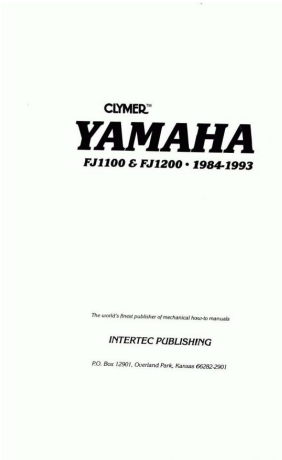

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CONTENTS

QUICK REFERENCE DATA

TIRE INFLATION PRESSURE (COLD)*

Load	psi	kPa
Up to 198 lb. (90 kg)		
Front	32	220
Rear	36	250
198–** lb. (90–** kg)		
Front	36	250
Rear	42	290
High speed riding		
Front	36	250
Rear	42	290

*Recommended air pressure for factory equipped tires. Aftermarket tires may require different air pressure.
**Maximum load limit includes total weight of motorcycle with accessories, rider(s) and luggage.

RECOMMENDED LUBRICANTS AND FLUIDS

Engine oil	
Temperatures 40° F (5° C) and up	SAE 20W40 SE/SF
Temperatures 40° F (5° C) and below	SAE 10W30 SE/SF
Brake fluid	DOT 4
Clutch hydraulic fluid	DOT 3 or DOT 4
Battery refilling (non-sealed)	Distilled water
Fork oil	10WT or SAE 10W/30 motor oil
Cables and pivot points	Yamaha chain and cable lube or SAE 10W/30 motor oil
Fuel	Unleaded regular
Drive chain	SAE 30-50W motor oil

APPROXIMATE REFILL CAPACITIES

Engine oil	
Without filter change	3.0 L (2.6 Imp. qt./3.2 U.S. quarts)
With filter change	3.25 L (2.9 Imp. qt./3.5 U.S. quarts)
Engine rebuild	4.2 L (3.7 Imp. qt./4.4 U.S. quarts)
Front forks	
Capacity	
1984-1990	424 cc (14.9 Imp. oz./14.3 U.S. oz.)
1991-on	466 cc (16.7 Imp. oz./15.8 U.S. oz.)
Fuel tank	
Tank total capacity	
1100 cc	24.5 L (5.4 Imp. gal./6.5 U.S. gal.)
1200 cc	22 L (4.9 Imp. gal./5.8 U.S. gal.)
Reserve (1200 cc)	5 L (1.1 Imp. gal./1.3 U.S. gal.)

MAINTENANCE AND TUNE-UP TIGHTENING TORQUES

Item	N·m	ft.-lb.
Oil drain plug	43	31
Oil filter drain bolt	7	5.1
Fork cap bolt	23	17
Upper fork bridge bolt	20	14
Spark plug (new)	17.5	12.5
Rear axle nut	160	115
Drive chain adjuster locknut	15	11

TUNE-UP SPECIFICATIONS

Air filter element	Dry element type
Ignition timing	Fixed
Valve clearance (cold)	
Intake	0.11–0.15 mm (0.0043–0.0059 in.)
Exhaust	0.16–0.20 mm (0.0063–0.0079 in.)
Spark plug	
Type	
U.S.	NGK DP8EA-9
	ND X24EPR-U9
U.K.	NGK BP8EA-9
	ND X24EPR-U9
Gap	0.8–0.9 mm (0.031–0.035 in.)
Tightening torque	17.5 N·m (12.5 ft.-lb.)
Idle speed	950–1,050 rpm
Compression pressure (cold at sea level)	
Standard	980 kPa (142 psi)
Service limit	686 kPa (100 psi)
Maximum	1,176 kPa (171 psi)
Maximum difference between cylinders	100 kPa (15 psi)

REPLACEMENT BULBS

U.S. Models	
Item	**Wattage**
Headlight	12V 60W/55W
Position light	8W (2)
Taillight/stoplight	8/27W (2)
Directional light	27W (4)
Meter light	3.4W (3)
Indicator light	3.4W (5)
U.K. Models	
Item	**Wattage**
Headlight	12V 60W/55W
Auxiliary light	5W (1)
Taillight/stoplight	5/21W (2)
Flasher light	21W (4)
Meter light	3.4W (3)
Indicator light	3.4W (6)

INTRODUCTION

This detailed, comprehensive manual covers the U.S and the U.K. models of the Yamaha FJ1100 from 1984-1985 and FJ1200 from 1986-on.

The expert text gives complete information on maintenance, tune-up, repair and overhaul. Hundreds of photos and drawings guide you through every step. The book includes all you will need to know to keep your Yamaha running right.

A shop manual is a reference. You want to be able to find information fast. As in all Clymer books, this one is designed with you in mind. All chapters are thumb tabbed. Important items are extensively indexed at the rear of the book. All procedures, tables, photos, etc., in this manual are for the reader who may be working on the bike for the first time or using this manual for the first time. All the most frequently used specifications and capacities are summarized in the *Quick Reference Data* pages at the front of the book.

Keep the book handy in your tool box. It will help you better understand how your bike runs, lower repair costs and generally improve your satisfaction with the Yamaha.

CHAPTER ONE

GENERAL INFORMATION

This detailed, comprehensive manual covers the U.S. and the U.K. models of the Yamaha FJ1100 from 1984-1985 and FJ1200 from 1986 on. **Table 1** lists engine and chassis numbers for models covered in this manual.

Troubleshooting, tune-up, maintenance and repair are not difficult, if you know what tools and equipment to use and what to do. Step-by-step instructions guide you through jobs ranging from simple maintenance to complete engine and suspension overhaul.

This manual can be used by anyone from a first time do-it-yourselfer to a professional mechanic. Detailed drawings and clear photographs give you all the information you need to do the work right.

Some of the procedures in this manual require the use of special tools. The resourceful mechanic can, in many cases, think of acceptable substitutes for special tools—there is always another way. This can be as simple as using a few pieces of threaded rod, washers and nuts to remove or install a bearing or fabricating a tool from scrap material. However, using a substitute for a special tool is not recommended as it can be dangerous to and may damage the part. If you find that a tool can be designed and safely made, but will require some type of machine work, you may want to search out a local community college or high school that has a machine shop curriculum. Shop teachers sometimes welcome outside work that can be used as practical shop applications for advanced students.

Table 1 lists model coverage with engine serial numbers.

Metric and U.S. standards are used throughout this manual. U.S. to metric conversion is given in **Table 2.**

Tables 1-5 are found at the end of the chapter.

MANUAL ORGANIZATION

This chapter provides general information and discusses equipment and tools useful both for preventive maintenance and troubleshooting.

Chapter Two provides methods and suggestions for quick and accurate diagnosis and repair of problems. Troubleshooting procedures discuss typical symptoms and logical methods to pinpoint the trouble.

Chapter Three explains all periodic lubrication and routine maintenance necessary to keep your Yamaha operating at top performance. Chapter Three also includes recommended tune-up procedures, eliminating the need to constantly consult other chapters on the various assemblies.

Subsequent chapters describe specific systems such as the engine top end, engine bottom end, clutch, transmission, fuel, exhaust, electrical, suspension, drive train, steering and brakes. Each chapter provides disassembly, repair and assembly procedures in simple step-by-step form. If a repair is impractical for a home mechanic, it is so indicated. It is usually faster and less expensive to take such repairs to a Yamaha dealer or competent repair shop. Specifications concerning a particular system are included at the end of the appropriate chapter.

NOTES, CAUTIONS AND WARNINGS

The terms NOTE, CAUTION and WARNING have specific meanings in this manual. A NOTE provides additional information to make a step or procedure easier or clearer. Disregarding a NOTE could cause inconvenience, but would not cause damage or personal injury.

A CAUTION emphasizes areas where equipment damage could occur. Disregarding a CAUTION could cause permanent mechanical damage; however, personal injury is unlikely.

A WARNING emphasizes areas where personal injury or even death could result from negligence. Mechanical damage may also occur. WARNINGS *are to be taken seriously*. In some cases, serious injury and death have resulted from disregarding similar warnings.

SAFETY FIRST

Professional mechanics can work for years and never sustain a serious injury. If you observe a few rules of common sense and safety, you can enjoy many safe hours servicing your own machine. If you ignore these rules you can hurt yourself or damage the equipment.

1. *Never* use gasoline as a cleaning solvent.

2. *Never* smoke or use a torch in the vicinity of flammable liquids, such as cleaning solvent, in open containers.

3. If welding or brazing is required on the machine, remove the fuel tank and rear shock to a safe distance, at least 50 feet away.

4. Use the proper sized wrenches to avoid damage to fasteners and injury to yourself.

5. When loosening a tight or stuck nut, be guided by what would happen if the wrench should slip. Be careful; protect yourself accordingly.

6. When replacing a fastener, make sure to use one with the same measurements and strength as the old one. Incorrect or mismatched fasteners can result in damage to the bike and possible personal injury. Beware of fastener kits that are filled with cheap and poorly made nuts, bolts, washers and cotter pins. Refer to *Fasteners* in this chapter for additional information.

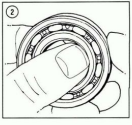
7. Keep all hand and power tools in good condition. Wipe greasy and oily tools after using them. They are difficult to hold and can cause injury. Replace or repair worn or damaged tools.

8. Keep your work area clean and uncluttered.

9. Wear safety goggles during all operations involving drilling, grinding, the use of a cold chisel or anytime you feel unsure about the safety of your eyes. Safety goggles should also be worn anytime solvent and compressed air is used to clean a part.

10. Keep an approved fire extinguisher (**Figure 1**) nearby. Be sure it is rated for gasoline (Class B) and electrical (Class C) fires.

11. When drying bearings or other rotating parts with compressed air, never allow the air jet to rotate the bearing or part. The air jet is capable of rotating them at speeds far in excess of those for which they were designed. The bearing or rotating part is very likely to disintegrate and cause serious injury and



damage. To prevent bearing damage when using compressed air, hold the inner bearing race by hand (**Figure 2**).

SERVICE HINTS

Most of the service procedures covered are straightforward and can be performed by anyone reasonably handy with tools. It is suggested, however, that you consider your own capabilities carefully before attempting any operation involving major disassembly of the engine or transmission.

Take your time and do the job right. Do not forget that a newly rebuilt engine must be broken in the same way as a new one. Keep the rpms within the limits given in your owner's manual when you get back on the road.

1. "Front," as used in this manual, refers to the front of the bike; the front of any component is the end closest to the front of the bike. The "left-" and "right-hand" sides refer to the position of the parts as viewed by a rider sitting on the seat facing forward. For example, the throttle control is on the right-hand side. These rules are simple, but confusion can cause a major inconvenience during service.

2. Whenever servicing the engine or clutch, or when removing a suspension component, the bike should be secured in a safe manner.

WARNING

Never disconnect the positive (+) battery cable unless the negative (–) cable but first been disconnected. Disconnecting the positive cable while the negative cable is still connected may cause a spark. This could ignite hydrogen gas given off by the battery, causing an explosion.

3. Disconnect the negative battery cable (**Figure 3**) when working on or near the electrical, clutch or starter systems and before disconnecting any electrical wires. On most batteries, the negative terminal will be marked with a minus (–) sign and the positive terminal with a plus (+) sign.

4. Tag all similar internal parts for location and mark all mating parts for position (A, **Figure 4**). Record number and thickness of any shims as they are removed. Small parts such as bolts can be identified by placing them in plastic sandwich bags (B, **Figure 4**). Seal and label them with masking tape.

5. Place parts from a specific area of the engine (e.g. cylinder head, cylinder, clutch, shift mechanism, etc.) into plastic boxes (C, **Figure 4**) to keep them separated.

6. When disassembling transmission shaft assemblies, use an egg flat (the type that restaurants get their eggs in) (D, **Figure 4**) and set the parts from the shaft in one of the depressions in the same order in which they were removed.

7. Wiring should be tagged with masking tape and marked as each wire is removed. Again, do not rely on memory alone.

8. Finished surfaces should be protected from physical damage or corrosion. Keep gasoline and brake fluid off painted surfaces.

9. Use penetrating oil on frozen or tight bolts, then strike the bolt head a few times with a hammer and punch (use a screwdriver on screws). Avoid the use of heat where possible, as it can warp, melt or affect the temper of parts. Heat also ruins finishes, especially paint and plastics.

10. No parts removed or installed (other than bushings and bearings) in the procedures given in this manual should require unusual force during disassembly or assembly. If a part is difficult to remove or install, find out why before proceeding.

11. Cover all openings after removing parts or components to prevent dirt, small tools, etc. from falling in.

12. Read each procedure *completely* while looking at the actual parts before starting a job. Make sure you *thoroughly* understand what is to be done and then carefully follow the procedure, step by step.

13. Recommendations are occasionally made to refer service or maintenance to a Yamaha dealer or a specialist in a particular field. In these cases, the work will be done more quickly and economically than if you performed the job yourself.

14. In procedural steps, the term "replace" means to discard a defective part and replace it with a new or exchange unit. "Overhaul" means to remove, disassemble, inspect, measure, repair or replace defective parts, reassemble and install major systems or parts.

15. Some operations require the use of a hydraulic press. Unless you have a press, it would be wiser to have these operations performed by a shop equipped for such work, rather than to try to do the job yourself with makeshift equipment that may damage your machine.

16. Repairs go much faster and easier if your machine is clean before you begin work. There are many special cleaners on the market, like Bel-Ray Degreaser, for washing the engine and related parts. Follow the manufacturer's directions on the container for the best results. Clean all oily or greasy parts with cleaning solvent as you remove them.

WARNING

Never use gasoline as a cleaning agent. *It presents an extreme fire hazard. Be sure to work in a well-ventilated area when using cleaning solvent. Keep a fire extinguisher, rated for gasoline fires, handy in any case.*

CAUTION

If you use a car wash to clean your bike, don't direct the high-pressure water hose at steering bearings, carburetor hoses, suspension linkage components, wheel bearings and electrical components. The water will flush grease out of the bearings or damage the seals.

17. Much of the labor charges for repairs made by dealers are for the time involved in the removal, disassembly, assembly and reinstallation of other parts in order to reach the defective part. It is frequently possible to perform the preliminary operations yourself and then take the defective unit to the dealer for repair at considerable savings.

18. If special tools are required, make arrangements to get them before you start. It is frustrating and time-consuming to get partly into a job and then be unable to complete it.

19. Make diagrams (or take a Polaroid picture) wherever similar-appearing parts are found. For instance, crankcase bolts are often not the same length. You may think you can remember where everything came from—but mistakes are costly. There is also the possibility that you may be sidetracked and not return to work for days or even weeks—in which time the carefully laid out parts may have become disturbed.

20. When assembling parts, be sure all shims and washers are replaced exactly as they came out.

21. Whenever a rotating part bats against a stationary part, look for a shim or washer. Use new gaskets if there is any doubt about the condition of the old ones. A thin coat of oil on non-pressure type gaskets may help them seal more effectively.

22. High spots may be sanded off a piston with sandpaper, but fine emery cloth and oil will do a much more professional job.

23. Carbon can be removed from the head, the piston crowns and the exhaust ports with a dull screwdriver. Do *not* scratch machined surfaces. Wipe off the surface with a clean cloth when finished.

24. A baby bottle makes a good measuring device for adding oil to the front forks. Get one that is graduated in fluid ounces and cubic centimeters. After it has been used for this purpose, do *not* let a small child drink out of it as there will always be an oil residue in it.

25. If it is necessary to make a clutch cover or ignition cover gasket and you do not have a suitable old gasket to use as a guide, you can use the outline of the cover and gasket material to make a new gasket. Apply engine oil to the cover gasket surface. Then place the cover on the new gasket material and apply pressure with your hands. The oil will leave a very accurate outline on the gasket material that can be cut around.

CAUTION

When purchasing gasket material to make a gasket, measure the thickness of the old gasket and purchase gasket material with the same approximate thickness.

26. Heavy grease can be used to hold small parts in place if they tend to fall out during assembly. However, keep grease and oil away from electrical and brake components.

27. The carburetor is best cleaned by disassembling it and soaking the parts in a commercial carburetor cleaner. Never soak gaskets and rubber parts in these cleaners. Never use wire to clean out jets and air passages. They are easily damaged. Use compressed air to blow out the carburetor only if the float has been removed first.

28. There are many items available that can be used on your hands before and after working on your bike. A little preparation prior to getting "all greased up" will help when cleaning up later. Before starting out, work Vaseline, soap or a product such as Invisible Glove (**Figure 5**) onto your forearms, into your hands and under your fingernails and cuticles. This will make cleanup a lot easier. For cleanup, use a waterless hand soap such as Sta Lube and then finish up with powdered Boraxo and a fingernail brush (**Figure 6**).

TORQUE SPECIFICATIONS

Torque specifications throughout this manual are given in Newton-meters (Nm) and foot-pounds (ft.-lb.).

Existing torque wrenches calibrated in meter kilograms can be used by performing a simple conversion. All you have to do is move the decimal point one place to the right; for example, 3.5 mkg = 35 Nm. This conversion is accurate enough for mechanical work even though the exact mathematical conversion is 3.5 mkg = 34.3 Nm.

Refer to **Table 3** for general torque specifications for various size screws, bolts and nuts that may not be listed in the respective chapters. To use the table, first determine the size of the bolt or nut. Use a Vernier caliper and measure the inside dimension of the threads of the nut (**Figure 7**) and across the threads for a bolt (**Figure 8**).

FASTENERS

The materials and designs of the various fasteners used on your Yamaha FJ1100 and FJ1200 are not arrived at by chance or accident. Fastener design determines the type of tool required to work the fastener. Fastener material is carefully selected to decrease the possibility of physical failure.

Nuts, bolts and screws are manufactured in a wide range of thread patterns. To join a nut and bolt, the diameter of the bolt and the diameter of the hole in the nut must be the same. It is just as important that the threads on both be properly matched.

The best way to tell if the threads on 2 fasteners are matched is to turn the nut on the bolt (or the bolt into the threaded hole in a piece of equipment) with fingers only. Be sure both pieces are clean. If much force is required, check the thread condition on each fastener. If the thread condition is good but the fasteners jam, the threads are not compatible. A thread pitch gauge (**Figure 9**) can also be used to determine pitch. Yamaha motorcycles are manufactured with ISO (International Organization for Standardization) metric fasteners. The threads are cut differently than that of American fasteners (**Figure 10**).

Most threads are cut so that the fastener must be turned clockwise to tighten it. These are called right-hand threads. Some fasteners have left-hand threads; they must be turned counterclockwise to be tightened. Left-hand threads are used in locations where normal rotation of the equipment would tend to loosen a right-hand threaded fastener.

ISO Metric Screw Threads

ISO (International Organization for Standardization) metric threads come in 3 standard thread sizes: coarse, fine and constant pitch. The ISO coarse pitch is used for most all common fastener applications. The fine pitch thread is used on certain precision tools and instruments. The constant pitch thread is used mainly on machine parts and not for fasteners. The constant pitch thread, however, is used on all metric thread spark plugs.

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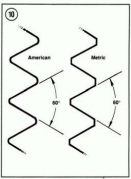

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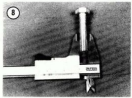

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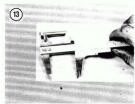


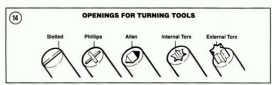
ISO metric threads are specified by the capital letter M followed by the diameter in millimeters and the pitch (or the distance between each thread) in millimeters separated by the sign x. For example a M8 x 1.25 bolt is one that has a diameter of 8 millimeters with a distance of 1.25 millimeters between each thread. The measurement across 2 flats on the head of the bolt (**Figure 11**) indicates the proper wrench size to be used. **Figure 12** shows how to determine bolt diameter.

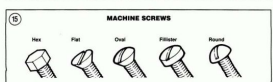
NOTE

*When purchasing a bolt from a dealer or parts store, it is important to know how to specify bolt length. The correct way to measure bolt length is by measuring the length starting from underneath the bolt head to the end of the bolt (**Figure 13**). Always measure bolt length in this manner to avoid purchasing bolts that are too long.*

Machine Screws

There are many different types of machine screws. **Figure 14** shows a number of screw heads requiring different types of turning tools. Heads are also designed to protrude above the metal (round) or to be slightly recessed in the metal (flat). See **Figure 15**.





Bolts

Commonly called bolts, the technical name for these fasteners is cap screws. Metric bolts are described by the diameter and pitch (or the distance between each thread). For example, a M8 x 1.25 bolt is one that has a diameter of 8 millimeters and a distance of 1.25 millimeters between each thread. The measurement across 2 flats on the head of the bolt (**Figure 11**) indicates the proper wrench size to be used. Use a Vernier caliper and measure across the threads (**Figure 12**) to determine the bolt diameter and to measure the length (**Figure 13**).

Nuts

Nuts are manufactured in a variety of types and sizes. Most are hexagonal (6-sided) and fit on bolts, screws and studs with the same diameter and pitch.

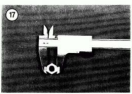
Figure 10 shows several types of nuts. The common nut is generally used with a lockwasher. Self-locking nuts have a nylon insert which prevents the nut from loosening; no lockwasher is required. Wing nuts are designed for fast removal by hand. Wing nuts are used for convenience in non-critical locations.

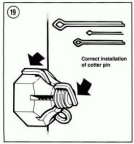
To indicate the size of a metric nut, manufacturers specify the diameter of the opening and the thread pitch. This is similar to bolt specifications, but without the length dimension. The measurement across 2 flats on the nut indicates the proper wrench size to be used (**Figure 17**).

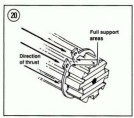
Prevailing Torque Fasteners

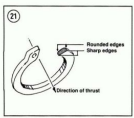
Several types of bolts, screws and nuts incorporate a system that develops an interference between the bolt, screw, nut or tapped hole threads. Interference is achieved in various ways: by distorting threads, coating threads with dry adhesive or nylon, distorting the top of an all-metal nut, using a nylon insert in the center or at the top of a nut, etc.

Prevailing torque fasteners offer greater holding strength and better vibration resistance. Some prevailing torque fasteners can be reused if in good condition. Others, like the nylon insert nut, form an initial locking condition when the nut is first installed; the nylon forms closely to the bolt thread pattern, thus reducing any tendency for the nut to loosen. When the nut is removed, the locking effi-









ciency is greatly reduced. For greatest safety, it is recommended that you install new prevailing torque fasteners whenever they are removed.

Washers

There are 2 basic types of washers: flat washers and lock washers. Flat washers are simple discs with a hole to fit a screw or bolt. Lockwashers are designed to prevent a fastener from working loose due to vibration, expansion and contraction. **Figure 18** shows several types of washers. Washers are also used in the following functions:

a. As spacers.
b. To prevent galling or damage of the equipment by the fastener.
c. To help distribute fastener load during torquing.
d. As seals.

Note that flat washers are often used between a lockwasher and a fastener to provide a smooth bearing surface. This allows the fastener to be turned easily with a tool.

Cotter Pins

Cotter pins (**Figure 19**) are used to secure special kinds of fasteners. The threaded stud must have a hole in it; the nut or nut lock piece has castellations around which the cotter pin ends wrap. Cotter pins should not be reused after removal.

Circlips

Circlips can be internal or external design. They are used to retain items on shafts (external type) or within tubes (internal type). In some applications, circlips of varying thicknesses are used to control the end play of parts assemblies. These are often called selective circlips. Circlips should be replaced during installation, as removal weakens and deforms them.

Two basic styles of circlips are available: machined and stamped circlips. Machined circlips (**Figure 20**) can be installed in either direction (shaft or housing) because both faces are machined, thus creating two sharp edges. Stamped circlips (**Figure 21**) are manufactured with one sharp edge and one rounded edge. When installing stamped circlips in a

thrust situation (transmission shafts, fork tubes, etc.), the sharp edge must face away from the part producing the thrust. When installing circlips, observe the following:

a. Compress or expand circlips only enough to install them.
b. After the circlip is installed, make sure it is completely seated in its groove.

Transmission circlips become worn with use and increase side play. For this reason, always use new circlips whenever a transmission is reassembled.

LUBRICANTS

Periodic lubrication assures long life for any type of equipment. The type of lubricant used is just as important as the lubrication service itself, although in an emergency the wrong type of lubricant is better than none at all. The following paragraphs describe the types of lubricants most often used on motorcycle equipment. Be sure to follow the manufacturer's recommendations for lubricant types.

Generally, all liquid lubricants are called "oil." They may be mineral-based (including petroleum bases), natural-based (vegetable and animal bases), synthetic-based or emulsions (mixtures). "Grease" is an oil to which a thickening base has been added so that the end product is semi-solid. Grease is often classified by the type of thickener added: lithium soap is commonly used.

Engine Oil

Four-cycle oil for motorcycle and automotive engines is graded by the American Petroleum Institute (API) and the Society of Automotive Engineers (SAE) in several categories. Oil containers display these ratings on the top or label.

API oil grade is indicated by letters; oils for gasoline engines are identified by an "S." Yamaha models described in this manual require SE or SF graded oil.

Viscosity is an indication of the oil's thickness. The SAE uses numbers to indicate viscosity: thin oils have low numbers while thick oils have high numbers. A "W" after the number indicates that the viscosity testing was done at low temperature to simulate cold-weather operation. Engine oils fall into the 5W-30 and 20W-50 range.

Multi-grade oils (for example 10W-40) are less viscous (thinner) at low temperatures and more viscous (thicker) at high temperatures. This allows the oil to perform efficiently across a wide range of engine operating conditions. The lower the number, the better the engine will start in cold climates. Higher numbers are usually recommended for engine running in hot weather conditions.

Grease

Greases are graded by the National Lubricating Grease Institute (NLGI). Greases are graded by number according to the consistency of the grease: these range from No. 000 to No. 6, with No. 6 being the most solid. A typical multipurpose grease is NLGI No. 2. For specific applications, equipment manufacturers may require grease with an additive such as molybdenum disulfide (MOS2) (**Figure 22**).

EXPENDABLE SUPPLIES

Certain expendable supplies are required during maintenance and repair work. These include grease, oil, gasket cement, wiping rags and cleaning solvent.

Ask your dealer for the special locking compounds, silicone lubricants and other products (**Figure 23**) which make bike maintenance simpler and easier. Cleaning solvent or kerosene is available at some service stations, paint or hardware stores.

WARNING

Having a stack of clean shop rags on hand is important when performing engine and suspension service work. However, to prevent the possibility of fire damage from spontaneous combustion from a pile of solvent soaked rags, store them in a lid sealed metal container until they can be washed or discarded.

NOTE

To avoid absorbing solvent and other chemicals into your skin while cleaning parts, wear a pair of petroleum-resistant rubber gloves. These can be purchased through industrial supply houses or well-equipped hardware stores.

PARTS REPLACEMENT

Yamaha makes frequent changes during a model year, some minor, some relatively major. When you order parts from the dealer or other parts distributor, always order by frame and engine numbers. The frame number serial number is stamped on the right-hand side of the upper frame tube (**Figure 24**). The engine number is stamped on a raised pad on the right-hand side of the crankcase (**Figure 25**) by the clutch cover. The carburetor number (**Figure 26**) is on the left-hand side of the No. 1 carburetor body just below the top cover.

Write the numbers down and carry them with you. Compare new parts to old before purchasing them. If they are not alike, have the parts manager explain the difference to you. **Table 1** lists engine and frame serial numbers for the models covered in this manual.

NOTE

If your Yamaha was purchased second-hand and you are not sure of its model year, use the bike's engine serial number and the information listed in **Table 1**. *Read your bike's engine serial number. Then compare the number with the engine and serial numbers listed in* **Table 1**. *If your bike's serial number is listed in* **Table 1**, *cross-reference the number with the adjacent model number and year.*

EMISSION CONTROL AND BATTERY LABELS

On U.S. models, an emission control information label is fixed to the top surface of the front portion of the rear fender under the seat (**Figure 27**). This

decal lists the emission control related tune-up information for your specific model.

On California models, an emission hose routing labels is also located in the same area.

Battery related information and caution label is also included in the same area. Refer to these whenever servicing the battery.

BASIC HAND TOOLS

Many of the procedures in this manual can be carried out with simple hand tools and test equipment familiar to the average home mechanic. Keep your tools clean and in a tool box. Keep them organized with the sockets and related drivers together, the open-end combination wrenches together, etc. After using a tool, wipe off dirt and grease with a clean cloth and return the tool to its correct place.

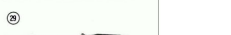
Top quality tools are essential; they are also more economical in the long run. If you are now starting to build your tool collection, stay away from the "advertised specials" featured at some parts houses, discount stores and chain drug stores. These are usually a poor grade tool that can be sold cheaply and that is exactly what they are—*cheap*. They are usually made of inferior material, and are thick, heavy and clumsy. Their rough finish makes them difficult to clean and they usually don't last very long. If it is ever your misfortune to use such tools, you will probably find out that the wrenches do not fit the heads of bolts and nuts correctly and damage the fastener.

Quality tools are made of alloy steel and are heat treated for greater strength. They are lighter and better balanced than cheap ones. Their surface is smooth, making them a pleasure to work with and easy to clean. The initial cost of good quality tools may be more but they are cheaper in the long run. Don't try to buy everything in all sizes in the beginning; do it a little at a time until you have the necessary tools.

The following tools are required to perform virtually any repair job on a bike. Each tool is described and the recommended size given for starting a tool collection. **Table 4** includes the tools that should be on hand for simple home repairs and/or major overhaul as shown in **Figure 28**. Additional tools and some duplicates may be added as you become more familiar with the bike. Almost all motorcycles and vehicles (with the exception of the U.S.-built Harley and some English bikes) use metric size bolts and nuts. If you are starting your collection now, buy metric sizes.

Screwdrivers

The screwdriver is a very basic tool, but if used improperly it will do more damage than good. The slot on a screw has a definite dimension and shape. A screwdriver must be selected to conform with that shape. Use a small screwdriver for small screws and a large one for large screws or the screw head will be damaged.



30

31

Two basic types of screwdriver are required: common (flat-blade) screwdrivers (**Figure 29**) and Phillips screwdrivers (**Figure 30**).

Screwdrivers are available in sets which often include an assortment of common and Phillips blades. If you buy them individually, buy at least the following:

a. Common screwdriver—5/16 × 6 in. blade.

b. Common screwdriver—3/8 × 12 in. blade.

c. Phillips screwdriver—size 2 tip, 6 in. blade.

Use screwdrivers only for driving screws. Never use a screwdriver for prying or chiseling metal. Do not try to remove a Phillips or Allen head screw with a common screwdriver (unless the screw has a combination head that will accept either type); you can damage the head so that the proper tool will be unable to remove it.

Keep screwdrivers in the proper condition and they will last longer and perform better. Always keep the tip of a common screwdriver in good condition. **Figure 31** shows how to grind the tip to the proper shape if it becomes damaged. Note the symmetrical sides of the tip.

Pliers

Pliers come in a wide range of types and sizes. Pliers are useful for cutting, bending and crimping. They should never be used to cut hardened objects or to turn bolts or nuts. **Figure 32** shows several pliers useful in motorcycle repairs.

Each type of pliers has a specialized function. Slip-joint pliers are general purpose pliers and are used mainly for holding things and for bending.

32

Needlenose pliers are used to hold or bend small objects. Channel lock pliers can be adjusted to hold various sizes of objects; the jaws remain parallel to grip around objects such as pipe or tubing. There are many more types of pliers. The ones described here are most suitable for bike repairs.

Vise-grip Pliers

Vise-grip pliers (**Figure 33**) are used to hold objects very tightly like a vise. But avoid using them unless absolutely necessary since their sharp jaws will permanently scar any objects which are held. Vise-grip pliers are available in many types for more specific tasks.

Circlip Pliers

Circlip pliers (**Figure 34**) are special in that they are only used to remove circlips from shafts or within engine or suspension housings. When purchasing circlip pliers, there are two kinds to distinguish from. External pliers (spreading) are used to remove circlips that fit on the outside of a shaft. Internal pliers (squeezing) are used to remove circlips which fit inside a gear or housing.

WARNING

Because circlips can sometimes slip and "fly off" during removal and installation, always wear safety glasses.

Box-end, Open-end and Combination Wrenches

Box-end, open-end and combination wrenches are available in sets or separately in a variety of sizes. On open-end and box-end wrenches, the number stamped near the end refers to the distance between 2 parallel flats on the hex head bolt or nut. On combination wrenches, the number is stamped near the center.

Box-end wrenches require clear overhead access to the fastener but can work well in situations where the fastener head is close to another part. They grip on all six edges of a fastener for a very secure grip. They are available in either 6-point or 12-point. The 6-point gives superior holding power and durability but requires a greater swinging radius. The 12-point works better in situations with limited swinging radius.

Open-end wrenches are speedy and work best in areas with limited overhead access. Their wide flat jaws make them unusable for situations where the bolt or nut is sunken in a well or close to the edge of a casting. These wrenches grip only two flats of a fastener so if either the fastener head or the wrench jaws are worn, the wrench may slip off.

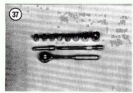
Combination wrenches (**Figure 35**) have open-end on one side and box-end on the other with both

36

ends being the same size. These wrenches are favored by professionals because of their versatility.

Adjustable (Crescent) Wrenches

An adjustable wrench (sometimes called crescent wrench) can be adjusted to fit nearly any nut or bolt head which has clear access around its entire perimeter. Adjustable wrenches (**Figure 36**) are best used as a backup wrench to keep a large nut or bolt from turning while the other end is being loosened or tightened with a proper wrench.



37

Adjustable wrenches have only two gripping surfaces which make them more subject to slipping off the fastener and damaging the part and possibly injuring your hand. The fact that one jaw is adjustable only aggravates this shortcoming.

These wrenches are directional; the solid jaw must be the one transmitting the force. If you use the adjustable jaw to transmit the force, it will loosen and possibly slip off.

Adjustable wrenches come in all sizes but something in the 6 to 8 in. range is recommended as an all-purpose wrench.

38

Socket Wrenches

This type is undoubtedly the fastest, safest and most convenient to use. Sockets which attach to a ratchet handle (**Figure 37**) are available with 6-point or 12-point openings and 1/4, 3/8, 1/2 and 3/4 in. drives. The drive size indicates the size of the square hole which mates with the ratchet handle (**Figure 38**).

39

Allen Wrenches

Allen wrenches (**Figure 39**) are available in sets or separately in a variety of sizes. These sets come in SAE and metric size, so be sure to buy a metric set. Allen bolts are sometimes called socket bolts. Sometimes the bolts are difficult to reach and it is suggested that a variety of Allen wrenches be purchases (e.g. socket driven, T-handle and extension type) as shown in **Figure 40**.

Torque Wrench

A torque wrench is used with a socket to measure how tightly a nut or bolt is installed. They come in a wide price range and with either 3/8 or 1/2 in. square drive (**Figure 41**). The drive size indicates the size of the square drive which mates with the socket. Purchase one that measures 0-280 Nm (0-200 ft.-lb.).


40

Impact Driver

This tool might have been designed with the bike in mind. This tool makes removal of fasteners easy and eliminates damage to bolts and screw slots. Impact drivers and interchangeable bits (**Figure 42**) are available at most large hardware, motorcycle or auto parts stores. Don't purchase a cheap one as they do not work as well and require more force (the "use a larger hammer" syndrome) than a moderately priced one. Sockets can also be used with a hand impact driver. However, make sure that the socket is designed for use with an impact driver or air tool. Do not use regular hand sockets, as they may shatter during use.


41

Hammers

The correct hammer (**Figure 43**) is necessary for repairs. Use only a hammer with a face (or head) of rubber or plastic or the soft-faced type that is filled with backshot. These are sometimes necessary in engine teardowns. *Never* use a metal-faced hammer on engine or suspension parts, as severe damage will result in most cases. You can always produce the same amount of force with a soft-faced hammer. A metal-faced hammer, however, will be required when using a hand impact driver.


42

PRECISION MEASURING TOOLS

Measurement is an important part of motorcycle service. When performing many of the service procedures in this manual, you will be required to make a number of measurements. These include basic checks such as valve clearance, engine compression and spark plug gap. As you get deeper into engine disassembly and service, measurements will be required to determine the size and condition of the piston and cylinder bore, valve and guide wear,


43

camshaft wear, crankshaft runout and so on. When making these measurements, the degree of accuracy will dictate which tool is required. Precision measuring tools are expensive. If this is your first experience at engine or suspension service, it may be more worthwhile to have the checks made at a Yamaha dealer or machine shop. However, as your skills and enthusiasm increase for doing your own service work, you may want to begin purchasing some of these specialized tools. The following is a description of the measuring tools required during engine and suspension overhaul.

Feeler Gauge

Feeler gauges come in assorted sets and types (**Figure 44**). The feeler gauge is made of either a piece of a flat or round hardened steel of a specified thickness. Wire gauges are used to measure spark plug gap and valve clearance. Flat gauges are used for all other measurements. Feeler gauges are also designed for specialized uses, such as for measuring valve clearances. On these gauges, the gauge end is usually small enough and angled so as to make checking valve clearances easier.

Vernier Caliper

This tool (**Figure 45**) is invaluable when reading inside, outside and depth measurements to within close precision. It can be used to measure clutch spring length and the thickness of clutch plates, shims and thrust washers.

Outside Micrometers

One of the most reliable tools used for precision measurement is the outside micrometer (**Figure 46**). Outside micrometers will be required to measure valve shim thickness, piston diameter and valve stem diameter. Outside micrometers are also used with other tools to measure the cylinder bore and the valve guide inside diameters. Micrometers can be purchased individually or as a set.

Dial Indicator

Dial indicators (**Figure 47**) are precision tools used to check dimension variations on machined parts such as transmission shafts and axles and to check crankshaft and axle shaft end play. Dial indicators are available with various dial types for different measuring requirements.

Cylinder Bore Gauge

The cylinder bore gauge is a very specialized precision tool. The gauge set shown in **Figure 48** is comprised of a dial indicator, handle and a number of length adapters to adapt the gauge to different bore sizes. The bore gauge can be used to make cylinder bore measurements such as bore size, taper and out-of-round. Depending on the bore gauge, it can sometimes be used to measure brake caliper and master cylinder bore sizes. An outside micrometer must be used together with the bore gauge to determine bore dimensions.

Small Hole Gauges

A set of small hole gauges allow you to measure a hole, groove or slot ranging in size up to 13 mm (0.500 in.). A small hole gauge will be required to measure valve guide, brake caliper and brake master cylinder bore diameters. An outside micrometer must be used together with the small hole gauge to determine bore dimensions.

Compression Gauge

An engine with low compression cannot be properly tuned and will not develop full power. A compression gauge (**Figure 49**) measures engine compression. The one shown has a flexible stem with an extension that can allow you to hold it while turning the engine over. Open the throttle all the way when checking engine compression. See Chapter Three.

Strobe Timing Light

This instrument is useful for checking ignition timing. By flashing a light at the precise instant the spark plug fires, the position of the timing mark can be seen. The flashing light makes a moving mark appear to stand still opposite a stationary mark.

Suitable lights range from inexpensive neon bulb types to powerful xenon strobe lights (**Figure 50**). A light with an inductive pickup is recommended to eliminate any possible damage to ignition wiring. Use according to manufacturer's instructions.

Multimeter or VOM

This instrument (**Figure 51**) is invaluable for electrical system troubleshooting. See *Electrical Troubleshooting* in Chapter Nine for its use.

Screw Pitch Gauge

A screw pitch gauge (**Figure 52**) determines the thread pitch of bolts, screws, studs, etc. The gauge

is made up of a number of thin plates. Each plate has a thread shape cut on one edge to match one thread pitch. When using a screw pitch gauge to determine a thread pitch size, try to fit different blade sizes onto the bolt thread until both threads match (**Figure 53**).

Magnetic Stand

A magnetic stand (**Figure 54**) is used to securely hold a dial indicator when checking the runout of a round object or when checking the end play of a shaft.

V-Blocks

V-blocks (**Figure 55**) are precision ground blocks used to hold a round object when checking its runout or condition. In motorcycle repair, V-blocks can be used when checking the runout of such items as valve stems, camshaft, balancer shaft, crankshaft, wheel axles and fork tubes.

SPECIAL TOOLS

A few special tools may be required for major service. Those are described in the appropriate chapters and are available either from a Yamaha dealer or other manufacturers as indicated.

This section describes special tools unique to this type of bike's service and repair.

The Grabbit

The Grabbit (**Figure 56**) is a special tool used to hold the clutch boss when removing the clutch nut and to secure the drive sprocket when removing the sprocket nut.

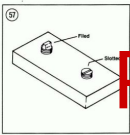
(56)

MECHANIC'S TIPS

Removing Frozen Nuts and Screws

When a fastener rusts and cannot be removed, several methods may be used to loosen it. First, apply penetrating oil such as Liquid Wrench or WD-40 (available at hardware or auto supply stores). Apply it liberally and let it penetrate for 10-15 minutes. Rap the fastener several times with a small hammer; do not hit it hard enough to cause damage. Reapply the penetrating oil if necessary.

For frozen screws, apply penetrating oil as described, then insert a screwdriver in the slot and rap the top of the screwdriver with a hammer. This loosens the rust so the screw can be removed in the



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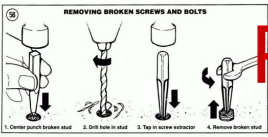

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