked, fit the clamp with its UP mark facing up, aligning the top mating surfaces of the clamp with the punch mark on the handlebar (see illustration). Tighten first the upper bolt, then the lower bolt to the torque setting specified at the beginning of the Chapter (see illustrations 5.8a and b).

25 Connect the brake hose(s) to the master cylinder, using new sealing washers on each side of the union(s), and aligning the hose(s) as noted on removal (see illustrations 5.6a and b). Tighten the banjo bolt to the torque setting specified at the beginning of this Chapter.

26 Install the brake lever (see Chapter 6), and on TDM and XTZ models the rear view mirror.

27 On TRX models, mount the reservoir onto its bracket and tighten the bolt securely (see illustration 5.7a). Connect the reservoir hose to the union and secure it with the clamp (see illustration 5.7b).

28 On TDM and TRX models, connect the brake light switch wiring (see illustrations 5.4a and b). On XTZ models, fit the switch into the lever bracket.

29 Fill the fluid reservoir with new DOT 4 brake fluid as described in *Daily (pre-ride) checks*. Refer to Section 8 of this Chapter and bleed the air from the system.

30 Fit the rubber diaphragm, making sure it is correctly seated, the diaphragm plate and the cover or cap onto the master cylinder reservoir (see illustration 5.3a). On TRX models, fit the cap clamp (see illustration 5.3b).

31 Check the operation of the front brake before riding the motorcycle.

6 Rear brake master cylinder - ^ removal, overhaul and S J^ 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 8), and the hydraulic hoses 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 obtain a new piston/seal kit. Also, you will need some new DOT 4 brake fluid, some clean rags and internal circlip pliers. **Note:** To prevent damage to the paint 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 TDM models, remove the seat, and on XTZ models remove the right-hand side cover (see Chapter 8).

4 Unscrew the bolt securing the master cylinder fluid reservoir to the frame, then remove the reservoir cap and pour the fluid into a container (see illustrations). Release



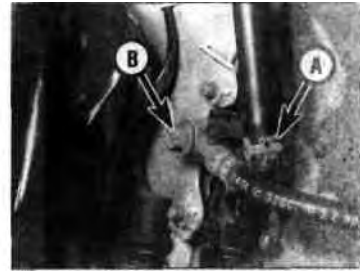
6.4a Master cylinder reservoir screw (arrowed) - TDM models



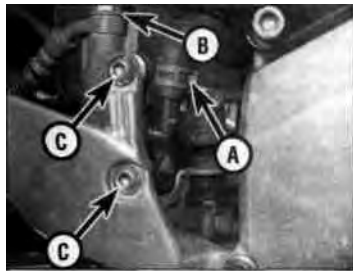
6.4b Master cylinder reservoir screw (arrowed) - TRX models



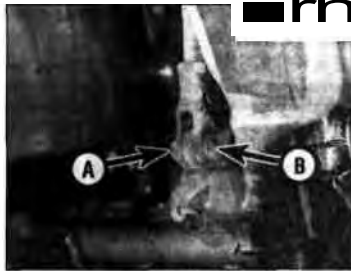
6.4c Master cylinder reservoir bolt (arrowed) - XTZ models



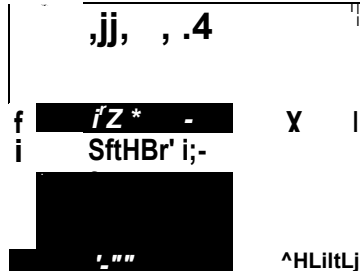
6.4d Reservoir hose clamp (A), brake banjo bolt (B) - TDM models



6.5b Reservoir hose clamp (A), brake hose banjo bolt (B), master cylinder mounting bolts (C) - TRX models



6.6 Remove the split pin (A) and withdraw the clevis pin (B)



6.7 Master cylinder mounting bolts (arrowed) - TDM shown

the clamp securing the reservoir hose to the union on the master cylinder and detach the hose (see illustrations 6.5a and b). 5 Unscrew the brake hose banjo bolt and separate the brake hose from the master cylinder, noting its alignment (see illustrations). Discard the two sealing washers as they must be renewed. 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.

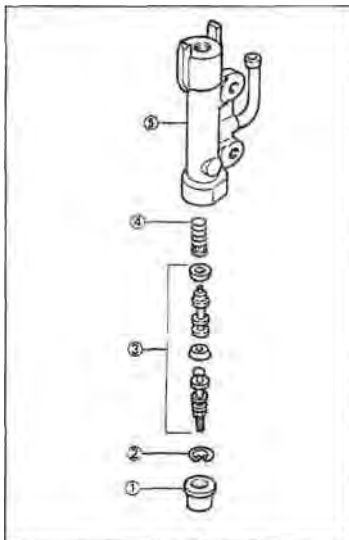
1 Remove the split pin and washer from the clevis pin securing the brake pedal to the master cylinder pushrod (see illustration). Withdraw the clevis pin and separate the pedal from the pushrod. Discard the split pin as a new one must be used. 2 Unscrew the two bolts securing the master cylinder to the bracket and remove the master cylinder (see illustration and 6.5b).

Overhaul

8 If required, mark the position of the clevis locknut on the pushrod, then slacken the locknut and thread the clevis and its base nut off the pushrod (see illustration).

9 Dislodge the rubber dust boot from the base of the master cylinder to reveal the pushrod retaining circlip (see illustrations).

10 Depress the pushrod and, using



6.9a Master cylinder components

Rubber boot
Circlip
Piston/seal assembly
Spring
Master cylinder



6.8 Hold the clevis and slacken the locknut

6.9b Remove the dust boot from the



pushrod

7«12 Brakes, wheels and tyres



6.10 Depress the piston and remove the circlip from the cylinder

circlip pliers, remove the circlip (**see illustration**). Slide out the piston assembly and spring. 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.

11 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).

12 Check the master cylinder bore for corrosion, scratches, nicks and score marks. If damage is evident, the master cylinder must be renewed. If the master cylinder is in poor condition, then the caliper should be checked as well.

13 Inspect the reservoir hose for cracks or splits and renew if necessary. If required, on TDM models remove the screw and on XTZ models the circlip securing the hose union to the master cylinder. On TRX models the union is a push fit. Pull the union from the master cylinder. Discard the O-ring or bush (TRX models) as a new one must be used.

14 The dust boot, circlip, piston, seal, primary cup and spring are only available as a kit. Use all of the new parts, regardless of the apparent condition of the old ones. If the seal and cup are not already on the piston, fit them according to the layout of the old piston assembly.



7.2 Flex the brake hoses and check for cracks, bulges and leaking fluid

15 Install the spring in the master cylinder so that its tapered end faces the piston.

16 Lubricate the piston, seal and cup with clean brake fluid. Install 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.

17 Install and depress the pushrod, then fit a new circlip, making sure it is properly seated in the groove.

18 Install the rubber dust boot, making sure the lip is seated properly in the groove.

19 If removed, fit a new O-ring or bush (TRX models) to the fluid reservoir hose union, then push the union into the master cylinder and on TDM and XTZ models secure it with its screw or circlip.

Installation

20 If removed, install the clevis locknut, the clevis and the base nut onto the master cylinder pushrod end. Position the clevis as noted on removal, then tighten the clevis locknut securely (**see illustration 6.8**).

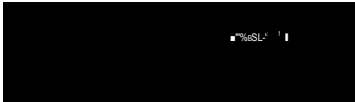
21 Install the master cylinder onto the footrest bracket and tighten its mounting bolts to the torque setting specified at the beginning of the Chapter (**see illustration 6.5b and 6.7**).

22 Align the brake pedal with the master cylinder pushrod clevis, then slide in the clevis pin and secure it using a new split pin, not forgetting the washer (**see illustration 6.6**).

23 Connect the brake hose banjo bolt to the master cylinder, using a new sealing washer on each side of the banjo union. Ensure that the hose is positioned so that it butts against the lug and tighten the banjo bolt to the specified torque setting (**see illustrations 6.5a and b**).

24 Secure the fluid reservoir to the frame with its retaining bolt (**see illustrations 6.4a, b and c**). 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 6.5a and b**). Check that the hose is secure and clamped at the reservoir end as well. If the clamps have weakened, use new ones.

25 Fill the fluid reservoir with new DOT 4



7.4 Remove the banjo bolt and separate the hose from the caliper; there is a sealing washer on each side of the fitting

brake fluid (*see Daily (pre-ride) checks*) and bleed the system following the procedure in Section 8.

26 On TDM models, install the seat, and on XTZ models install the right-hand side cover (*see Chapter 8*).

27 Check the operation of the brake carefully before riding the motorcycle.

7 Brake hoses, pipes and unions - inspection and replacement

Inspection

1 Brake hose and pipe condition should be checked regularly and the hoses renewed at the specified interval (*see Chapter 1*).

2 Twist and flex the rubber hoses while looking for cracks, bulges and seeping fluid (**see illustration**). Check extra carefully around the areas where the hoses connect with the banjo fittings, as these are common areas for hose failure.

3 Inspect the metal brake pipe (1996-on models) and the banjo union fittings connected to the brake hoses. If the fittings are rusted, scratched or cracked, renew them.

Replacement

4 The brake hoses have banjo union fittings on each end, with the exception of the rear caliper hose on TDM models which has a joint piece. On 1996-on TDM models, the brake pipe splitting the front brake hose has flare nuts. Cover the surrounding area with plenty of rags and unscrew the banjo bolt or flare nut at each end of the hose or pipe, noting its alignment. On the rear caliper on TDM models, counter-hold the hose nut and unscrew the locknut and separate the hose from the hose joint in the caliper (**see illustration 3.2b**). If required, unscrew the joint from the caliper. Free the hose or pipe from any clips or guides and remove it. Discard the sealing washers on the hose unions (**see illustration**).

5 Position the new hose or pipe, 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 or pipe as noted on removal. Install the hose banjo bolts using new sealing washers on both sides of the unions. Tighten the banjo bolts to the torque settings specified at the beginning of this Chapter. Do not overtighten the brake pipe flare nuts. On the rear caliper on TDM models, if removed, thread the joint piece into the caliper using a new sealing washer and tighten securely (**see illustration 3.2b**). Fit the hose against the hose joint and tighten the locknut onto the hose, counter-holding the hose nut to prevent the hose twisting. Do not overtighten the locknut. Make sure the hoses and pipes are correctly aligned and routed clear of all moving components.



8.6a Brake caliper bleed valve



8.6b To bleed the brakes, you need a spanner, a short section of clear tubing, and a clear container half-filled with brake fluid

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 8). Check the operation of the brakes carefully before riding the motorcycle.

8 Brake system - 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 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 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 rear brake, on TDM models, remove the seat, and on XTZ models remove the right-hand side cover (see Chapter 8) for access to the fluid reservoir.

5 Remove the reservoir cover or cap, diaphragm plate (where fitted) and diaphragm and 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. Doing this bleeds the air from the master cylinder end of the line. Loosely refit the reservoir cover.

6 Pull the dust cap off the bleed valve (see illustration). 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).

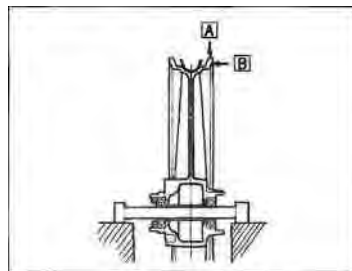
7 Remove the reservoir cover and check the fluid level. Do not allow the fluid level to drop below the lower mark during the bleeding process.

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 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.

10 On TDM and TRX models front brakes, go on to bleed air from the other brake caliper. On the rear brake of TDM and TRX models, go on to bleed air from the other side of the caliper (two bleed valves are fitted).

11 Install the diaphragm and cover assembly, wipe up any spilled brake fluid and check the entire system for leaks.



9.2 Check the wheel for radial (out-of-round) runout (A) and axial (side-to-side) runout (B)

BWJrPl *If it's not possible to produce a firm feel to the HIIUT 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.*

Wheels - inspection and repair

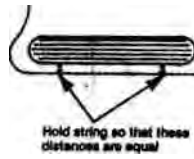
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1 In order to carry out a proper inspection of the wheels, it is necessary to support the bike upright so that the wheel being inspected is raised off the ground. Position the motorcycle on an auxiliary stand. Clean the wheels thoroughly to remove 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 slider or the swingarm and position its stem against the side of the rim. 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 (see illustration).

3 An easier, though slightly less accurate, method is to attach a stiff wire pointer to the fork slider 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 or hub bearings very carefully before replacing the wheel.*

7»14 Brakes, wheels and tyres



String held taut

4 The wheels should also be visually inspected for cracks, flat spots on the rim and other damage. On cast alloy wheels, look very 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 renewed. Never attempt to repair a damaged cast alloy wheel.

5 On XTZ models, check for loose or broken spokes. Tapping the spokes with a screwdriver is the best guide to their tension. A loose spoke will make a dull flat note compared to a tight one. Loose spokes must be tightened by turning the nipple at the spoke end in an anti-clockwise direction. Always check for runout after altering the tension in any of the spokes. Small irregularities can be corrected by adjusting the spokes in the affected area, although a certain amount of practice is necessary to prevent over-correction. If the wheel runout continues to be excessive, take the wheel to a professional wheel builder for inspection and adjustment.

10 Wheel 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 and 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. 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.

Check for contact here

5 Run the other end of the string forward and

pull it tight so that it is roughly parallel to the floor.

6 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 (see illustration).

7 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.

8 As was previously pointed out, a perfectly straight length of wood may be substituted for the string (see illustration). The procedure is the same.

9 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.

10 If the front-to-back alignment is correct, the wheels still may be out of alignment vertically.

11 Using the 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 auxiliary stand.

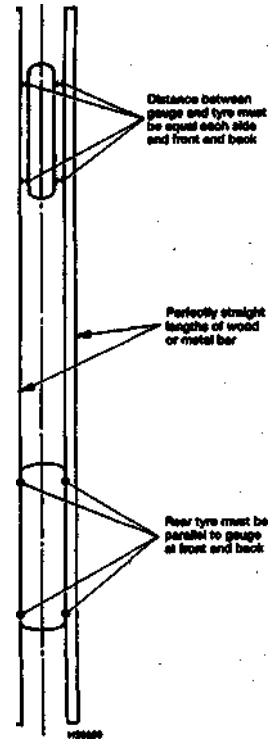
12 Once the rear wheel is vertical, check the front wheel in the same manner. If both wheels are not perfectly vertical, the frame and/or major suspension components are bent.

11 Front wheel-removal and installation

Removal

1 Position the motorcycle 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 Remove the brake caliper mounting bolts

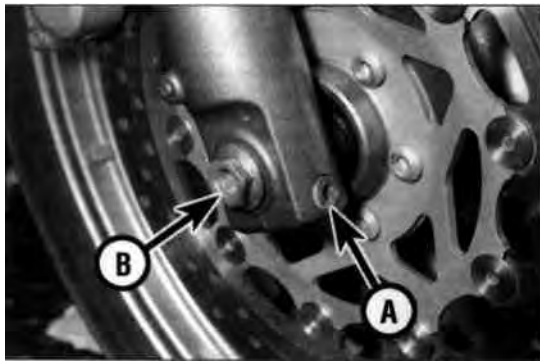


10.7 Wheel alignment check using a straight-edge

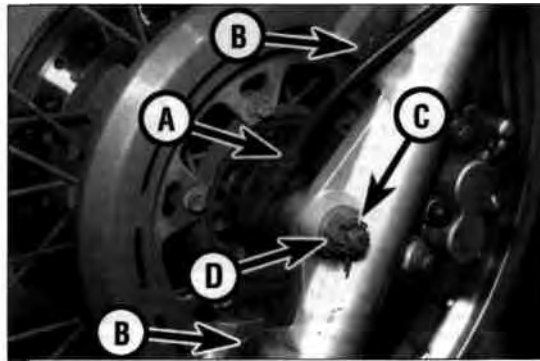
and slide the calipers off the discs (see Section 3). Support the calipers with a piece of wire or a bungee cord so that no strain is placed on the hydraulic hoses. There is no need to disconnect the hoses from the calipers. **Note:** Do not operate the front brake lever with the calipers removed. 3 On TRX, XTZ and 1991 to 1998 TDM models, unscrew the knurled ring securing the speedometer cable to the drive gear and detach the cable (see illustration and 11.5).



11.3 Unscrew the ring (arrowed) and detach the cable



11.4 Slacken the clamp bolt (A) and unscrew the axle (B)



11.5 Speedometer cable (A), disc cover screws (B), split pin (C), axle nut (D)

On 1999 TDM models, trace the wiring from the speedometer drive gear up to its 3-pin connector and disconnect it, then free the wiring from the clips which retain it to the brake hose; alternatively, leave the wiring attached so that as the wheel is removed the drive gear is left joined to its lead.

4 On TDM and TRX models, slacken the axle clamp bolt on the bottom of the right-hand fork, then unscrew the axle (see illustration).

5 On XTZ models, first remove the screws securing the disc covers and remove the covers (see illustration). Remove the split pin from the end of the axle, then unscrew the axle nut and remove the washer. Counter-hold the axle head to prevent it turning if necessary. Discard the split pin as a new one should be used.

6 Support the wheel, then withdraw the axle from the right-hand side and carefully lower the wheel. Use a drift to drive out the axle if required.

7 Remove the spacer from the right-hand side of the wheel and the speedometer drive gear from the left-hand side, noting how they fit (see illustrations).

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 axle is bent, renew it.

9 Check the condition of the wheel bearings (see Section 13).

Installation

10 Apply lithium-based grease to the wheel spacer, the lips of the grease seals and to the to the speedometer drive gear. Fit the spacer into the right-hand side of the wheel and the drive gear into the left-hand side, making sure

the tabs locate in the slots (see illustrations 11.7a and b).

11 Manoeuvre the wheel into position. Apply a thin coat of grease to the axle.

12 Lift the wheel into place between the fork sliders, making sure the spacer and drive gear remain in position, and that the slot in the drive gear locates over the tab on the inside of the fork (see illustration). Slide the axle in from the right-hand side (see illustration).

13 On TDM and TRX models, tighten the axle to the torque setting specified at the beginning of the Chapter (see illustration).

11.7b ... and the speedometer drive gear housing



11.7a Remove the spacer...



11.12a Locate the tab on the inside of the fork in the slot in the top of the housing ...



11.12b ... and insert the axle



11.13 Tighten the axle to the specified torque

7*16 Brakes, wheels and tyres

Now tighten the axle clamp bolt on the bottom of the right-hand fork to the specified torque setting (see illustration 11.4).

14 On XTZ models, fit the washer and axle nut, then counter-hold the head of the axle and tighten the nut to the torque setting specified at the beginning of the Chapter. Fit a new split through the end of the axle (see illustration 11.5). Install the disc covers.

15 Install the brake calipers, making sure the pads sit squarely on either side of the discs (see Section 3). Tighten the caliper mounting bolts to the specified torque setting.

16 Fit the speedometer cable into the drive housing and tighten the knurled ring securely (see illustrations 11.3 and 11.5). On 1991 TDM models if the speedometer wiring was disconnected, remake the 3-pin connector and secure the wiring to the brake hose and the guide provided on the brake caliper lower mounting bolt; use the proper clips to secure the wire to the brake hose and don't fasten them too tight otherwise the hose will be distorted.

17 Apply the front brake a few times to bring the pads back into contact with the discs. Move the motorcycle off the stand, apply the front brake and pump the front forks a few times to settle all components in position.

18 Check for correct operation of the front brake before riding the motorcycle.

12 Rear wheel - removal and installation

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Removal

1 Position the motorcycle on an auxiliary stand so that the wheel is off the ground. On XTZ models, unscrew the bolts securing the rear brake caliper shield and remove the cover (see illustration 3.1).

2 Remove the brake caliper mounting bolts and slide the caliper off the disc (see Section 3). Support the caliper with a piece of wire or a bungee cord so that 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 calipers removed. On TDM models, slacken the caliper bracket bolt on the swingarm (see illustration).

3 Where fitted, remove the split pin from the axle nut on the end of the axle (see illustration). Unscrew the axle nut and remove the washer, and on TRX models the adjuster position marker (see illustration).

4 Support the wheel then withdraw the axle and lower the wheel to the ground (see illustration). On TRX models, retrieve the adjustment position marker. Note how the caliper bracket locates between the wheel and the swingarm.

5 Disengage the chain from the sprocket and remove the wheel from the swingarm (see illustration 12.10).

Caution: Do not lay the wheel down and allow it to rest on the disc or the sprocket - they could become warped. Set the wheel on wood blocks so the disc or the sprocket doesn't support the weight of the wheel. Do not operate the brake pedal with the wheel removed.

6 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 axle is bent, renew it.

7 Remove the collar from each side of the wheel, noting which fits where (see illustrations). Check the condition of the grease seals and wheel bearings (see Section 13).

Installation

8 Apply a thin coat of lithium-based grease to the lips of each grease seal, and also to the collars and the axle. On TRX models, slide the right-hand adjustment position marker onto the axle, making sure it is the correct way round.

9 Install the short collar into the left-hand side of the wheel and the long shouldered collar into the right-hand side (see illustrations 12.7b and a). Manoeuvre the wheel so that it is in between the ends of the swingarm. Align



12.2 On TDM models, slacken the caliper bracket bolt (arrowed)



12.3a Rear axle nut and split pin -1991 to 1995 TDM models



12.3b Rear axle nut (A) and position marker (B) - TRX models



12.4 Withdraw the axle and remove the wheel



12.7a Remove the collar from each side...



12.7b ... noting which way round they fit

12.10 Manoeuvre the wheel into position and fit the chain onto the sprocket

the brake caliper bracket, on XTZ models locating it against the swingarm so that the lug on the swingarm fits into the slot in the bracket.

10 Engage the drive chain with the sprocket and lift the wheel into position (see illustration). Make sure the collars and caliper bracket remain correctly in place.

11 Install the axle with its washer, or on TRX models with the adjustment marker (see illustration 12.4). On 1991 to 1995 TDM models, the axle goes in from the left, while on all other models it goes in from the right. Make sure it passes through the chain adjusters and the caliper bracket. On TRX models, align the flats on the axle head with the adjustment marker (see illustration). Check that

12.11 On TRX models, make sure the axle head locates correctly in the adjustment marker

everything is correctly aligned, then fit the left-hand adjustment position marker (TRX models), the washer and the axle nut (see illustration 12.3b). Tighten the nut lightly at this stage, on TDM and XTZ models counter-holding the axle head on the other side of the wheel.

12 Adjust the chain slack as described in Chapter 1. Now tighten the axle nut to the specified torque setting. On 1991 to 1995 TDM models and XTZ models, secure the nut using a new split pin (see illustration). On TDM models, tighten the caliper bracket bolt to the specified torque setting (see illustration 12.2).

13 Install the brake caliper, making sure the pads sit squarely on either side of the disc

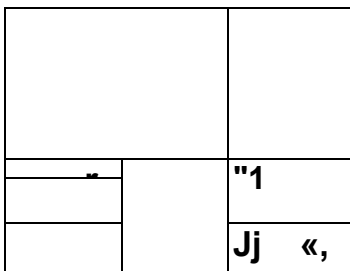
13.3b ... then lever out the retainer plate and remove the drive plate (arrowed)



13.3a Lever out the grease seal...



13.5a Knock out the bearings using a drift...



13.5b ... locating it as shown

12.12 Where fitted, use a new split pin

(see Section 3). Tighten the caliper mounting bolts to the specified torque setting. On XTZ models, install the caliper shield (see illustration 3.1).

14 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.

13 Wheel bearings - removal, inspection and installation

Front wheel bearings

Note: Always renew the wheel bearings in pairs. Never renew the bearings individually. Avoid using a high pressure cleaner on the wheel bearing area.

- 1 Remove the wheel (see Section 11).
- 2 Set the wheel on blocks so as not to allow the weight of the wheel to rest on the brake disc.
- 3 On 1991 to 1998 TDM and all TRX models, lever out the grease seal on each side of the wheel using a flat-bladed screwdriver, taking care not to damage the rim of the hub (see illustration). Discard the seals if they are damaged or deteriorated. Lever out the retainer plate on the left-hand side of the wheel and remove the speedometer drive plate, noting how it fits (see illustrations).

[JEffffq?] Position a piece of wood "***" against the wheel to prevent**

the screwdriver shaft damaging it when levering the grease seals out.

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4 On XTZ models, lever out the grease seal on the right-hand side of the wheel using a flat-bladed screwdriver, taking care not to damage the rim (see illustration 13.3).

5 Using a metal rod (preferably a brass drift punch) inserted through the centre of the 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.

7*18 Brakes, wheels and tyres



13.10 A socket can be used to drive in the bearing



13.12a Fit the drive plate as described .



13.12b ... then fit the retainer plate

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.*

BWJHS Refer to *Tools and IlfilhTI workshop Tips (Section 5)*

for more information about bearings.

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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, renew it.

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 lithium-based grease.

10 Thoroughly clean the hub area of the wheel. Install the right-hand bearing into its recess in 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 left-hand bearing into place as described above.

12 On 1991 to 1998 TDM and all TRX models, fit the speedometer drive plate into the left-hand side of the wheel, with the drive tabs facing out and aligning the flat tabs with the cutouts in the hub (**see illustration**). Press the retainer plate onto the drive plate (**see illustration**).

13 Apply a smear of lithium-based grease to the lips of the seal(s), then press them into the wheel, using a seal or bearing driver or a suitable socket to drive it into place if necessary (**see illustration**).

14 Clean off all grease from the brake discs using acetone or brake system cleaner then install the wheel (see Section 11).

Rear wheel bearings

15 Remove the rear wheel (see Section 12). Lift the sprocket coupling out of the wheel, noting how it fits (**see illustration**).

16 Set the wheel on blocks so as not to allow the weight of the wheel to rest on the brake disc.

17 Lever out the grease seal on the right-hand side of the wheel using a flat-bladed screwdriver, taking care not to damage the

rim of the hub (**see illustration**). Discard the seal as a new one should be used.

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 (**see illustrations 13.5a and b**). 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. First install the right-hand bearing into its recess in 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 squarely until it's completely seated (**see illustration 13.10**).

22 Turn the wheel over and install the bearing spacer. Drive the left-hand side bearing into place as described above.

23 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 to drive it into place if necessary (**see illustration**).

24 Clean off all grease from the brake disc



13.13 Press the grease seal into place



13.15 Lift the sprocket coupling out of the wheel



13.17 Lever out the grease seal



13.23 Where the seal sits flush with the rim, a piece of wood can be used as shown



13.26a Use a socket to drive out the spacer...



13.26b ... noting how it fits
13.27 Drive the bearing out from the inside

using acetone or brake system cleaner. Install the sprocket coupling assembly onto the wheel, then install the wheel (see Section 12).

Sprocket coupling bearing

25 Remove the rear wheel (see Section 12). Lift the sprocket coupling out of the wheel, noting how it fits (see illustration 13.15).

26 Remove the spacer from the inside of the coupling bearing, using a suitable socket to drive it out if it is tight, noting which way round it fits (see illustrations). Using a flat-bladed screwdriver, lever out the grease seal from the outside of the coupling (see illustration).

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 bearings.

29 Thoroughly clean the bearing recess then install the bearing into the recess in the coupling, with the marked or sealed side facing out. 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 is completely seated (see illustration 13.10).

30 Apply a smear of grease to the lips of the new seal, and press it into the coupling, using



13.26c Lever out the grease seal



a seal or bearing driver, a suitable socket or a flat piece of wood to drive it into place if necessary (see illustration). Install the spacer into the inside of the coupling, making sure it is the correct way round (see illustration 13.26b), and drive it into place if it is tight (see illustration).

31 Check the sprocket coupling/rubber damper (see Chapter 6).

32 Clean off all grease from the brake disc using acetone or brake system cleaner. Fit the sprocket coupling into the wheel (see illustration 13.15), then install the wheel (see Section 12).

14 Tyres - general information and fitting

General information

- 1 The wheels fitted on TDM and TRX models are designed to take tubeless tyres only. The wheels fitted on XTZ models are designed to take tubed tyres only. Tyre sizes are given in the Specifications at the beginning of this chapter.
- 2 Refer to the Daily (pre-ride) checks listed at



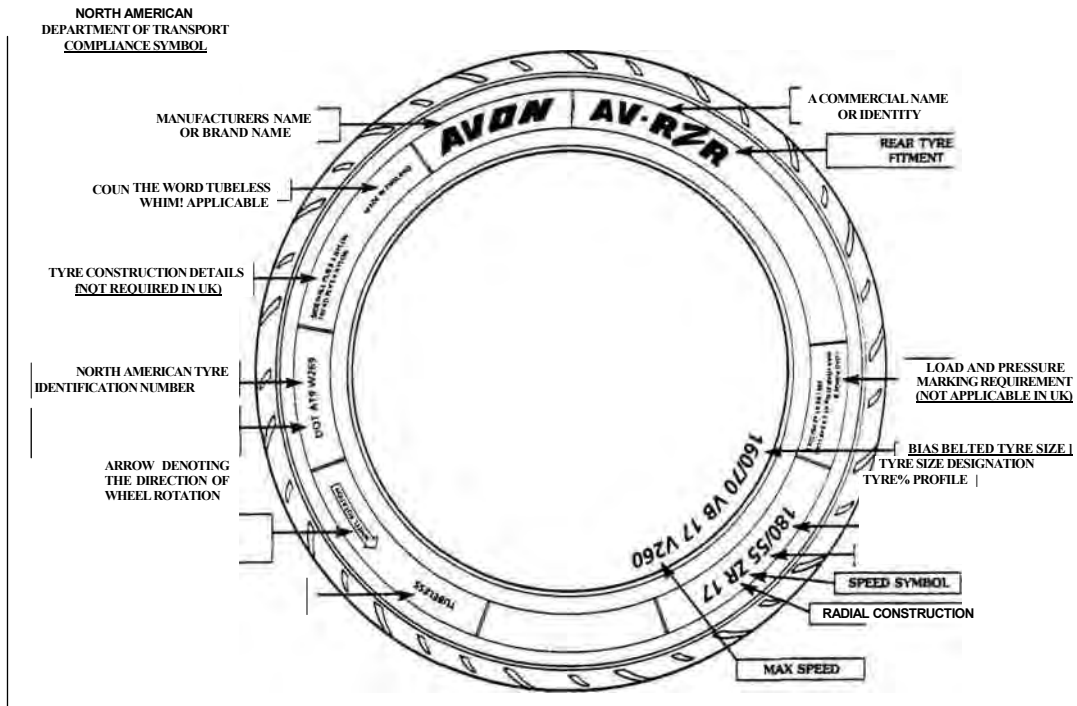
13.30a Fit the grease seal...



13.30b ... and the spacer

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7*20 Brakes, wheels and tyres



14.3 Common tyre sidewall markings

the beginning of this manual for tyre maintenance.

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 Yamaha 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. Any such repairs must be carried out professionally by a motorcycle tyre fitting specialist and advice sought on reduced speed limits for repaired tyres.

6 A punctured tubed tyre is best repaired by fitting a new inner tube and of course removing the item which caused the puncture from the tyre tread. Inner tubes can be repaired using a kit, but the safest option is to renew the inner tube.

Chapter 8 Bodywork

Contents

Engine bashplate - removal and installation	7	General information	1
Fairing - removal and installation	5	Seat - removal and installation	2
Fairing side panels - removal and installation	4	Side covers - removal and installation	3
Front mudguard - removal and installation	6		

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	fk iiS	Difficult , suitable for experienced DIY mechanic	15	Very difficult, suitable for expert DIY or professional
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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 renew it (or replace it with a used one from a breaker). Note that there are however some companies that specialise in 'plastic welding' and there are a number of bodywork repair kits now available for motorcycles.

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 renewing broken fairing panels!

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 are in good condition, including all trim nuts or clips and damping/rubber mounts;

any of these must be renewed 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.

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. Where quick-release fasteners are fitted, turn them 90° anti-clockwise to release them, and 90° clockwise to secure them.

BERTHS *Note, hat a sma n moun ζot*
Bhjimsi *lubricant (liquid soap or similar) applied to mounting rubber grommets will assist pegs to engage without the need for undue pressure.*

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8*2 Bodywork



2.2 Turn the key to release the latch



2.3 Make sure the seat locates correctly against the tank ■ peg-type (arrowed)

2 Seat-removal and installation

1991 to 1995 TDM models

1 Pull the sides of the seat away from the fuel tank to release the Velcro fastener or the pegs from the grommets.

2 Insert the ignition key into the seat lock located behind the rider's seat, and turn it clockwise to unlock the seat (see illustration). Remove the seat, noting how it fits.

3 Installation is the reverse of removal. Make sure the tab at the front of the seat locates correctly under the tank bracket. Make sure the Velcro fastens or the pegs locate correctly in their rubber grommets (see illustration). Push down on the rear of the seat to engage the latch.

1996-on TDM models

4 Insert the ignition key into the seat lock

located behind the rider's seat, and turn it clockwise to unlock the seat. Remove the seat, noting how it fits.

5 Installation is the reverse of removal. Make sure the tabs at the front of the seat locate correctly under and on the back of the tank. Push down on the rear of the seat to engage the latch.

TRX models

6 Insert the ignition key into the seat lock located below the side cover on the left-hand side, and turn it clockwise to unlock the passenger seat (see illustration). Remove the seat, noting how it fits.

7 Pull back the latch at the back of the rider's seat and remove the seat, noting how it fits (see illustration).

8 Installation is the reverse of removal. Make sure the tabs at the front of the rider's seat locate correctly under the tank bracket, then push down on the back of the seat to engage the latch. Make sure the hooks on the front of the passenger seat locate correctly under the

hooks, then push down on the rear of the seat to engage the latch.

XTZ models

9 Remove the side covers (see Section 3).

10 Unscrew the bolt securing each side of the seat and remove the seat, noting how it fits (see illustration).



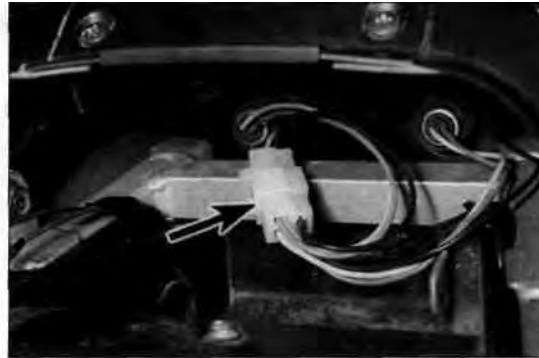
2.6 Turn the key in the lock (arrowed) and remove the passenger seat



2.7 Pull back the latch to release the rider's seat



2.10 Unscrew the bolt on each side (arrow) and remove the seat



3.1 Disconnect the tail light wiring connector (arrowed)

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2.11 Locate the tab (A) under the bracket (B)

11 Installation is the reverse of removal. Make sure the tab at the front of the seat locates correctly under the tank bracket, then tighten the bolts securely (see illustration).

Side covers - removal and installation

TDM models

1 Remove the seat (see Section 2). Disconnect

the tail light wiring connector (see illustration).

2 Unscrew the four bolts securing the side cover assembly to the frame (see illustration). Carefully pull each side away from the frame at the front to release the clips from the grommets (see illustration). Carefully lift one side up to clear the frame then remove the assembly along with the tail light (see illustration).

3 Installation is the reverse of removal.

TRX models

4 Remove the seats (see Section 2).

5 Remove the six screws securing the side cover assembly (see illustration). Carefully lift one side up to clear the frame then remove the assembly (see illustration).

6 Installation is the reverse of removal.

XTZ models

7 Remove the screw securing the side cover (see illustration). Carefully pull the cover away from the frame to release the pegs from the grommets, one at each end of the cover (see illustration).

8 Installation is the reverse of removal.



3.2a Unscrew the two bolts (arrowed) on each side ...



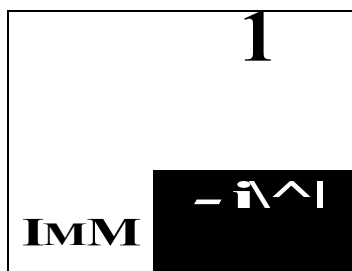
3.2b ... then release each clip from its grommet (arrow)...



3.2c ... and remove the side cover assembly



3.5a Remove the three screws (arrowed) on each side ...



3.5b ... and remove the side cover assembly



3.7a Remove the screw (arrowed)...

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8*4 Bodywork



3.7b ... then draw the cover away to release the pegs from the grommets (arrowed)



4.1 a Remove the four screws (arrowed)...



4.1b ... and remove the panel

liring side panels
removal and installation



2 Installation is the reverse of removal.

panel, noting how it locates onto the lug on the frame.

5 Installation is the reverse of removal.

1991 to 1995 TDM models

1 Remove the four screws securing the side panel and carefully manoeuvre the panel away, noting how it fits (see illustrations).

1996-on TDM models

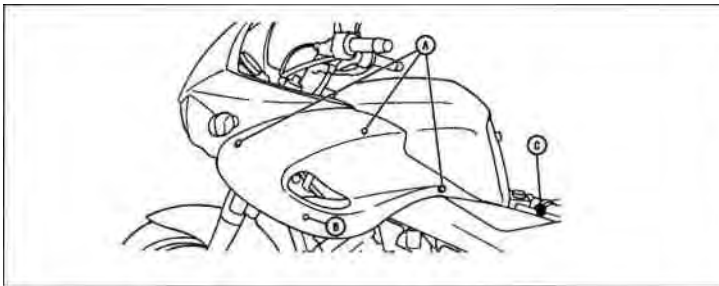
3 Remove the three screws securing the side panel, then carefully draw the panel away to release the peg from the grommet (see illustration).

4 If required, remove the single screw securing the side trim panel and remove the

XTZ models

6 Remove the seven screws securing the side cover (see illustration). Carefully release the slot at the bottom from the tab, then release the tabs at the top from the fairing and remove the panel (see illustrations).

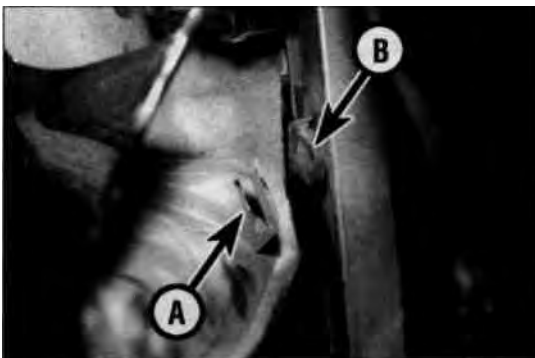
7 Installation is the reverse of removal.



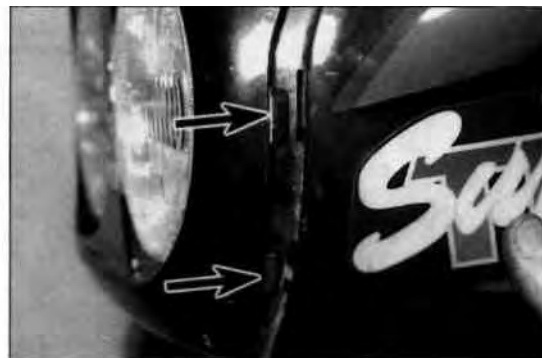
4.3 Fairing side panel screws (A), peg location (B) and trim panel screw (C)



4.6a Remove the screws (arrowed)...



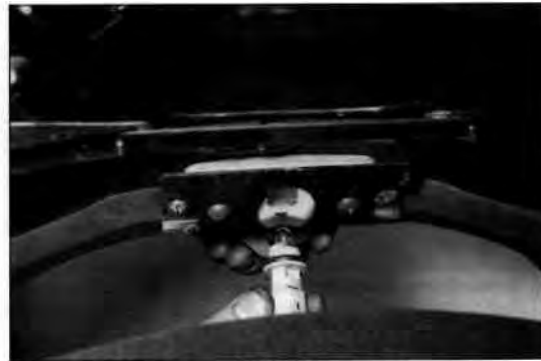
4.6b ... then release the slot (A) from the tab (B) on the frame...



4.6c ... and the tabs (arrowed) from the slots in the fairing



5.2a Remove the screws and bolts (arrowed)...



5.2b ... then draw the fairing forward and remove the auxiliary light bulbholder...

5 Fairing -
removal and installation

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1991 to 1995 TDM models

Removal

1 Remove the fairing side panels (see Section 4).
2 Remove the two screws and two bolts securing the fairing (see illustration) on each side. Carefully draw the fairing up and forward until the auxiliary light bulbholder becomes accessible, then remove it from the auxiliary light and remove the fairing (see illustrations).
Installation

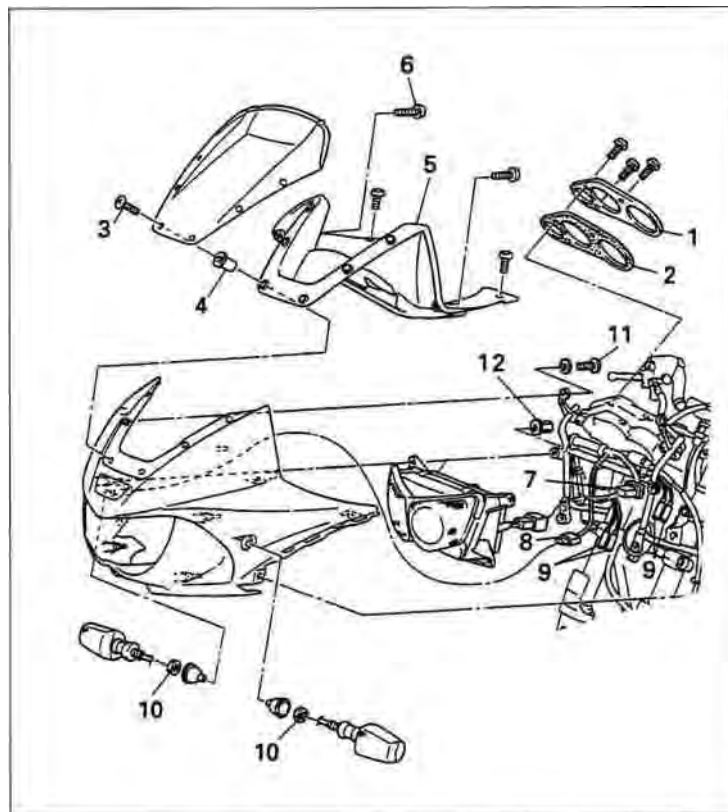
3 Installation is the reverse of removal. Make sure the wiring connector is correctly and securely connected.

1996-on TDM models Removal

4 Remove the fairing side panels (see Section 4). Remove the three screws securing the instrument cluster cover and remove the cover and the foam damper (see illustration).
5 Remove the screws securing the windshield and remove the windshield. Ease the rubber expanders out of the windshield mounting points in the fairing.



5.2c ... and remove the fairing



5.4 Fairing mountings

- | | | |
|----------------------------|-----------------------------|-----------------------------------|
| 1 Instrument cluster cover | 5 Cockpit trim panel | 9 Turn signal connectors |
| 2 Foam clamber | 6 Screw -4 off | 10 Turn signal retaining nuts |
| 3 Windshield screw -6 off | 7 Headlight connector | 11 Fairing mounting screw - 2 off |
| 4 Rubber expander - 6 off | 8 Auxiliary light connector | 12 Fairing mounting nut -4 off |

8

8*6 Bodywork



5.10a Unscrew the nuts (arrowed).



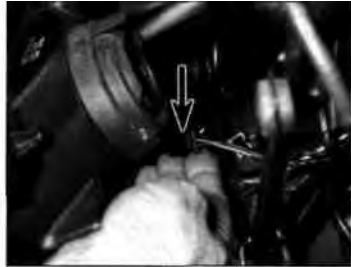
5.10b ... withdraw the screws and remove the mirrors...



5.10c ... and the rubber pad



5.11a Disconnect the headlight wiring connector (arrowed)...



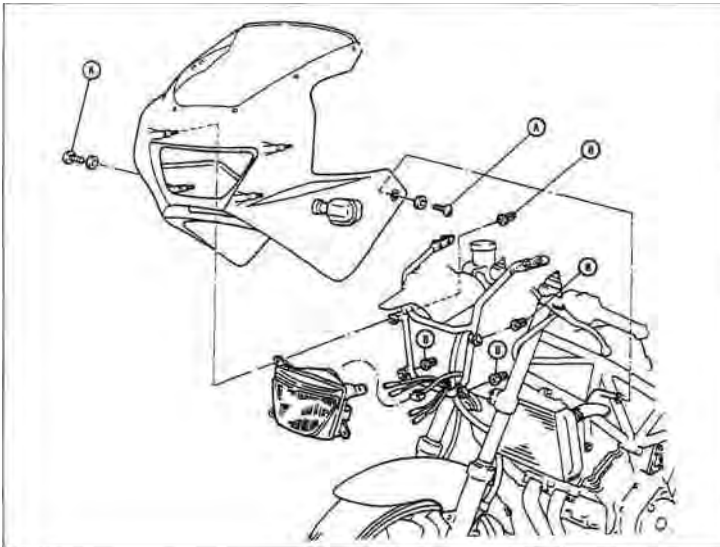
5.11b ... the auxiliary light wiring connector (arrowed)...



5.11c .. and the turn signal wiring connectors

6 Remove the remaining screws securing the turn signal to the fairing. Thread the nut off the cockpit trim panel and remove the panel.
 7 Reach inside the fairing and disconnect the headlight, auxiliary light and turn signal wiring connectors. Unscrew the nut which retains each

5.12 Fairing mounting screws (A) and nuts (B)



remove it along with the headlight. If required, lift the headlight out of the fairing. **Installation**

9 Installation is the reverse of removal. Make sure the wiring connectors are correctly and securely connected. Check that the headlight, auxiliary light and turn signals are all working.

TRX models

Removal

10 Unscrew the nuts securing the rear view mirrors to the fairing bracket and remove the mirrors along with the rubber pads (**see illustrations**).

11 Disconnect the headlight, auxiliary light and turn signal wiring connectors (**see illustrations**).

12 Remove the screw securing each side of the fairing and the four nuts securing the fairing and headlight to the bracket (**see illustration**). Carefully draw the fairing forward and remove it along with the headlight. If required, lift the headlight out of the fairing.

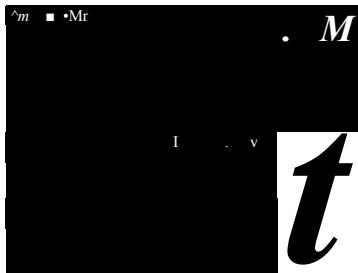
Installation

13 Installation is the reverse of removal. Make sure the arrow on each rubber pad for the mirror is on the outside and pointing forward (**see illustration 5.10c**). Make sure the wiring connectors are correctly and securely connected. Check that the headlight, auxiliary light and turn signals are all working.

Bodywork 8*7



5.15 Disconnect the headlight wiring connector (A) and the auxiliary light wiring connector (B) for each light



5.16 The headlight comes away with the fairing



6.2a On TDM models, note how the mounting brackets fit

XTZ models

Removal

14 Remove the fairing side panels (see Section 4).

15 Disconnect the headlight wiring connectors and the auxiliary light wiring connectors (see illustration).

16 Remove the three nuts securing the fairing and headlight to the bracket. Carefully draw the fairing forward and remove it along with the headlight (see illustration). If required, lift the headlight out of the fairing.

Installation

17 Installation is the reverse of removal.

Make sure the wiring connectors are correctly the cable and draw it up through the guide on and securely connected. Check that the headlight and auxiliary lights are all working.

6 Front mudguard - removal and installation

(see illustrations).

Installation

3



on is the reverse of removal.

Installati

Unscrew the four bolts securi

Removal

1 On 1991 to 1995 TDM models, unscrew the knurled ring securing the speedometer to the drive housing on the front wheel, then detach

7 Engine bashplate (1991-95 TDM and all XTZ) - removal and installation



3.2b Mudguard mounting bolts (arrowed) TRX models



6.2c On XTZ models, the bolts (arrowed) are on the inside of the fork leg

Removal

1 On TDM models, remove the cap from the end of the through-bolt, then remove the split pin and washer and withdraw the bolt (see illustration). Unscrew the two bolts on the bottom of the plate and remove the bashplate, noting how it fits.

2 On XTZ models unscrew the four bolts securing the bashplate to the frame and engine and remove the plate, noting how it fits (see illustrations).

Installation

3 Installation is the reverse of removal.



7.1 Engine bashplate mountings - TDM models



7.2a The bashplate is secured by a bolt (arrowed) on each side at the front...



7.2b .. and on each side underneath

Chapter 9

Electrical system

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Headlight assembly - removal and installation 8	

Degrees of difficulty

Easy, suitable for novice with little experience	% •^	Fairly easy, suitable for beginner with some experience	^js, \$\$	Fairly difficult, suitable for competent DIY mechanic	k ^	Difficult, suitable for experienced mechanic	^ 3^ > S	Very difficult, suitable for expert or professional	^S ^
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Specifications

Battery

Capacity

TDM and TRX models.....	12V, 10Ah
XTZ models	12V, 14Ah

Voltage - TDM and TRX models

Fully charged	12.8V
Requires charging.....	below 12.5V

Specific gravity - XTZ models

Fully charged	1.280
Requires charging.....	below 1.280

Charging time - TDM and TRX models until fully charged (12.8V) (max 6.5 hrs for a flat battery)

Charging rate - XTZ models 0.4A for 10 hrs

Charging system

Current leakage limit.....	1 mA (max)
Regulated voltage output (no load)	14.3 to 15.3V @ 5000 rpm

Alternator nominal output

TDM and XTZ models.....	14V, 25A @ 5000 rpm
TRX models	14V, 23.5A @ 5000 rpm

Alternator stator coil resistance

1991 to 1995 TDM models and XTZ models	0.20 to 0.30 ohms @ 20°C
1996-on TDM models	0.23 to 0.35 ohms @ 20°C
TRX models	0.22 to 0.32 ohms @ 20°C

9*2 Electrical system

Starter motor

Brush length	
Standard	12.5 mm
Service limit (min)	5 mm
Commutator diameter	
Standard	28 mm
Service limit (min)	27 mm
Mica depth	0.7 mm
Armature coil resistance	0.01 ohms @ 20°C

Fuses

1991 to 1995 TDM models	
Main	30A
Headlight	20A
Signals	10A
Ignition	10A
Fan	10A
1996 to 1998 TDM models	
Main	30A
Headlight	15A
Signals	15A
Ignition	7.5A
Fan	7.5A
1999 TDM models	
Main	30A
Headlight	15A
Signals	15A
Ignition	10A
Auxiliary light and hazard	10A
Fan	7.5A
Back-up	5A
TRX models	
Main	30A
Headlight	15A
Signals	15A
Ignition	7.5A
Fan	7.5A
XTZ models	
Main	30A
Fan	10A

Bulbs

Headlight	
1991 to 1995 TDM models	35/35W halogen x 2
1996-on TDM models	55W halogen H3 x 2
TRX models	60/55W halogen x 1
XTZ models	35/35W halogen x 2
Auxiliary light	
TDM models	5.0W x 1
TRX models	3.4W x 1
XTZ models	3.4W x 2
Brake/tail light	21/5W
Turn signal lights	21W
Instrument and warning lights-TRX, XTZ and 1991 to 1998 TDM models	
Instrument lights	3.4W, 1.7W
Turn signal indicator light	3.4W
Neutral indicator light	3.4W
High beam indicator light	3.4W
Instrument and warning lights - 1999 TDM models	
Instrument lights	2.0W
Turn signal indicator light	1.4W
Neutral indicator light	1.4W
High beam indicator light	1.4W
Coolant warning light	1.4W
Fuel level warning light	2.0W

Torque settings

Transmission output shaft retainer plate bolts	10Nm
Starter motor mounting bolts	10 Nm
Alternator rotor screws	7 Nm
Pick-up coil screws	4 Nm
Alternator rotor bolt	130 Nm

1 General information

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

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

The starter motor is mounted on the bottom of the engine. The starting system includes the motor, the battery, the relay and the various wires and switches. A safety cut-out circuit prevents the starter motor operating unless the transmission is in neutral or the clutch lever is pulled in and the sidestand is up

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

2 Electrical system - fault finding

Warning: *To prevent the risk of fatal short circuits, the ignition (main) switch must always be OFF and the battery negative (-ve) terminal should be disconnected before any of the bike's other electrical components are disturbed. Don't forget to reconnect the terminal securely once work is finished or if battery power is needed for circuit testing.*

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 connection, as several circuits often are routed through the same fuse and earth 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	
HINT	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 8).
- 2 On 1991 to 1995 TDM models, TRX and XTZ models, 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 or holder, where fitted, and remove the battery from the bike (see illustration).
- 3 On 1996-on TDM models, lift the insulating cover from the battery negative (-ve) lead terminal on the frame, then remove the terminal screw and detach the lead. Lift the insulating cover from the battery positive (+ve) lead terminal on the starter relay, then remove the terminal screw and detach the lead. Fit the insulating covers back over the lead ends and tape them in place to prevent the lead ends contacting each other and shorting the battery when it is being manoeuvred out of the frame. Remove the two screws securing the battery box, then manoeuvre the box around the right-hand side of the shock absorber and draw it out of the bike. If required, disconnect the leads from the battery, noting which fits where, and lift the battery out of its box.
- 4 On 1991 to 1995 TDM models, if required,

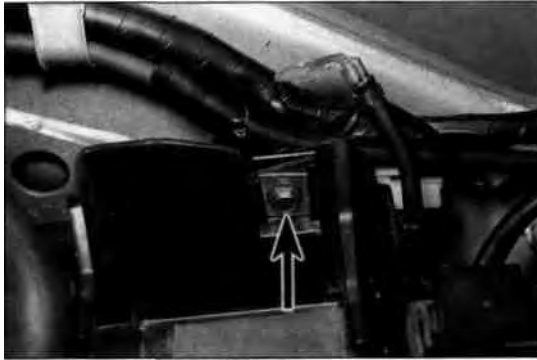


3.2a Detach the negative lead first, then the positive (arrowed)...



3.2b ... and remove the battery

9*4 Electrical system



3.4a Unscrew the bolt (arrowed) on each side.



3.4b ... and lift out the box

unscrew the two bolts securing the battery box and lift out the box (see illustrations). 5 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.

IljQffli-1 Battery corrosion can be
IlUilSI jcgpf to a minimum av
Hi AIT applying a layer of
petroleum jelly to the
terminals after the cables have been
connected.

6 Install the seat(s) (see Chapter 8).

Inspection and maintenance

7 The battery fitted to XTZ models is of the conventional lead/acid type, requiring regular checks of the electrolyte level, as described in Chapter 1, in addition to those detailed below.

8 The battery fitted to TDM and TRX models is of the maintenance free (sealed) type, therefore requiring no specific maintenance. However, the following checks should still be regularly performed.

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

10 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.

11 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

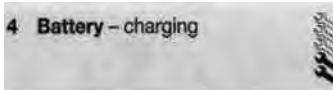
thoroughly, then touch up any damaged paint.

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

13 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 more than 12.5 volts present. If the voltage falls below 12.5 volts the battery must be removed, disconnecting the negative (-ve) terminal first, and recharged as described in Section 4.

14 On XTZ models, if available, an hydrometer should be used to measure the specific gravity of the electrolyte. Remove the battery and its cell caps, then measure each cell in turn. If the reading is below the level specified, the battery should be recharged.

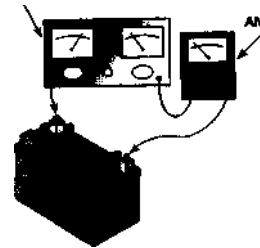
Iljvftfllj Refer to 'Fault Finding
 " * Equipment' in the
HINT Reference
 section for more information on
 battery voltage and specific
 gravity checks.



Caution: Be extremely careful when handling or working around the battery. The electrolyte is very caustic and an explosive gas (hydrogen) is given off when the battery is charging. 1 Remove the battery (see Section 3). 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.

2 If the battery is fully discharged, Yamaha recommend that the battery should be charged for a maximum of 6.5 hours (TDM and TRX models) or at a maximum rate of 0.4 amps for 10 hours (XTZ models). If the battery was partially charged, the battery should be charged until the voltage across the terminals reaches 12.8 V, or on XTZ models until the specific gravity is at its correct reading (see above). 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 battery can be charged at a higher rate of around 3.0 amps for a period of 1 hour. However, this is not recommended and the low amp charge is by far the safer method of charging the battery.**

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



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



5.1a Fusebox - TDM models

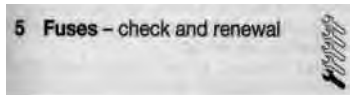


5.1 b Fusebox - TRX models



5.1c Cooling fan fuse - XTZ models

- 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.



1 The electrical system is protected by fuses of different ratings. On TDM and TRX models, the fuses are housed in the fusebox, which is located under the seat (see illustrations), although on 1996-on TDM and all TRX models the main fuse is located on the starter relay (see Section 27). On XTZ models, the main fuse is housed in the battery bracket on the front of the battery, while the cooling fan fuse is fitted in line with the wiring for the fan (see illustration).

2 To access the fuses on TDM and TRX models, remove the seat (see Chapter 8) and unclip the fusebox lid (see illustration). On XTZ models, remove the left-hand side cover to access the main fuse (see Chapter 8), and the fuel tank to access the cooling fan fuse (see Chapter 4).

3 The fuses can be removed and checked visually. If you can't pull the fuse out with your fingertips, use a pair of suitable pliers. TDM and TRX models use flat-blade type fuses and the XTZ model uses glass cartridge type fuses. A blown fuse is easily identified by a break in the element (see illustration). Each

fuse is clearly marked with its rating and must only be replaced by a fuse of the correct rating. A spare fuse of each rating is housed in the fusebox on TDM and TRX models, and a spare main fuse in the battery bracket on XTZ models. If a spare fuse is used, always renew it 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 30 and 31 for charging system tests. Also, check the condition of the fuses. 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.

Headlight

2 If the headlight fails to work, first check the fuse with the key ON (see Section 5), and then the bulb (see Section 7). If they are both good, use jumper wires to connect the bulb directly to the battery terminals. If the light comes on, the problem lies in the wiring or one of the switches in the circuit. Refer to Section 19 for the switch testing procedures, and also the wiring diagrams at the end of this Chapter.

3 On 1996 to 1998 TDM models, a diode is fitted in the headlight circuit (see *Wiring Diagrams* at the end of the Chapter). To test the diode, disconnect it from the harness. Using an ohmmeter or continuity tester, connect the positive (+ve) probe to the female terminal of the diode and the negative (-ve) probe to the male terminal. The diode should show continuity. Now reverse the probes. The diode should show no continuity. If it doesn't behave as stated, renew the diode. The diode is located on the left-hand side of the headlight assembly.

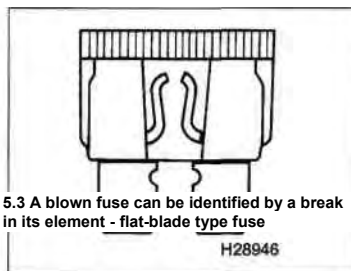
Tail light

4 If the tail light fails to work, check the bulbs and the bulb terminals first (see Section 9), then the fuse, then check for battery voltage at the blue/red (TDM and XTZ models), or blue (TRX models) terminal on the supply side of the tail light wiring connector. If voltage is present, check the earth circuit for an open or poor connection.

5 If no voltage is indicated, check the wiring between the tail light and the ignition switch,



5.2 On TDM and TRX models, unclip the fusebox lid to access the fuses



5.3 A blown fuse can be identified by a break in its element - flat-blade type fuse

H28946



7.2a Disconnect the wiring connector...



7.2b ... and remove the dust cover

should be wiped carefully when cold with a rag soaked in methylated spirit and dried before fitting.

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

Headlight

- 1 For best access to the headlight bulb(s), remove the fairing on TDM models and the relevant fairing side panel on XTZ models (see Chapter 8).
- 2 Disconnect the relevant wiring connector from the back of the headlight assembly and remove the rubber dust cover, noting how it fits (see illustrations).
- 3 Release the bulb retaining ring or clip, noting how it fits, then remove the bulb (see illustrations).
- 4 Fit the new bulb, bearing in mind the 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 ring or clip.
- 5 Install the dust cover, making sure it is correctly seated and with the TOP mark at the top, and connect the wiring connector.
- 6 Check the operation of the headlight.

then check the switch. Also check the lighting switch.

Brake light

- 6 If the brake light fails to work, check the bulbs and the bulb terminals first (see Section 9), then the fuse, then check for battery voltage at the yellow (TDM and TRX models) or green/yellow (XTZ models) terminal on the supply side of the tail light wiring connector, with the brake lever pulled in or the pedal depressed. If voltage is present, check the earth circuit for an open or poor connection.
- 7 If no voltage is indicated, check the brake light switches, then the wiring between the tail light and the switches.
- 8 See Section 14 for brake switch check and Section 9 for tail light bulb renewal.

Instrument and warning lights

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

Turn signal lights

10 See Section 11 for turn signal circuit check.

7 Headlight bulb and auxiliary light bulb - renewal

Note: The headlight bulb is of the quartz-halogen type. Do not touch the bulb glass as skin acids will shorten the bulb's service life. If the bulb is accidentally touched, it

ifHfJlS Always use a paper towel or "2"TI dry cloth when handling new

bulbs to prevent injury if the bulb should break and to increase bulb life.

HiMT



7.3a Remove the ring .



7.3b ... or release the clip.

Auxiliary light

- 7 On TDM models, remove the screws securing the auxiliary light lens and remove the lens (see illustration). Carefully pull the bulb out of its holder and install the new one, then refit the lens (see illustration). Do not overtighten the screws as the lens could crack.
- 8 On XTZ models, for best access remove the relevant fairing side panel (see Chapter 8). On TRX and XTZ models, release the bulbholder from its socket in the base of the headlight, then press the bulb in and twist it anti-



7.3c ... and remove the bulb



7.7a Remove the screws (arrowed) and the lens...



7.7b ... and pull out the bulb



7.8 Pull the bulbholder out of the base of the headlight



8.2a Removing the headlight - TRX models



8.2b Removing the headlight - XTZ models

clockwise to release it from the holder (see illustration). Install the new bulb in the bulbholder, then install the bulbholder in the headlight. Make sure the rubber cover is correctly seated. 9 Check the operation of the auxiliary light.

8 Headlight assembly -
 ■ removal and installation

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Removal

- 1 Remove the fairing (see Chapter 8).
- 2 On 1996-on TDM models, TRX and XTZ models, lift the headlight out of the fairing (see illustration).
- 3 On 1991 to 1995 TDM models, disconnect the headlight wiring connectors (see illustration 7.2a), then unscrew the three nuts securing the headlight assembly to the bracket and draw the assembly forward and off the bracket (see illustrations).
- 4 On 1991 to 1995 TDM models and XTZ models, the headlight can be disassembled and the lights renewed individually if required.

Installation

- 5 Installation is the reverse of removal. Make sure all the wiring is correctly connected and secured. Check the operation of the headlight



8.3a Unscrew the nut on each side (A), and the central nut on the bottom (B)...

and auxiliary light. Check the headlight aim (see Chapter 1).



8.3b ... and remove the headlight assembly

9 Brake/tail light bulb-renewal

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- 1 On TDM models, remove the seat (see Chapter 8). On TRX models, remove the passenger seat, though best access is obtained by removing the side covers as well (see Chapter 8). On XTZ models open the storage compartment cover behind the seat and remove the cover (see illustration).
- 2 Turn the bulbholder anti-clockwise and

- withdraw it from the tail light (see illustration).
- 3 Push the bulb into the holder and twist it anti-clockwise to remove it (see illustration). Check the socket terminals for corrosion and clean them if necessary. Line up the pins of the new bulb with the slots in the socket, then push the bulb in and turn it clockwise until it locks into place. **Note:** *The pins on the bulb are offset so it can only be installed one way. 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 Install the bulbholder into the tail light and turn it clockwise to secure it.



9.1 On XTZ models, remove the storage cover to access the bulbs



9.2 Release the bulbholder ...



9.3 ... and remove the bulb



10.2a Tail light wiring connector (arrowed) - TRX models



10.2b Tail light wiring connector (arrowed) - XTZ models

10 Tail light assembly - removal and installation

Removal

- 1 On TDM and TRX models remove the side covers (see Chapter 8). On XTZ models open the storage compartment cover behind the seat and remove the cover (see illustration 9.1).
- 2 On TRX and XTZ models, disconnect the tail light wiring connector (see illustrations).
- 3 Unscrew the nuts securing the tail light assembly to either the side cover assembly (TDM models) or the frame (TRX and XTZ models) and carefully remove it noting how it fits (see illustrations). If required, turn the bulbholders anti-clockwise and withdraw them from the tail light.

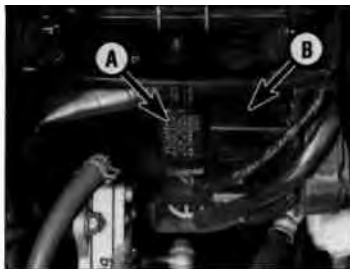
10.3a Tail light assembly nuts (arrowed) - TDM models



10.3b Tail light assembly nuts (arrowed) -XTZ models



11.3a Turn signal relay (arrowed) - TDM models



11.3b Turn signal relay (A), starter circuit cut-off relay (B) - TRX models

always check the battery voltage first. Low battery voltage indicates either a faulty battery or a defective charging system. Refer to Section 3 for battery checks and Sections 30 and 31 for charging system tests. Also, check the fuse (except XTZ models) (see Section 5) and the switch (see Section 19).

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

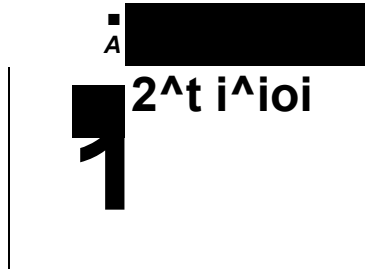
3 The relay is mounted under the seat on TDM and TRX models, and behind the fairing on XTZ models (see illustrations). Remove the seat or fairing for access (see Chapter 8). If the bulbs and sockets are good, check for voltage at the turn signal relay brown wire (brown/red on 1997-on UK models) with 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 ignition (main) switch. On 1999 TDM models, if there's no voltage check the hazard relay as described below.

4 If voltage was present, check for voltage at the relay brown/white wire with the ignition ON. If no voltage is present, renew the relay. If voltage is 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.

Hazard relay (1999 TDM models)

5 If there's no voltage at the flasher relay brown/red wire (see Step 3) check for voltage at the hazard relay brown wires with the ignition ON. If no voltage is shown check the signal fuse and the wiring between the fuse and hazard relay for a break or bad connection.

6 Also check for voltage at the hazard relay blue/red wire with the ignition ON; if no voltage is shown check the hazard fuse and the wiring between the hazard fuse and hazard relay. Finally check the brown/red wire from the hazard relay to the flasher relay for a break or bad connection. If the fault still exists, renew the hazard relay.



11.3c Turn signal relay (arrowed) - XTZ models



12.1a Turn signal lens screw (arrowed) - TDM models



12.1b Turn signal lens screw (arrowed) - TRX models



12.1c Turn signal lens screw (arrowed) - XTZ models

12 Turn signal bulbs - renewal

1 Remove the screw securing the turn signal lens and remove the lens, noting how it fits (see illustrations).

2 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.

3 Fit the lens onto the holder. Do not overtighten the screw as the lens or threads could be damaged.



12.1d Remove the screw and detach the lens...



12.2 ... and remove the bulb

13 Turn signal assemblies - removal and installation

Removal

1 Disconnect the turn signal wiring connectors. On the front turn signals, they are on the inside of the fairing (see illustrations). On TDM models remove the fairing, and on XTZ models the fairing side panel(s) for best access (see Chapter 8). On the rear turn signals, remove the seat (see Chapter 8) (see illustrations).



13.1a Front turn signal wiring connectors - TDM models



13.1b Rear turn signal wiring connectors (arrowed) - TDM models



13.1c Front turn signal wiring connectors - TRX models



13.1d Rear turn signal wiring connectors - TRX models



13.1e Front turn signal wiring connectors - XTZ models



13.1f Rear turn signal wiring connectors - XTZ models



13.2a Front turn signal mounting nut (arrowed) - TDM models



13.2b Rear turn signal mounting nut (arrowed) - XTZ models

2 On TDM and XTZ models, pull back the rubber boot and unscrew the nut securing the turn signal (see illustration). Remove the assembly, taking care not to snag the wiring.
 3 On TRX models, remove the screw or nut securing the assembly to either the inside of the fairing or rear mudguard (see illustration). Remove the mounting plate, noting how it fits, and withdraw the turn signal, taking care not to snag the wiring.

Installation

4 Installation is the reverse of removal. Check the operation of the turn signals.

14 Brake light switches - check and replacement

Circuit check

1 Before checking any electrical circuit, check the bulbs (see Section 9) and fuses (see Section 5).
 2 On XTZ models, remove the fuel tank to access the front brake switch wiring connector (see Chapter 4). On all models, remove the seat to access the rear brake switch connector (see Chapter 8).
 3 Using a multimeter or test light connected to a good earth, check for voltage at the brake light switch brown or black/red



13.3 Front turn signal mounting screw and plate - TRX models



14.7a Front brake switch wiring connector (arrowed) - TDM models

wire (as applicable) connector with the ignition ON (connector halves remain joined). If there's no voltage present, check the wire between the switch and the ignition switch (see the wiring diagrams at the end of this Chapter).

4 If voltage is available, touch the probe of the test light to the other terminal of the switch, then pull the brake lever in or depress the brake pedal. If no reading is obtained or the test light doesn't light up, renew the switch.

5 If a reading is obtained or the test light does light up, check the wiring between the switch and the brake light bulb (see the wiring diagrams at the end of this Chapter).

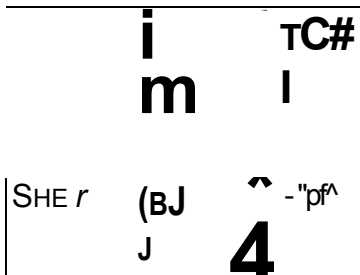
Switch replacement

Front brake lever switch

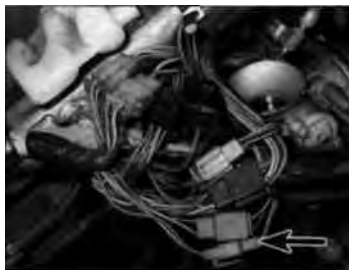
6 The switch is mounted on the underside of the brake lever bracket on TDM and TRX models, and is a push-fit into the bracket on XTZ models. On XTZ models remove the fuel tank to access the wiring connector.

7 Disconnect the wiring connector(s), then either remove the screws and detach the switch or withdraw the switch from the bracket, according to model (see illustrations). On XTZ models, free the wiring from any clips or ties.

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



14.7b Front brake switch wiring connectors (A), mounting screw (B) - TRX models



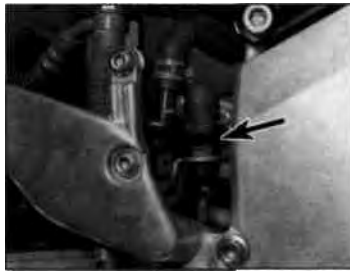
14.7c Front brake switch wiring connector (arrowed) - XTZ models



14.7d Front brake switch screws (arrowed) - TDM models



14.9a Rear brake light switch (arrowed) - TDM models



14.9b Rear brake light switch (arrowed) - TRX models



14.9c Rear brake switch wiring connector (arrowed) - TDM models

Rear brake pedal switch

9 The switch is mounted on the inside of the right-hand footrest bracket (see illustrations). Remove the seat for access to the connector (see Chapter 8). Trace the wiring from the switch and disconnect it at the connector (see illustration). Free the wiring from any clips or ties.

10 Detach the lower end of the switch spring from the brake pedal, then unscrew and remove the switch.

11 Installation is the reverse of removal. Make sure the brake light is activated just before the rear brake pedal takes effect. If adjustment is necessary, hold the switch and

turn the adjusting ring on the switch body until the brake light is activated when required.

15 Instrument cluster and speedometer cable - removal and installation

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Instrument cluster

Removal

1 Remove the fairing (see Chapter 8). On TRX models, remove the fuel tank and air filter housing for best access to the wiring connectors (see Chapter 4). On XTZ models,

release the clips on the instrument cluster surround from the grommets on the cluster and remove the surround (see illustration). On TRX models, remove the screws securing the trim cover to free the wiring loom (see illustration).

2 On all except 1999 TDM models, unscrew the knurled ring securing the speedometer cable to the back of the speedometer and detach the cable (see illustration 15.6a).

3 Disconnect the instrument cluster wiring connector(s) (see illustrations).

4 Unscrew the nuts securing the instrument cluster to the bracket and lift the cluster off, noting how it fits (see illustrations).



15.1a Release the clips from the grommets and remove the surround



15.1b On TRX models, remove the trim that houses the wiring loom



15.3a Instrument cluster wiring connectors - TDM models



15.3b On TRX models, the wiring connectors are located behind the steering head



15.3c Instrument cluster wiring connector (arrowed) - XTZ models



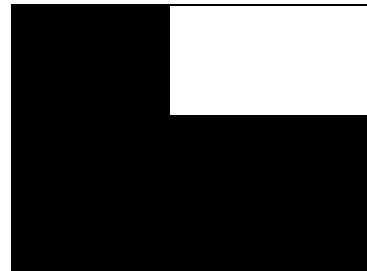
15.4a Unscrew the nuts (arrowed)...



15.4b ... and remove the cluster (TRX shown)



15.6a Unscrew the ring (arrowed) (XTZ shown)...



15.6b ... and detach the cable (TDM shown)

Installation

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

Speedometer cable (TRX, XTZ and 1991 to 1998 TDM models)

Removal

6 Remove the fairing (see Chapter 8). Unscrew the knurled ring securing the speedometer cable to the back of the speedometer and detach the cable (see illustration). On TRX models, access is restricted due to the surround, so if required, displace the instrument cluster (see illustrations 15.4a and b), then remove the screw securing the surround and remove the surround (see illustration 16.2).

7 Unscrew the knurled ring securing the lower end of the cable to the drive housing on the front wheel and detach the cable (see illustrations).

8 Withdraw the cable, releasing it from its guides, and remove it from the bike, noting its correct routing.

Installation

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

10 Connect the cable upper end to the speedometer and tighten the retaining ring securely (see illustrations 15.6b and a).

11 Connect the cable lower end to the drive housing and tighten the retaining ring securely (see illustrations 15.7b and a).

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

16 Instruments - check, replacement and bulbs

Speedometer

Check (TRX, XTZ and 1991 to 1998 TDM models)

1 Special instruments are required to properly check the operation of this meter. If it is believed to be faulty, take the motorcycle to a Yamaha dealer for assessment. Check that the fault is not due to a broken cable. **Check (1999 TDM models)**

2 The electronic speedometer is supplied with wheel speed information by a sensor on

the front wheel. To test the sensor, disconnect its 3-pin connector and make the following test on the sensor side of the connector. Set a multimeter to the 0 to 20 volts DC scale and connect its positive (+ve) probe to the white wire terminal and its negative (-ve) probe to the black wire terminal. Now connect a fully charged 12V battery: positive lead to the red wire terminal and negative lead to the black wire terminal. Position the bike on an auxiliary stand and support it under the crankcase so that the front wheel is off the ground. Slowly rotate the front wheel and note the reading on the meter. If the sensor is operating correctly, it should read 5V four times per wheel revolution.

3 If the speed sensor doesn't produce the correct reading it must be renewed. If the reading is correct, the fault must lie in the speedometer or the wiring between the sensor and speedometer.

4 If the electronic clock/odometer is faulty note that it is only available as part of the speedometer and tachometer assembly.

Replacement - all models

5 Remove the instrument cluster (see Section 15). On TRX models, remove the screw



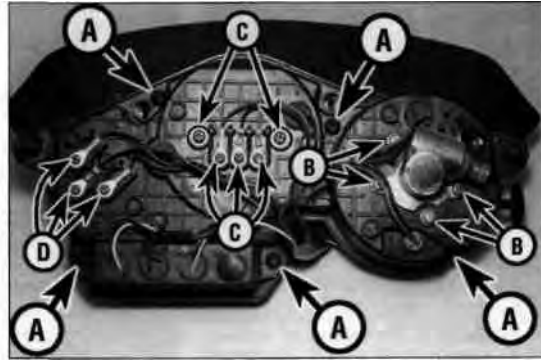
15.7a Unscrew the ring (arrowed).



15.7b ... and detach the cable



16.5 Remove the screw and detach the surround



16.6a Casing screws (A), speedometer screws (B), tachometer screws (C), temperature gauge screws (D) -1991 to 1998 TDM models

securing the surround and remove the surround (see illustration).

6 On TRX, XTZ and 1991 to 1998 TDM models, remove the casing screws from the back of the cluster and lift off the front cover assembly (see illustrations). On 1999 TDM models, remove the seven screws from the base of the cluster and separate the upper and lower covers from the instrument assembly; note that the speedometer and tachometer are only available as a unit with their housing - remove the fuel gauge and transfer it to the new assembly.

7 On 1991 to 1998 TDM and all TRX models, remove the two screws securing the speedometer gearbox and lift off the box.

8 Remove the two screws securing the speedometer to the casing. Carefully withdraw the speedometer from the front.

9 Installation is the reverse of removal.

Tachometer

Check

10 Special instruments are required to properly check the operation of this meter. If it

is believed to be faulty, take the motorcycle to a Yamaha dealer for assessment. **Replacement**

11 Remove the instrument cluster (see Section 15). On TRX models, remove the screw securing the surround and remove the surround (see illustration 16.5).

12 On TRX, XTZ and 1991 to 1998 TDM models, remove the casing screws from the back of the cluster and lift off the front cover assembly (see illustrations 16.6a, b or c). On 1999 TDM models, remove the seven screws from the base of the cluster and separate the upper and lower covers from the instrument assembly; note that the speedometer and tachometer are only available as a unit with their housing - remove the fuel gauge and transfer it to the new assembly.

13 Remove the screws securing the three tachometer wires and detach the wires, noting which fits where.

14 Remove the two screws securing the tachometer to the casing. Carefully withdraw the tachometer from the front.

15 Installation is the reverse of removal.

Make sure the wiring is correctly connected. As you look at the back of the cluster, the brown wire is for the left-hand terminal, the black for the middle terminal, and the grey for the right-hand terminal.

Coolant temperature gauge (TRX, XTZ and 1991 to 1998 TDM models)

Check

16 See Chapter 3.

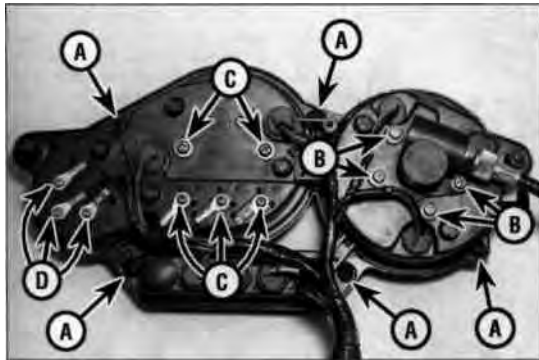
Replacement

17 Remove the instrument cluster (see Section 15). On TRX models, remove the screw securing the surround and remove the surround (see illustration 16.5).

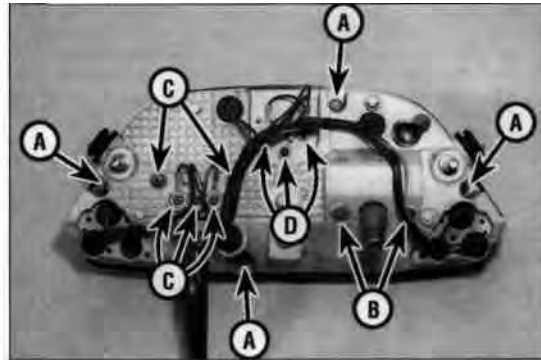
18 Remove the casing screws from the back of the cluster and lift off the front cover assembly (see illustrations 16.6a, b or c).

19 Remove the screws securing the three temperature gauge wires and detach the wires, noting which fits where.

20 Carefully withdraw the temperature gauge from the front.



16.6b Casing screws (A), speedometer screws (B), tachometer screws (C), temperature gauge screws (D) - TRX models



16.6c Casing screws (A), speedometer screws (B), tachometer screws (C), temperature gauge screws (D) - XTZ models

9»14 Electrical system



16.26a Pull out the bulbholder...



16.26b ... and remove the bulb

21 Installation is the reverse of removal. Make sure the wiring is correctly connected. As you look at the back of the cluster, the green/red wire is for the left-hand terminal, the black for the middle terminal, and the brown for the right-hand terminal.

Fuel gauge (1999 TDM models)

Check

22 See Section 17.

Replacement

23 Remove the instrument cluster (see Section 15). Remove the seven screws from the base of the cluster and separate the upper and lower covers from the instrument assembly. The fuel gauge is retained by three screws.

24 Installation is the reverse of removal.

Bulb renewal

25 Remove the fairing (see Chapter 8). The bulbs are accessible with the instrument cluster in place, but access is quite restricted. If it is too restricted, unscrew the nuts securing the instrument cluster and displace it as required to improve access (see Section 15).

26 Gently pull the bulbholder out of the instrument casing, then pull the bulb out of the bulbholder (see illustrations). If the socket contacts are dirty or corroded, scrape them clean and spray with electrical contact cleaner before a new bulb is installed. Carefully push the new bulb into the holder and push the holder into the casing.

27 Install the fairing (see Chapter 8).



18.1a Ignition switch wiring connector - TDM models



18.1b Ignition switch wiring connector (arrowed) - XTZ models

17 Fuel gauge and sender unit - check and replacement (1999 TDM models)

Check

1 If the fuel gauge fails to operate or the warning light doesn't come on when the fuel level falls to a low level, the fuel sender unit in the tank may be at fault. Remove the fuel sender unit from the tank as described below.

2 Reconnect the sender wiring, then turn the ignition ON and manually raise its float. With the float fully raised the gauge needle should swing over to the F on the gauge. Now lower the float and check that the needle swings over to the E on the gauge. Turn the ignition OFF when the check is complete. If the gauge does not operate as described it should be renewed.

3 Make the following test with the sender unit disconnected from the bike and on the bench. Using a multimeter set to the ohms x 1 range, connect the meter's positive probe to the green/red wire terminal of the wire connector and its negative probe to the black wire terminal of the connector. With the float in the down position, 90 to 100 ohms should be indicated on the meter. Raise the float up to its highest position and check the meter reading - 4 to 10 ohms should now be indicated. If the sender unit does not produce the correct readings it must be renewed.

4 Before renewing the fuel gauge or the sender unit, check that the fault is not due to a

poor wire connection or break in any of the circuit wiring. Check that the fuel level warning light bulb has not blown.

Replacement

5 Refer to Section 16 for renewal of the fuel gauge and warning light bulb.

6 To access the sender unit, first remove the fuel tank as described in Chapter 4 and drain all fuel from the tank into a suitable container.

7 Remove the four bolts which retain the sender unit to the base of the tank. Withdraw the sender unit very carefully so that its float and arm and not bent. Check that the float is not punctured and that the arm moves smoothly.

8 When installing the sender unit, always use a new gasket between the sender and tank and make sure that the washers are in place on the four retaining bolts.

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

18 Ignition (main) switch - check, removal and installation S^A

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

Check

1 On TDM models, remove the fairing. On TRX models remove the air filter housing, and on XTZ models remove the fuel tank (see Chapter 4). Trace the ignition (main) switch wiring back from the base of the switch and disconnect it at the connector (see illustrations and 15.3b).

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 is in the indicated position.

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

Removal

4 On TDM models, remove the fairing. On TRX models remove the air filter housing, and on XTZ models remove the fuel tank (see Chapter 4). Trace the ignition (main) switch



18.8 Ignition switch bolts (arrowed)

wiring back from the base of the switch and disconnect it at the connector (see illustrations 18.1a and b and 15.3b). Draw the wiring through to the switch, freeing it from any clips or ties and noting its routing.

5 On 1996-on TDM models, unscrew the bolts securing the choke knob and the cable guide to the top yoke. On TRX models, unscrew the bolt securing the master cylinder reservoir to the top yoke. On XTZ models, unscrew the bolt securing the cable guide to the top yoke.

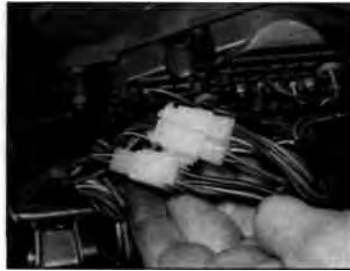
6 Displace the handlebars from the top yoke (see Chapter 6).

7 Slacken the fork clamp bolts in the top yoke. Unscrew the steering stem nut or bolt and remove it along with its washer, where fitted. Lift the top yoke off the steering stem and remove it.

8 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 off before the switch can be removed. Mount the yoke in a vice equipped with soft jaws and padded out with rags and drill off the heads. Remove the bolts and withdraw the switch from the top yoke.

Installation

9 Installation is the reverse of removal. Tighten the new bolts until the heads shear



19.3 Handlebar switch wiring connectors - TDM models

off. Make sure the wiring connector is securely connected and correctly routed.

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 renewed, as individual parts are not available.

2 The switches can be checked for continuity using an ohmmeter or a continuity test light. Always disconnect the battery negative (-ve) cable, which will prevent the possibility of a short circuit, before making the checks.

3 On TDM models, remove the fairing (see Chapter 8). On TRX models remove the air filter housing, and on XTZ models remove the fuel tank (see Chapter 4). Trace the wiring harness of the switch in question back to its connector and disconnect it (see illustration and 18.1b and 15.3b).

4 Check for continuity between the terminals of the switch harness with the switch in the various positions (ie 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 contacts can be scraped clean with a knife or polished with crocus cloth. If switch components are damaged or broken, it will be obvious when the switch is disassembled.

20 Handlebar switches -removal and installation 1

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 connector(s) and disconnect it/them. On TDM models, remove the fairing (see Chapter 8). On TRX models remove the air filter housing, and on XTZ models remove the fuel tank (see Chapter 4). Trace the wiring harness of the switch in question back to its connector and disconnect it (see illustrations 19.3, 18.1b and 15.3b). Work back along the harness, freeing it from all the relevant clips and ties, whilst noting its correct routing.

2 On TDM and TRX models, disconnect the wiring connector(s) from the brake light switch (if removing the right-hand switch) or the clutch switch (if removing the left-hand switch) (see illustrations 14.7a and b, or 23.2a).

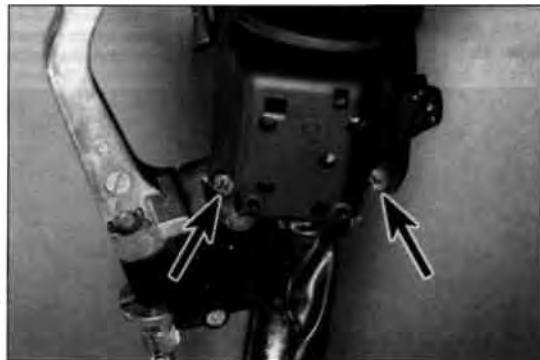
3 Unscrew the handlebar switch screws and free the switch from the handlebar by separating the halves (see illustrations).

Installation

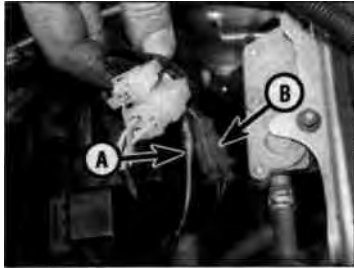
4 Installation is the reverse of removal. Make sure the locating pin in the switch housing locates in the hole in the handlebar and on 1999 TDM models ensure that the choke lever locates correctly.



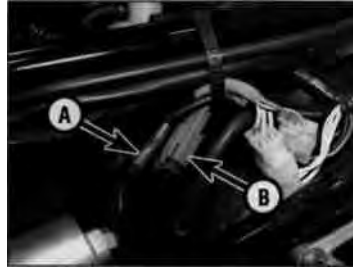
20.3a Right-hand switch housing screws (arrowed) - TDM models



20.3b Left-hand switch housing screws (arrowed) - TDM models



21.2a Neutral switch wiring connector (A), sidestand switch wiring connector (B) - TDM models



21.2b Neutral switch wiring connector (A), sidestand switch wiring connector (B) - TRX models



21.2c Neutral switch wiring connector (arrowed) - XTZ models

21 Neutral switch - check, removal and installation

Check

- 1 Before checking the electrical circuit, check the bulb (see Section 16) and fuse (see Section 5).
- 2 The switch is located in the left-hand side of the transmission casing above the front sprocket. To access the wiring connector, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8). Trace the single light blue wire from the top of the alternator cover and disconnect it at



21.8 Unscrew the bolts (arrowed) and remove the plate



21.9 Detach the wiring grommet and remove the screws (arrowed)...

- the connector (see illustrations). Make sure the transmission is in neutral.
- 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 at some point.
 - 4 Check for continuity between the wire terminal on the switch side of the wiring connector and the crankcase. With the transmission in gear, there should be no continuity. If the tests prove otherwise, then the switch is faulty.
 - 5 If the continuity tests prove the switch is good, check for voltage at the terminal on the wiring loom side of the wiring connector using a test light with the ignition ON. If there's no voltage present, check the wire between the connector, the instrument cluster and fusebox (see the *wiring diagrams* at the end of this Chapter). Turn the ignition OFF.

Removal

- 6 Make sure the transmission is in neutral. The switch is located in the left-hand side of the transmission casing above the front sprocket. To access the wiring connector, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8). Trace the single light blue wire from the top of the alternator cover and disconnect it at the connector (see illustrations 21.2a, b and c).



21.10 ... and remove the switch

- 7 Remove the alternator cover (see Section 32).
- 8 Unscrew the bolts securing the transmission output shaft retainer plate to the left-hand side of the crankcase and remove the plate (see illustration).
- 9 Pull the wiring grommet from its cutout in the crankcase (see illustration).
- 10 Remove the screws securing the switch and detach it from the casing (see illustration). Discard the O-ring as a new one must be used.

Installation

- 11 Fit a new O-ring onto the switch (see illustration), then install the switch and tighten its screws securely (see illustration 21.9).
- 12 Press the wiring grommet into its cutout in the crankcase (see illustration 21.9).
- 13 Install the transmission output shaft retainer plate onto the left-hand side of the crankcase (see illustration 21.8). Apply a suitable non-permanent thread locking compound to the threads of the bolts and tighten them to the specified torque setting.
- 14 Connect the wiring connector (see illustrations 21.2a, b and c). Check the operation of the neutral light.
- 15 Install the alternator cover (see Section 8).
- 16 On TDM models install the seat, on TRX models install the side covers, and on XTZ models install the left-hand side cover (see Chapter 8).



21.11 Fit a new O-ring onto the switch

22 Sidestand switch - check and replacement

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Check

- 1 The sidestand switch is mounted on the sidestand. The switch is part of the safety cutout circuit which only allows the starter motor to operate if the transmission is in neutral or the clutch lever is pulled in and the sidestand is up. Before checking the electrical circuit, check the fuse (see Section 5).
- 2 To access the wiring connector, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8). Trace the wiring back from the switch and disconnect it at the connector (see illustration and 21.2a and b).
- 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 wiring between the various components in the starter safety circuit (see the *wiring diagrams* at the end of this book).

Replacement

- 6 The sidestand switch is mounted on the sidestand. To access the wiring connector, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8). Trace the wiring back from the switch to its connector and disconnect it (see illustrations 21.2a and b and 22.2). Work back along the switch wiring, freeing it from any relevant retaining clips and ties, noting its correct routing.
- 7 Unscrew the switch bolts or screws and remove the switch from the stand, noting how it fits (see illustration).



23.2a Clutch switch wiring connector (arrowed) - TDM models



22.2 Sidestand switch wiring connector -XTZ models

- 8 Fit the new switch onto the sidestand, making sure the plunger locates correctly, and tighten the bolts or screws securely.
- 9 Make sure the wiring is correctly routed up to the connector and retained by all the necessary clips and ties.
- 10 Reconnect the wiring connector and check the operation of the sidestand switch.
- 11 On TDM models install the seat, on TRX models install the side covers, and on XTZ models install the left-hand side cover (see Chapter 8).

23 Clutch switch - check and replacement

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Check

- 1 The clutch switch is mounted on the underside of the clutch lever bracket on TDM and TRX models, and is a push-fit into the bracket on the XTZ models. 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 On XTZ models, to access the switch wiring connector, remove the fuel tank (see Chapter 4). To check the switch, disconnect the wiring connector(s) (see illustrations). Connect the probes of an ohmmeter or a continuity test



23.2b Clutch switch wiring connector (arrowed) - XTZ models



22.7 Sidestand switch screws (arrowed) - TDM shown

- light to the two switch terminals. 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, 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 book).

Replacement

- 4 The clutch switch is mounted on the underside of the clutch lever bracket on TDM and TRX models, and is a push-fit into the bracket on XTZ models. On XTZ models, to access the switch wiring connector, remove the fuel tank (see Chapter 4).
- 5 Disconnect the wiring connector(s) (see illustrations 23.2a and b), then either remove the screw(s) and detach the switch or withdraw the switch from the bracket, according to model (see illustration).
- 6 Installation is the reverse of removal.

24 Diode (XTZ models) - check and replacement

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Check

- 1 The diode is a small block that plugs into the main wiring harness (see *Wiring Diagrams* at the end of the Chapter). Remove the seat



23.5 Clutch switch screw (arrowed) - TDM models

and fuel tank for access (see Chapters 8 and 4). The diode 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

2 Disconnect the diode from the harness. The diode is situated on the left-hand side of the **25.2b Starter circuit cut-off relay (arrowed) - XTZ models**



25.2a Starter circuit cut-off relay (arrowed) - TDM models



frame in the area where the fuel tank and side cover meet.

3 Using an ohmmeter or continuity tester, connect the positive (+ve) probe to one terminal of the diode and the negative (-ve) probe to the other terminal. Now reverse the probes. The diode should show continuity in one direction and no continuity in the other direction. If it doesn't behave as stated, renew the diode.

4 If the diode 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 book).

Replacement

5 The diode is a small block that plugs into the main wiring harness on the left-hand side of the frame in the area where the fuel tank and side cover meet. Remove the seat and fuel tank for access (see Chapters 8 and 4). Disconnect the diode from the harness and connect the new one.

r13—E1

B/Y UY LW

R/B Sb

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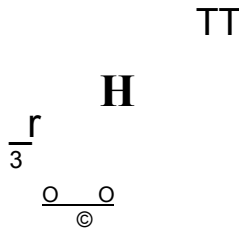
-Ⓡ

14Ⓡ

L/WL/W B/Ysbl/YR/B

mm

25.3a Starter circuit cut-off relay test set-up -1991 to 1995 TDM models



- black
- 2 Black/yellow
- 3 Blue/white
- 4 Blue/white

25 Starter circuit cut-off relay - ^
check and replacement «

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Check

1 The starter circuit cut-off relay 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.

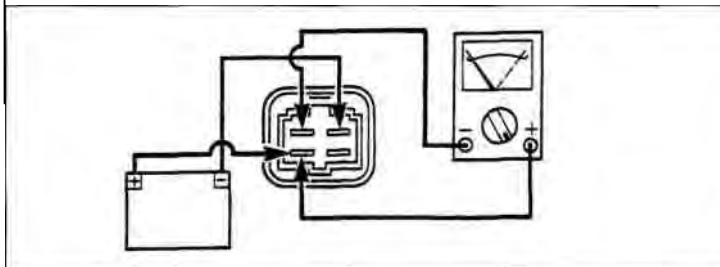
2 If the starter circuit is faulty, first check the fuse (see Section 5). The starter cut-off relay is located under the seat on all except 1996-on TDM models, where it is behind the fairing. Remove the seat or fairing for access (see Chapter 8). Disconnect the relay wiring connector and remove the relay (see **illustrations and 11.3b**).

3 Set a multimeter to the ohms x 1 scale and connect it across the relay's terminals as shown, according to your model (see **illustrations**). Using a fully-charged 12 volt battery and two insulated jumper wires, connect the battery to the relay's terminals as shown, according to your model. At this point the multimeter should show zero ohms (continuity). If this is the case the relay is proved good. If the relay indicates no continuity (infinite resistance) across its terminals, it is faulty and must be renewed.

Note: No test details are available for the 1999 TDM model - the relay can only be checked by the substitution of a new relay.

4 If the relay 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 book).

25.3b Starter circuit cut-off relay test set-up -1996 to 1998 TDM models and TBX models



25.3c Starter circuit cut-off relay test set-up - XTZ models

Replacement

5 The starter cut-off relay is located under the seat on all except 1996-on TDM models, where it is behind the fairing. Remove the seat or fairing for access (see Chapter 8). Disconnect the relay wiring connector and remove the relay (see Illustrations 25.2a and b, and 11.3b).

6 Installation is the reverse of removal.

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26 Horn - check and replacement

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26.3a Horn wiring connectors (A) and mounting bolt (B) - TDM models



26.3b Horn wiring connectors (A).

Check

1 If the horn, doesn't work, first check the fuse (see Section 5) and the battery (see Section 3).

2 The horn is mounted behind the fairing side panels or the fairing, depending on model. On TDM and TRX models, remove the fairing, and on XTZ models remove the left-hand fairing side panel (see Chapter 8).

3 Unplug the wiring connectors from the horn (see Illustrations). Using two jumper wires, apply battery voltage directly to the terminals on the horn. If the horn sounds, check the switch (see Section 19) and the wiring between the switch and the horn (see the wiring diagrams at the end of this Chapter).

4 If the horn doesn't sound, renew it.



26.3c ... and mounting bolt (B) - TRX models



26.3d Horn wiring connectors (A) and mounting bolt (B) - XTZ models

Replacement

5 The horn is mounted behind the fairing side panels or the fairing, depending on model. On TDM and TRX models, remove the fairing, and on XTZ models remove the left-hand fairing side panel (see Chapter 8).

6 Unplug the wiring connectors from the horn, then unscrew the bolt(s) securing the horn and remove it from the bike (see Illustrations 26.3a, b, c and d).

7 Install the horn and securely tighten the bolt(s). Connect the wiring connectors to the horn.

neutral and the clutch pulled in, 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 This test is made with the relay removed from the bike and on the bench. 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 jumper leads as follows according to the model being worked on:

1991 to 95 TDM

Battery positive lead to the red wire terminal of the relay, negative lead to the blue/white terminal Battery positive lead to the red/white positive lead to the red/white wire terminal of the relay, negative lead to the blue/white terminal Battery positive lead to the blue/white wire terminal of the relay, negative lead to

TRX the red terminal

Battery positive lead to the blue/white wire terminal of the relay, negative lead to the red/white terminal

XTZ

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 renewed.

5 If the relay 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 book).

Replacement

6 Remove the seat (see Chapter 8).

7 Disconnect the relay wiring connector, and unscrew the two nuts securing the starter motor and battery leads to the relay and



27.2 Detach the starter motor lead from the relay

27 Starter relay - check and replacement

Check

1 If the starter circuit is faulty, first check the fuse (see Section 5).

2 The starter relay is located under the seat. Remove the seat for access (see Chapter 8). Lift the rubber terminal cover and unscrew the bolt securing the starter motor lead (see illustration); position the lead away from the relay terminal. With the ignition switch ON, the engine kill switch in the RUN position, the transmission in

1996-on TDM wire terminal of the relay, negative lead to the blue/white terminal



27.7 Pull back the covers to access the terminal nuts



28.4a Unscrew the bolts (arrowed).

detach the leads (see illustration). 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.

28 Starter motor - removal and installation

Removal

- 1 Remove the seat (see Chapter 8). Disconnect the battery negative (-ve) lead.
- 2 The starter motor is mounted underneath the engine.
- 3 Peel back the rubber terminal cover and remove the nut securing the starter lead to the starter relay (see illustration 27.2). Detach the lead and feed it through to the starter motor.
- 4 Unscrew the two bolts securing the starter motor to the crankcase (see illustration). Slide the starter motor out from the crankcase and remove it from the machine (see illustration).
- 5 Remove the O-ring on the end of the starter

motor and discard it as a new one must be used.

Installation

- 6 Install a new O-ring on the end of the starter motor and ensure it is seated in its groove (see illustration). Apply a smear of engine oil to the O-ring to aid installation.
- 7 Manoeuvre the motor into position and slide it into the crankcase (see illustration 28.4b). 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).
- 8 Connect the starter lead to the starter relay and secure it with the nut (see illustration 27.2). Make sure the rubber cover is correctly seated over the terminal.
- 9 Connect the battery negative (-ve) lead and install the seat (see Chapter 8).



28.4b ... and remove the starter motor



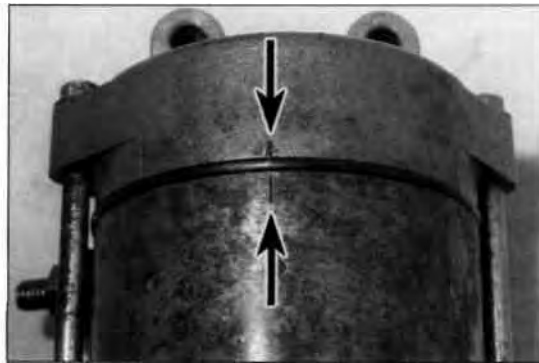
28.6 Fit a new O-ring into the groove



28.7 Install the bolts and tighten them to the specified torque



29.1 Unscrew the terminal nut and detach the lead



29.2 Note the alignment marks (arrowed), or make your own



29.3 Unscrew the long bolts (arrowed)



29.4a Remove the front cover...



29.4b ... and slide off the shims

29 Starter motor - disassembly, inspection and reassembly §[^]
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Disassembly

- 1 Remove the starter motor (see Section 28). Pull back the rubber terminal cover, then unscrew the nut and detach the lead from the terminal bolt (see illustration).
- 2 Note the alignment marks between the

main housing and the front and rear covers, or make your own if they aren't clear (see illustration).

3 Unscrew the two long bolts and withdraw them from the starter motor (see illustration).

4 Wrap some insulating tape around the teeth on the end of the starter motor shaft - this will protect the oil seal from damage as the front cover is removed. Remove the front cover from the motor (see illustration). Remove the cover O-ring from the main housing and discard it as a new one must be used.

Remove the shims from the front end of the armature shaft or the inside of the front cover, noting their correct fitted locations (see illustration). Also remove the tabbed thrust washer from the front cover (see illustration 29.20b).

5 Remove the rear cover from the motor (see illustration). Remove the cover O-ring from the main housing and discard it as a new one must be used. Remove the shims from the rear end of the armature shaft or from inside the rear cover (see illustration).

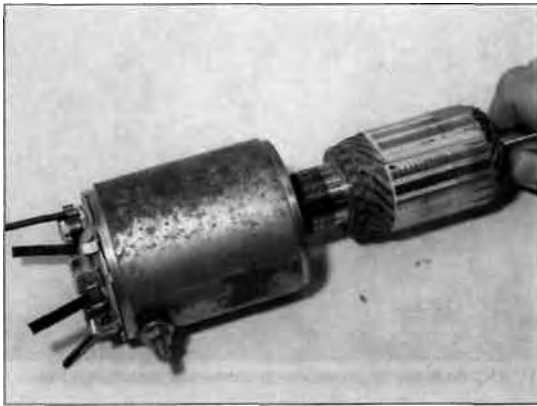


29.5a Remove the rear cover...

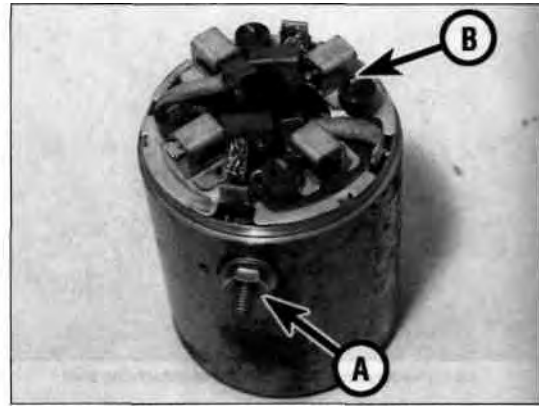


29.5b ... and slide off the shims

9*22 Electrical system



29.6 Withdraw the armature



29.7 Unscrew the terminal nut (A) and remove the washers, then lift out the brushplate (B)

6 Withdraw the armature from the main housing (see illustration).

7 Noting the correct fitted location of each component, unscrew the terminal nut and remove it along with its washer and the insulating washers (see illustration). Withdraw the brushplate assembly and

terminal bolt from the main housing. Remove the brushplate seat (see illustration 29.15a).

Inspection

8 The parts of the starter motor that are most likely to require attention are the brushes. Measure the length of the brushes and compare the results to the brush length listed in this Chapter's Specifications (see illustration). If any of the brushes are worn beyond the service limit, renew the brush assembly. If the brushes are not worn excessively, nor cracked, chipped, or otherwise damaged, they may be re-used.

9 Inspect the commutator bars on the armature 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. Measure the diameter of

the commutator and compare it to the specifications. If it has worn below the wear limit, renew the starter motor. Measure the depth of the insulating Mica below the surface of the commutator bars. If the Mica is less than the depth specified, scrape it away until the specified depth is reached.

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 (see illustration). 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 terminal bolt and the housing (when assembled). There should be no continuity (infinite resistance).

12 Check the front end of the armature shaft for worn, cracked, chipped and broken teeth.



29.8 Measure the length of each brush



29.10a Continuity should exist between the commutator bars



29.10b There should be no continuity between the commutator bars and the armature shaft



29.15a Fit the brushplate seat



29.15b Make sure the insulators are in place..



15c ... then install the terminal bolt assembly into the housing and brushplate seat...



29.15d . and fit the washers and nut

If the shaft is damaged or worn, renew the armature.

13 Inspect the end covers for signs of cracks or wear. Inspect the magnets in the main housing and the housing itself for cracks.

14 Inspect the insulating washers and front cover oil seal for signs of damage and renew them if necessary.

17 Fit each brush into its holder and press it back against the spring, then lock it in that position by inserting a strip of plastic (such as the cut-off end of a cable tie) between the spring end and the holder, preventing the spring from pushing the brush back out (see illustration). This provides the clearance necessary for the armature to be installed

without becoming entangled with the exposed brush ends.

18 Insert the armature into the main housing, noting that it will be forcibly drawn in by the attraction of the magnets (see illustration 29.6). Remove the strips securing the brushes. Check that each brush is securely pressed against the commutator

Reassembly

15 Fit the brushplate seat into the main housing (see illustration). Ensure that the inner rubber insulator and O-ring are in place on the terminal bolt, then insert the bolt through the main housing and locate the arms into the brushplate seat (see illustrations). Fit the insulating washers over the terminal, then fit the standard washer and the nut (see illustration).

16 Fit the brushplate assembly onto the main housing, locating the terminal bolt brush wires in the cutouts and making sure the tab on the plate locates in the cutout in the housing (see illustration).



29.16 Fit the brushplate, locating the tab in the notch (A) the brush wires in the cutouts (B)



29.17 Lock the brushes into their holders as described and shown



29.19 Fit a new O-ring onto the rear of the housing



29.20a Fit a new O-ring onto the front of the housing .

by its spring and is free to move easily in its holder.

19 Slide the shims onto the end of the armature (see illustration 29.5b), then fit a new rear cover O-ring (see illustration). Fit the rear cover onto the housing, aligning the marks noted or made earlier (see illustration 29.5a).

20 Slide the shims onto the front of the armature (see illustration 29.4b), then fit a new front cover O-ring (see illustration). Apply a smear of grease to the lips of the front cover oil seal. Fit the tabbed washer onto the cover (see illustration), making sure the tabs locate correctly, then install the cover, aligning the marks made on removal (see illustration 29.4a). Remove the protective tape from the shaft end.

21 Check the alignment marks made on removal are correctly aligned, then install the long bolts and tighten them securely (see illustration).

22 Fit the starter motor lead onto the terminal bolt, then secure it with the nut and cover it with the rubber boot (see illustration 29.1).

23 Install the starter motor (see Section 28).

30 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).

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 Yamaha dealer.

31 Charging system -leakage and output test

1 If the charging system of the machine is thought to be faulty, remove the seat (see Chapter 8) 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.

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



29.20b ... and fit the tabbed washer into the cover



29.21 Install and tighten the long bolts



31.3 Checking the charging system leakage rate - connect the ammeter as shown

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.

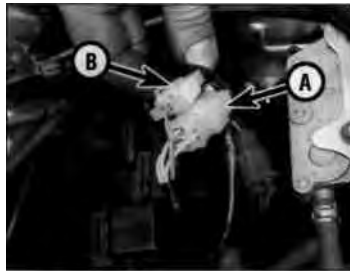
4 If the current leakage indicated exceeds the amount specified at the beginning of the Chapter, there is probably a short circuit in the wiring. Disconnect the meter and connect the negative (-ve) lead to the battery, tightening it securely,

5 If leakage is indicated, use the wiring diagrams at the end of this book to systematically disconnect individual electrical components and repeat the test until the source is identified.

Output test

6 Start the engine and warm it up to normal operating temperature. Remove the seat (see Chapter 8).

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) between the terminals of the battery (meter positive (+ve) lead to battery positive terminal, meter negative (-ve) lead to battery negative terminal). Slowly increase the engine speed to 5000 rpm and note the reading obtained. The regulated voltage should be as specified at the beginning of the Chapter. If the voltage is outside these limits, check the alternator and the regulator (see Sections 32 and 33).



32.2a Alternator wiring connector (A), pickup coil wiring connector (B) - TDM models



32.2b Alternator wiring connector (A), pickup coil wiring connector (B) - TRX models

HTOIB?! *Clues to a faulty regulator are constantly blowing bulbs, with brightness varying considerably with engine speed, and battery overheating.*

HINT

32 Alternator - check, removal and installation

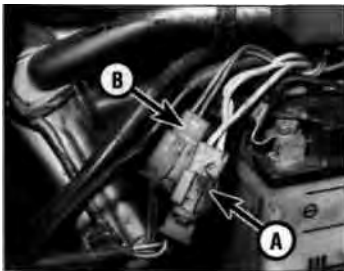
Check

- 1 To access the wiring connectors, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8).
- 2 Trace the wiring back from the top of the alternator cover on the left-hand side of the engine and disconnect it at the white connector containing the three white wires (see illustrations).
- 3 Using a multimeter set to the ohms x 1 (ohmmeter) scale measure the resistance between each of the white wires on the alternator side of the connector, taking a total of three readings, then check for continuity between each terminal and earth. If the stator coil windings are in good condition the three readings should be within the range shown in the Specifications at the start of this Chapter

and there should be no continuity (infinite resistance) between any of the terminals and earth. If not, the alternator stator coil assembly is at fault and should be renewed. Note: Before condemning the stator coils, check the fault is not due to damaged wiring between the connector and coils.

Removal

- 4 To access the wiring connectors, on TDM models remove the seat, on TRX models remove the side covers, and on XTZ models remove the left-hand side cover (see Chapter 8).
- 5 Trace the alternator/pick-up coil wiring back from the top of the alternator cover on the left-hand side of the engine and disconnect it at the two white connectors (see illustrations 32.2a, b and c). Free the wiring from any clips or guides and feed it through to the alternator cover.
- 6 On TDM and XTZ models, unscrew the bolts securing the outer front sprocket cover and remove the cover (see illustration). Unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (see illustration). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation. Unscrew the bolts securing the inner sprocket cover, on TDM models noting the clip secured by the



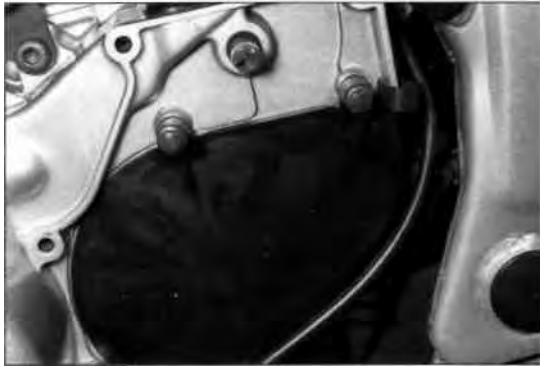
32.2c Alternator wiring connector (A), pickup coil wiring connector (B) - XTZ models



32.6a Unscrew the bolts (arrowed) and remove the cover



32.6b Gearchange arm/shaft alignment -TDM models



32.6c Unscrew the two bolts and remove the inner cover



32.7 Gearchange arm/shaft alignment - TRX models

top rear bolt, and remove the cover (**see illustration**).

7 On TRX models, unscrew the gearchange lever linkage arm pinchbolt and remove the arm from the shaft, noting the alignment of the punch mark with the slit in the clamp (**see illustration**). If no mark is visible, make your own before removing the arm so that it can be correctly aligned with the shaft on installation.

Unscrew the bolts securing the outer front sprocket cover and remove the cover, then unscrew the bolts securing the inner sprocket cover, noting the clip secured by the top rear bolt, and remove the cover. 8 Working in a criss-cross pattern, unscrew the bolts securing the alternator cover and remove the cover (**see illustration**). Discard the gasket as a new one must be used. Note

the position of the dowels and remove them if loose.

9 Withdraw the shaft from the starter idle/reduction gear and remove the gear, noting how it fits (**see illustration**).

10 To remove the rotor bolt it is necessary to stop the rotor from turning. If a rotor holding strap or tool is not available, and if the engine is still in the frame, place the transmission in gear and have an assistant apply the rear brake, then unscrew the bolt (**see illustration**).

11 To remove the rotor from the shaft it is necessary to use a rotor puller. Yamaha provide a special tool (Pt. Nos. 90890-01362 and 90890-01382, or alternatively a similar tool can be set up as shown, using the threaded holes in the rotor (**see illustration**). After the rotor has been removed, remove the Woodruff key from the slot in the crankshaft for safekeeping if loose (**see illustration 32.14a**).

12 To remove the stator from the cover, remove the three screws securing the stator, and the two screws securing the pick-up coil,



32.8 Unscrew the bolts (arrowed) and remove the cover



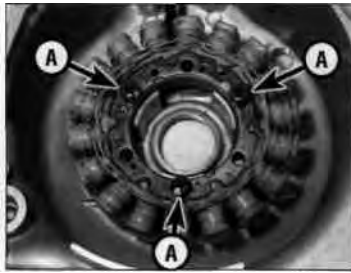
32.9 Withdraw the shaft (arrowed) and remove the gear



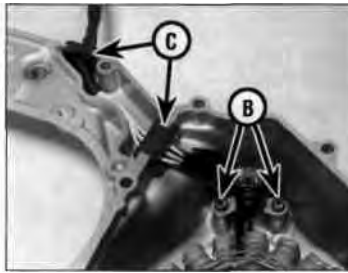
32.10 Unscrew the rotor bolt (arrowed)



32.11 Drawing the rotor off the shaft using a puller



32.12a Remove the rotor screws (A).



32.12b ... and the pick-up coil screws (B), and free the wiring grommets (C)



32.14a If removed, fit the Woodruff key into its slot...

then remove the assembly, noting how the rubber wiring grommets fit (see illustrations).

Installation

13 Install the stator and the pick-up coil in the cover, aligning the rubber wiring grommets with the grooves (see illustrations 32.12a and b). Apply a suitable non-permanent thread locking compound to the stator and pick-up coil screw threads, then install the screws and tighten them to the torque settings specified at the beginning of the Chapter. Apply a suitable sealant to the wiring grommets, then press them into the cut-outs in the cover.

14 Clean the tapered end of the crankshaft and the corresponding mating surface on the inside of the rotor with a suitable solvent. Fit the Woodruff key into its slot in the crankshaft (see illustration). Make sure that no metal objects have attached themselves to the magnet on the inside of the rotor, then install the rotor onto the shaft, making sure the slot is correctly aligned with the key (see illustration).

15 Install the rotor bolt with its washer and tighten it to the torque setting specified at the beginning of the Chapter, using the method employed on removal to prevent the rotor from turning (see illustrations).

16 Lubricate the starter idle/reduction gear shaft with clean engine oil. Install the



32.14b ... then slide on the rotor, aligning the slot (arrowed) with the key

idle/reduction gear, making sure it engages correctly with both the starter motor pinion and the starter clutch pinion, and insert the shaft (see illustration 32.9).

17 Install the alternator cover using a new gasket, making sure it locates onto the dowels, and tighten the cover bolts evenly in a criss-cross pattern to the specified torque setting (see illustrations). Connect the alternator and pick-up coil wiring connectors, making sure they are correctly routed and secured by any clips or ties (see illustrations 32.2a, b and c).

18 On TDM and XTZ models, install the inner sprocket cover, on TDM models not forgetting the clip secured by the top rear bolt, and tighten the bolts securely (see illustration

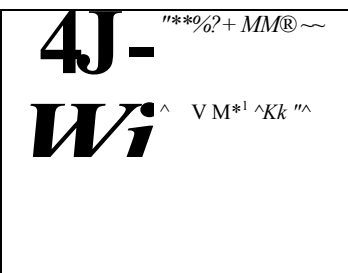


32.15a Install the bolt...

32.6c). Align the split in the gearchange linkage arm clamp with the punch mark on the shaft, then fit the arm on the shaft and tighten the pinchbolt to the specified torque setting (see illustration 32.6b). Install the outer sprocket cover and tighten its bolts to the specified torque (see illustration 32.6a). 19 On TRX models, install the inner sprocket cover, not forgetting the clip secured by the top rear bolt, and tighten the bolts securely. Install the outer sprocket cover and tighten its bolts to the specified torque. Align the split in the gearchange linkage arm clamp with the punch mark on the shaft, then fit the arm on the shaft and tighten the pinchbolt to the specified torque setting (see illustration 32.7).



32.15b ... and tighten it to the specified torque



32.17a Locate the gasket onto the dowels (arrowed)...



32.17b ... then install the cover

9»28 Electrical system

33 Regulator/rectifier-check and replacement

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Check

1 Yamaha provide no test specifications for the regulator/rectifier. If it is suspected of being faulty, first check all other components and wiring in the charging circuit, referring to the relevant Sections in this Chapter and to the wiring diagrams at the end.

2 If all other components and the wiring are good, then the regulator/rectifier could be faulty. Remove the unit (see below) and take it to a Yamaha dealer for testing. Alternatively, substitute the suspect unit with a known good one and see if the fault is cured.

Replacement

3 On 1991 to 1995 TDM models, the regulator/rectifier is mounted on the outside of the left-hand frame beam (see illustration). On 1996-on TDM models, it is mounted behind the fairing. Remove the fairing for access (see Chapter 8). On 1991 to 1995



33.3a Regulator/rectifier -1991 to 1995 TDM models



33.3b Regulator/rectifier wiring connector - 1991 to 1995 TDM models

models, remove the air filter housing for access to the wiring connector (see Chapter 4) (see illustration). 4 On TRX models, the regulator/rectifier is mounted to the underside of the rear mudguard near the top of the shock absorber (see illustration). Remove the rider's seat to access its wiring connector (see Chapter 8) (see illustration).

5 On XTZ models, the regulator/rectifier is mounted behind the left-hand side cover (see illustration). Remove the cover for access (see Chapter 8).

6 Disconnect the wiring connector.

7 Unscrew the two bolts or nuts securing the regulator/rectifier and remove it.

8 Install the new unit and tighten its bolts or nuts securely. Connect the wiring connector.



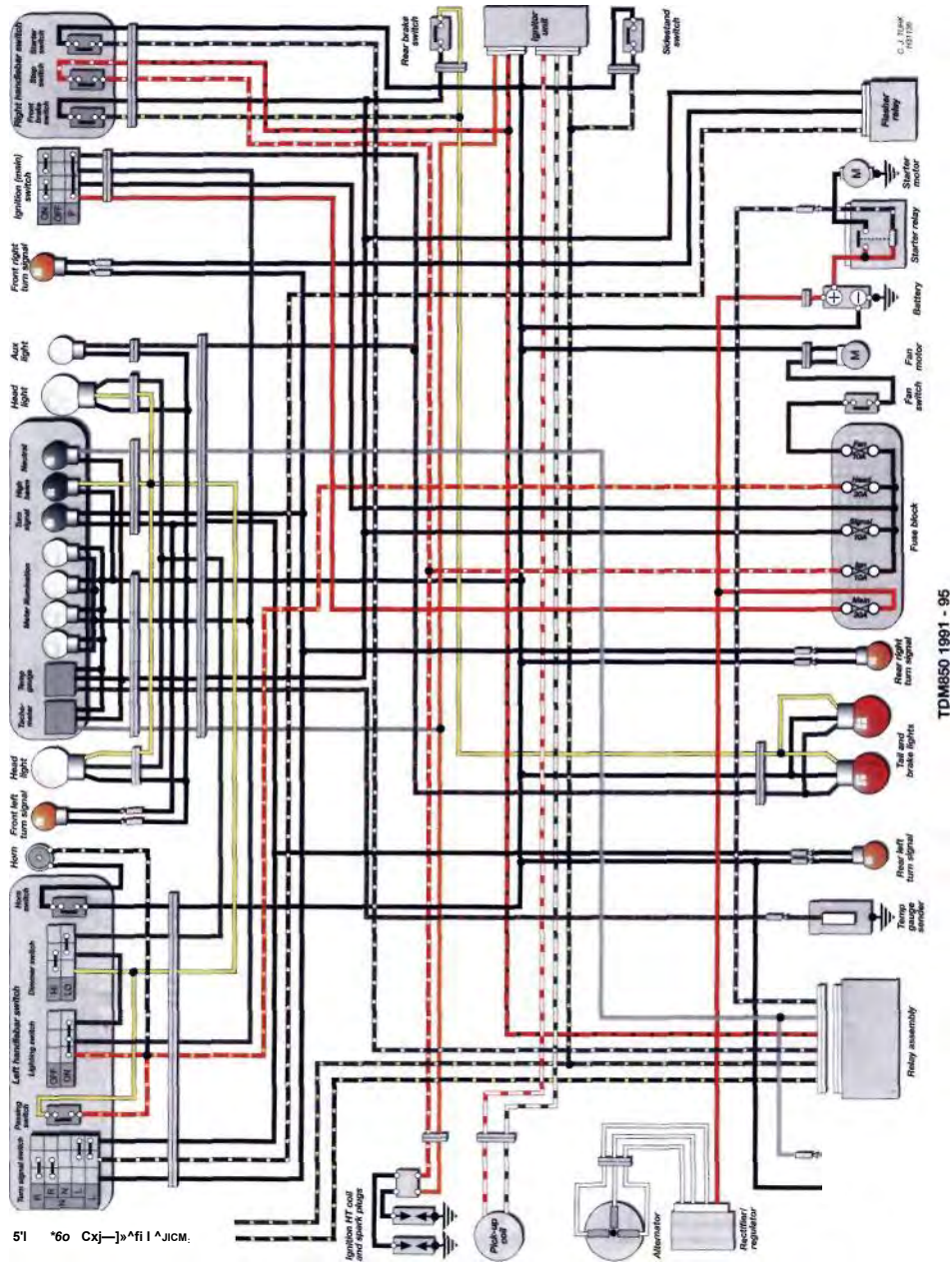
33.4a Regulator/rectifier - TRX models

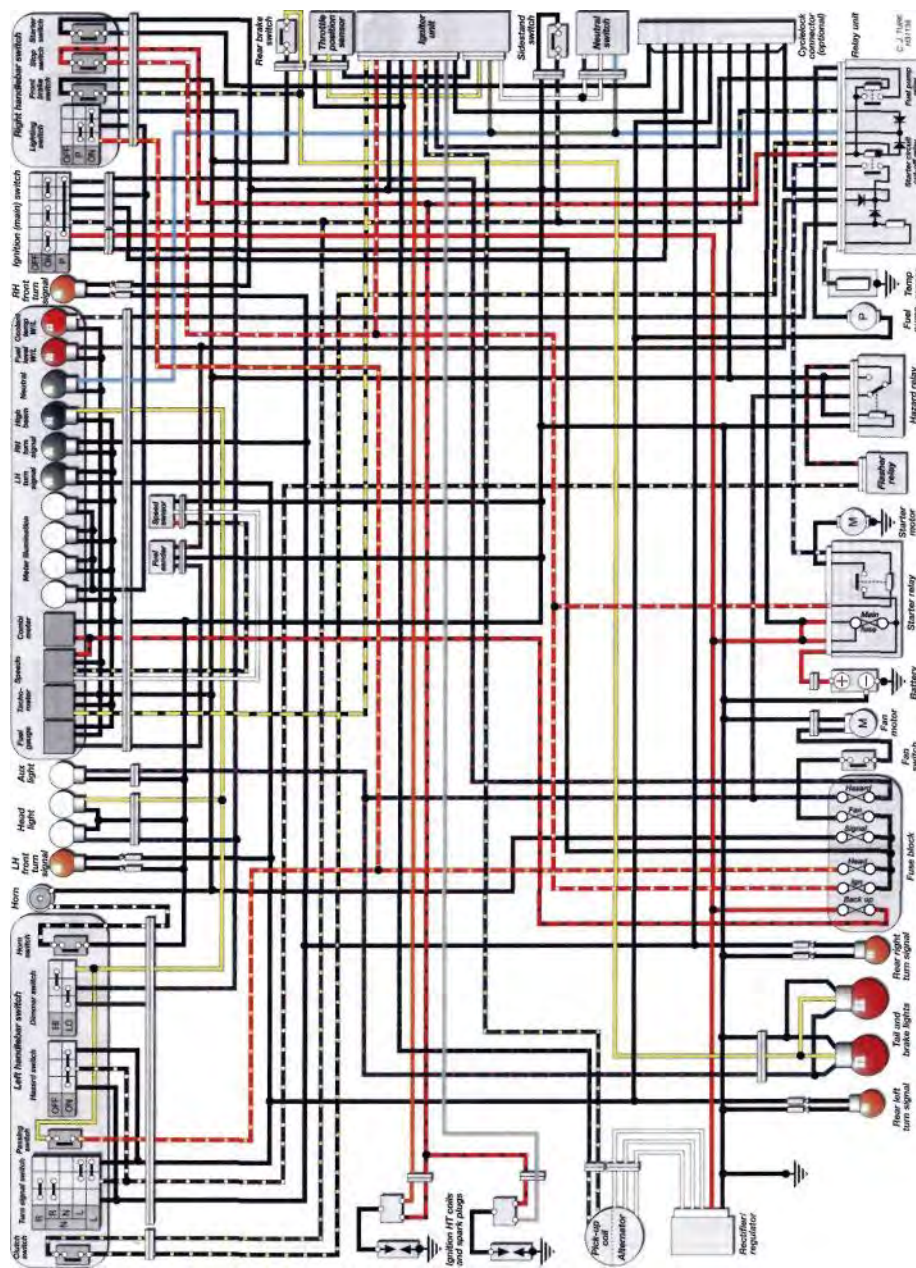


33.4b Regulator/rectifier wiring connector - TRX models

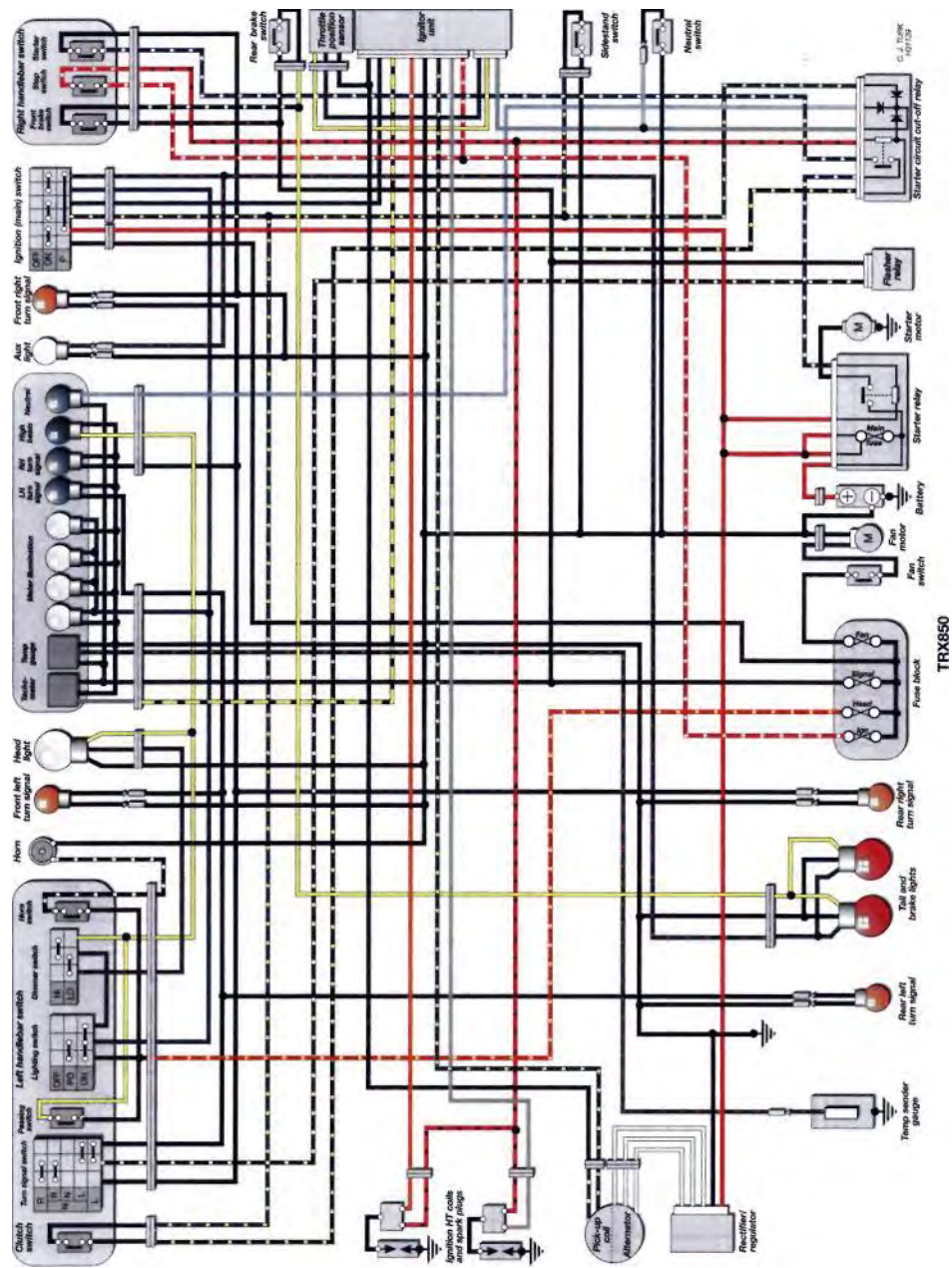


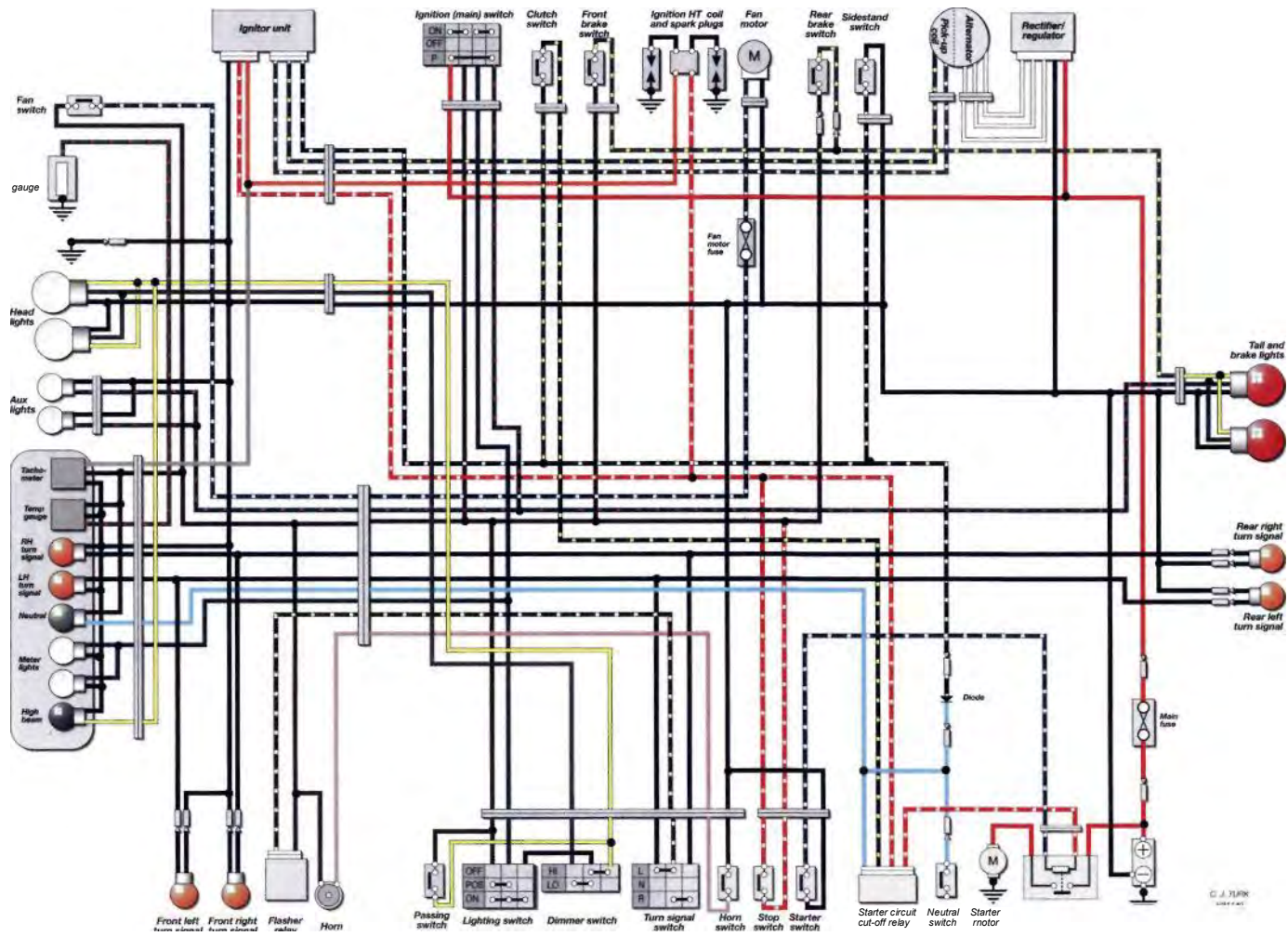
33.5 Regulator/rectifier - XTZ models





9»32 Wiring diagrams





XTZ750

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