CHAPTER ONE

GENERAL INFORMATION

This service and repair manual covers all Harley-Davidson 1340 cc Softail models from 1984-1999.

Procedures unique to 1995-1999 models are covered in the supplement at the end of the 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 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.

General specifications arc listed in **Table 2** while gross vehicle weight ratings are listed in **Table 3**. Fuel lank capacity is listed in **Table 4**.

U.S. to metric conversion is given in **Table 5**.

Critical torque specifications are found in table form at the end of each chapter (as required). The general torque specifications listed in **Table 6** can be used when a torque specification is not listed for a specific component or assembly.

Inch Lap drill sizes can be found in **Table 7**.

A wind chill chart is found in **Table 8** that can be used to better prepare yourself when riding your Harley in cold weather.

MANUAL ORGANIZATION

This chapter provides general information useful to Harley vehicle owners and mechanics. In addition, information in this chapter discusses the tools and techniques for preventive maintenance, trouble-shooting and repair.

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

Harley operating well. Chapter Three also includes recommended tune-up procedures, eliminating the need to consult other chapters constantly on the various assemblies.

Subsequent chapters describe specific systems, providing disassembly, repair, assembly and adjustment 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 dealer or competent repair shop. Specifications concerning a specific 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 has 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.

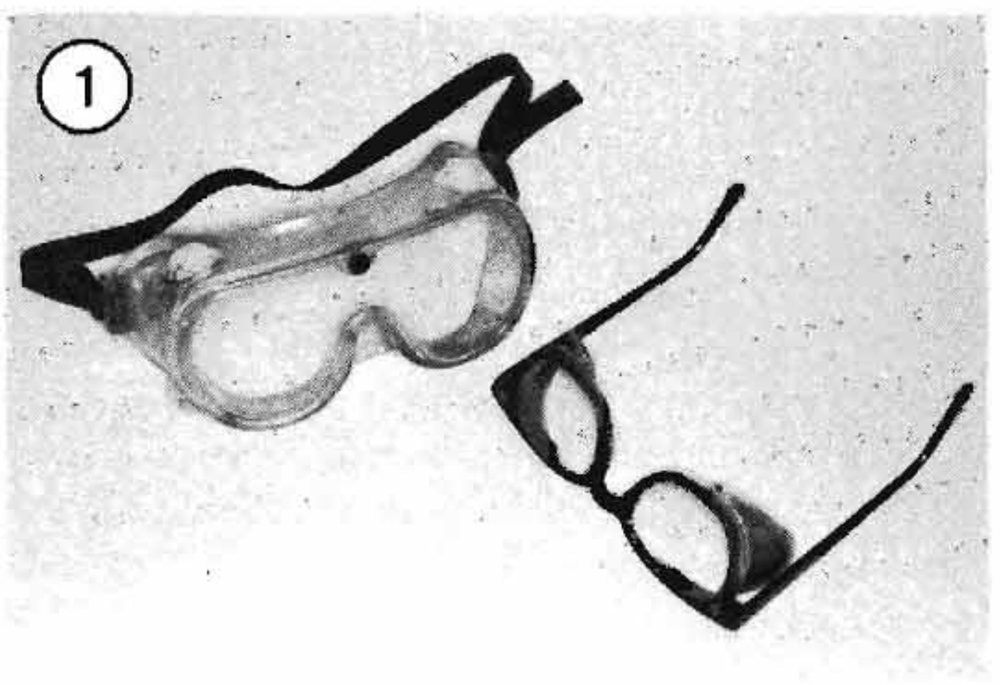
WARNING

Gasoline should only be stored in an approved safety gasoline storage container, properly labeled. Spilled gasoline should be wiped up immediately.

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 tanks 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 your Harley 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 *any* time you feel unsure about the safety of your eyes. Safety goggles (**Figure 1**) should also be worn when solvent and compressed air is used to clean parts.

WARNING

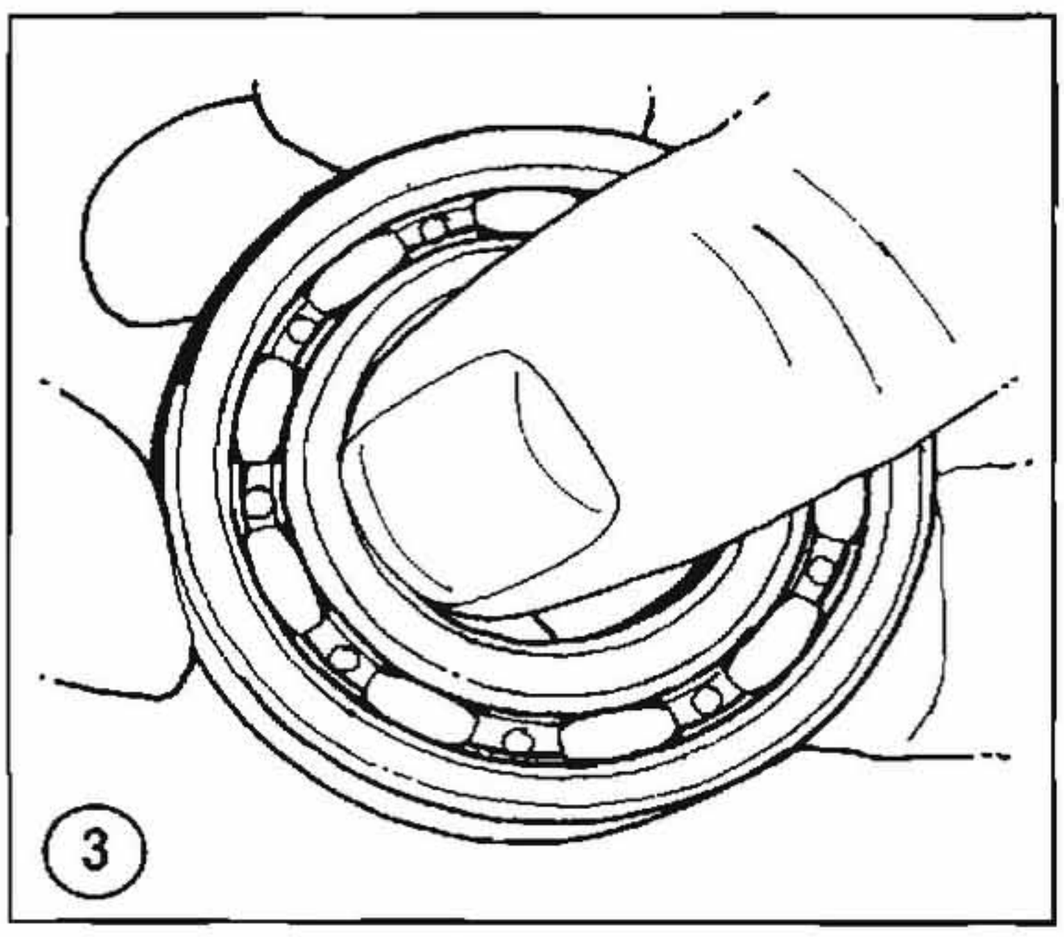
*The improper use of compressed air is very dangerous. Using compressed air to dust off your clothes, bike or workbench can cause flying particles to be blown into your eyes or skin. **Never** direct or blow compressed air into your skin or through any body opening (in-*



cluding cuts) as this can cause severe injury or death. Compressed air should be used carefully; never allow children to use or play with compressed air.

10. Keep an approved fire extinguisher nearby (**Figure 2**). 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 (**Figure 3**) by hand.



12. Never work on the upper part of the bike while someone is working underneath it.

13. Never carry sharp tools in your pockets.

14. There is always a right way and wrong way to use tools. Learn to use them the right way.

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.

1. "Front," as used in this manual, refers to the front of the motorcycle; the front of any component is the end closest to the front of the motorcycle. The "left-" and "right-hand" side refer to the position of the parts as viewed by a rider sitting on the seat and 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 transmission, or when removing a suspension component, the bike should be secured in a safe manner. If the bike is to be parked on its jiffy stand, check the stand to make sure it is secure and not damaged. Block the front and rear wheels if they remain on the ground. A small hydraulic jack and a block of wood can be used to raise the chassis or you can use a commercial type of stand. If the transmission is not going to be worked on and the drive chain or drive belt is connected to the rear wheel, shift the transmission into first gear.

3. Repairs go much faster and easier if the bike is clean before you begin work. There are special cleaners for washing the engine and related parts. Spray or brush on the cleaning solution, following the manufacturer's directions. Rinse parts with a garden hose. 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.*

4. Much of the labor charged for by mechanics is to remove and disassemble other parts to reach the defective unit. It is usually possible to perform the preliminary operations yourself and then take the defective unit to the dealer for repair.

5. Once you have decided to tackle the job yourself, read the entire section *completely* while looking at the actual parts before starting the job. Make sure you have identified the proper procedure. Study the illustrations and text until you have a good idea of what is involved in completing the job satisfactorily. If special tools or replacement parts 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.

NOTE

Some of the procedures or service specifications listed in this manual may not be applicable if your Harley has been modified or if it has been equipped with non-stock equipment. When modifying or installing non-stock equipment, file all printed instruction or technical information regarding the new equipment in a folder or notebook for future reference. If your Harley was purchased second hand, the previous owner may have installed non-stock parts. If necessary, consult with your dealer or the accessory manufacturer on components that may change tuning or repair procedures.

6. Simple wiring checks can be easily made at home, but knowledge of electronics is almost a necessity for performing tests with complicated test gear.

CAUTION

Improper testing can sometimes damage an electrical component.

7. Disconnect the negative battery cable (**Figure 4**) when working on or near the electrical, clutch or starter systems and before disconnecting any wires. On all models covered in this manual, the negative terminal will be marked with a minus (–) sign and the positive terminal with a plus (+) sign.

WARNING

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

8. During disassembly, keep a few general cautions in mind. Force is rarely needed to get things apart. If parts are a tight fit, such as a bearing in a case, there is usually a tool designed to separate them. Never use a screwdriver to pry parts with machined surfaces such as crankcase halves. You will mar the surfaces and end up with leaks.

9. 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 the time carefully laid out parts may have become disturbed.

10. Tag all similar internal parts for location and mark all mating parts for position (A, **Figure 5**). Record number and thickness of any shims as they are removed; measure with a vernier caliper or micrometer. Small parts such as bolts can be identified by placing them in plastic sandwich bags (B, **Figure 5**). Seal and label them with masking tape.

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

12. When disassembling transmission shaft assemblies, use an egg flat (type that restaurants get their eggs in) (D, **Figure 5**) and set the parts from the shaft in one of the depressions in the same order in which they were removed.

13. Wiring should be tagged with masking tape and marked as each wire is removed. Again, do not rely on memory alone, especially if the wiring was changed by a previous owner.

14. Finished surfaces should be protected from physical damage or corrosion. Keep gasoline off painted surfaces.

15. 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.

16. 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.

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

18. Recommendations are occasionally made to refer service or maintenance to a Harley-Davidson dealer or independent Harley-Davidson repair shop. In these cases, the work will be done more quickly and economically than if you performed the job yourself.

19. 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.

20. Some operations require the use of a hydraulic 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.

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

22. Whenever a rotating part butts against a stationary part, look for a shim or washer.

23. Use new gaskets if there is any doubt about the condition of the old ones.

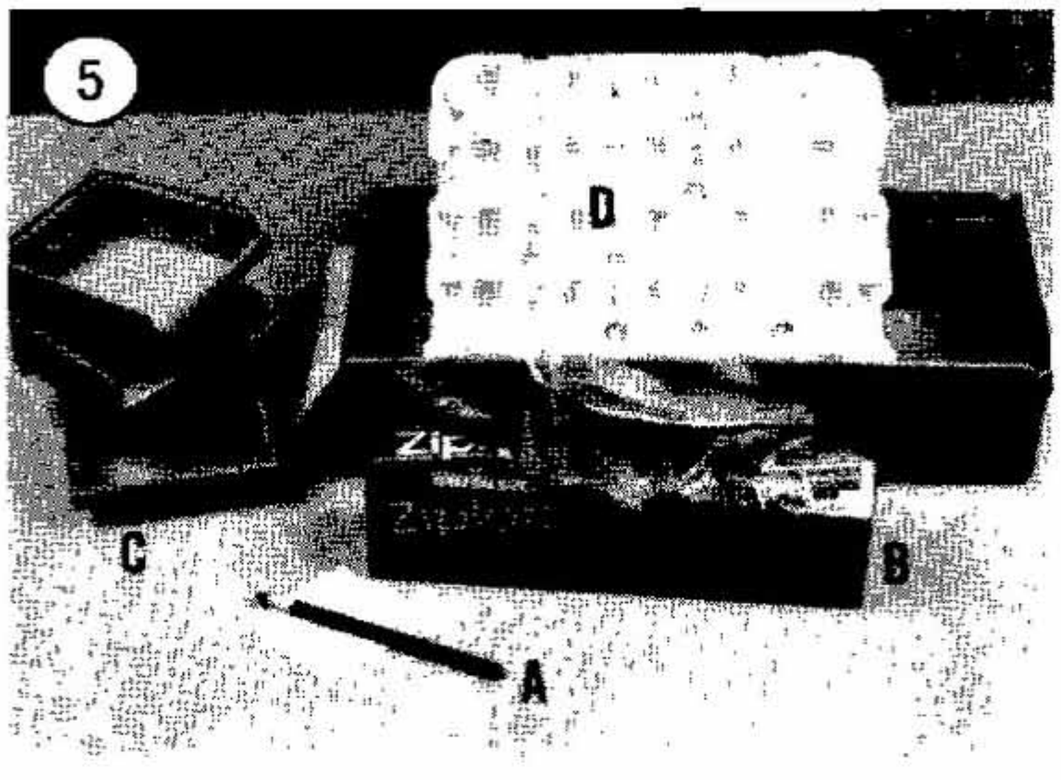
24. If it becomes necessary to purchase gasket material to make a gasket, measure the thickness of the old gasket (at an uncompressed point) and purchase gasket material with the same approximate thickness.

25. 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.

26. 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 diaphragm has been removed first.

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

28. Take your time and do the job right. Do not forget that a newly rebuilt engine must be broken in just like a new one.



SERIAL NUMBERS

Harley-Davidson makes frequent changes during a model year, some minor, some relatively major. All Harley models in this manual can be identified by their individual 17 digit Vehicle Identification Number (VIN); for example, 1HD1BJL11LM110001. This number is stamped into the steering head (**Figure 6**) and recorded on a label placed on the right front frame downtube. The engine is identified with an abbreviated VIN number stamped onto the left-hand crankcase at the base of the rear cylinder block (**Figure 7**); for example, BJLM110001.

NOTE

When Harley-Davidson makes a running change during a production year, the bikes, depending on where they are produced during production, are identified as an early or late model for that year. For example, if a production

change was made during the 1985 production run, the bikes, depending on where they were manufactured during the actual run, would be referred to as an Early 1985 or Late 1985 model. If you run across this type of designation in this manual that pertains to your model, give your Harley-Davidson dealer a call and have them identify your model with its 17 digit VIN number.

PARTS REPLACEMENT

When you order parts from the dealer or other parts distributor, always order by the full 17 digit VIN number. Compare new parts to old before purchasing them. If they are not alike, have the parts manager explain the difference to you.

TORQUE SPECIFICATIONS

Torque specifications throughout this manual are given in foot-pounds (ft.-lb.) as well as the metric equivalent in newton-meters (N•m).

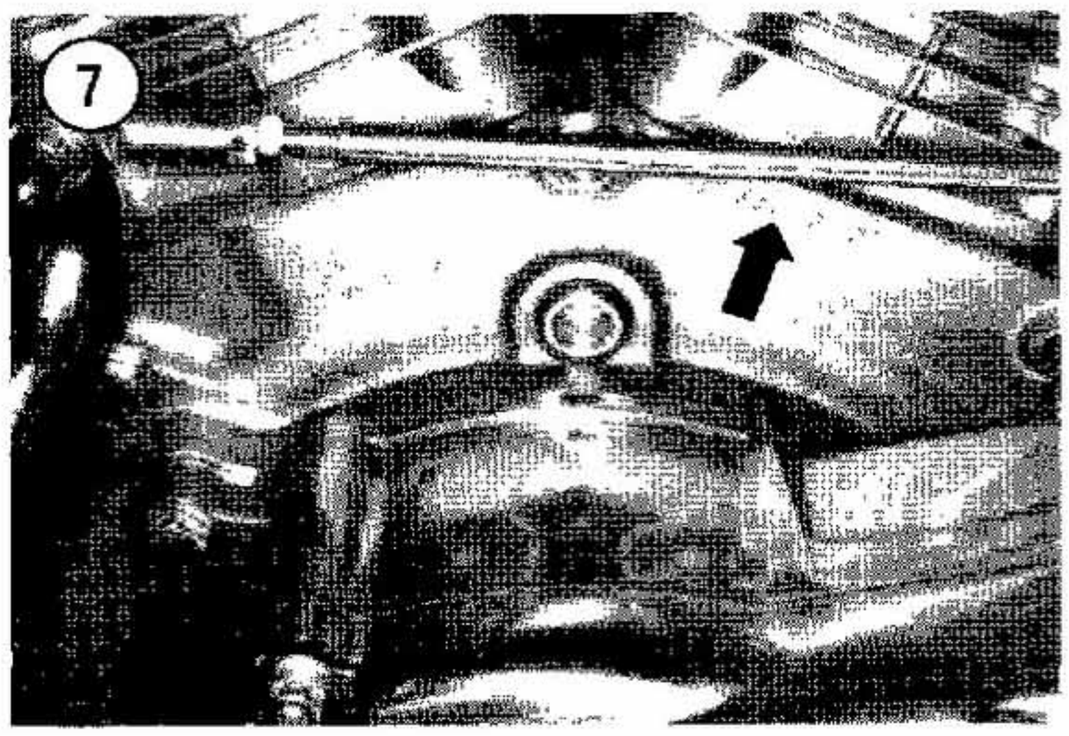
Table 6 lists general torque specifications for nuts and bolts that are not listed in the respective chapters. To use the table, first determine the size of the bolt or nut. Use a vernier caliper and measure the inside dimensions of the threads of the nut (**Figure 8**) and across the threads for a bolt (**Figure 9**).

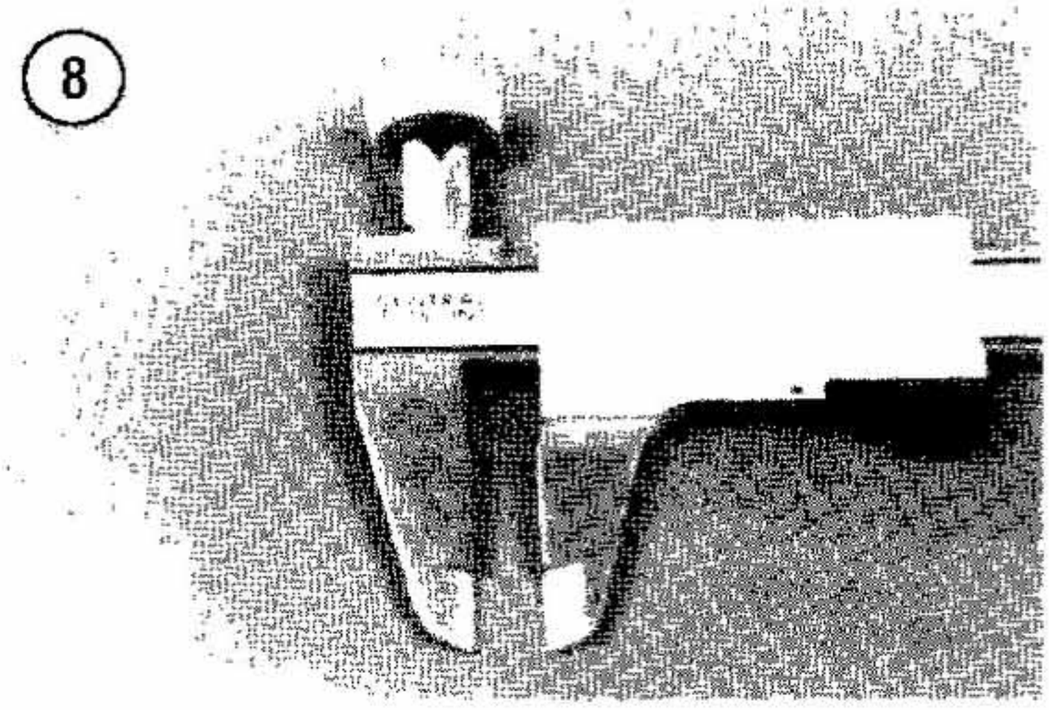
FASTENERS

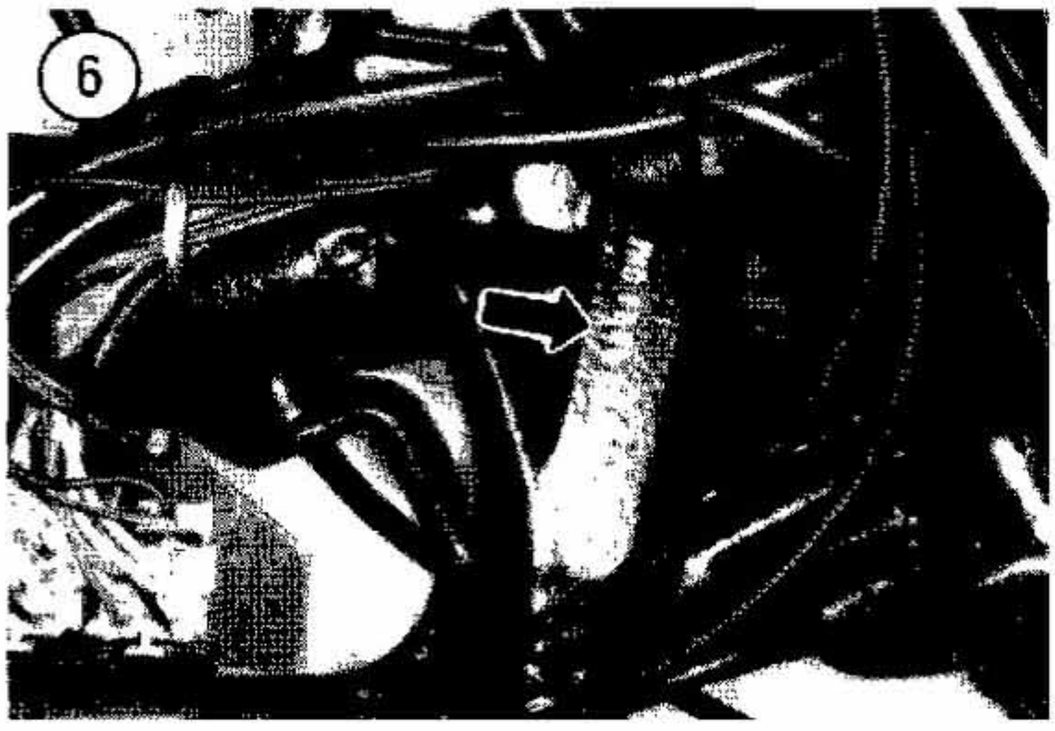
The materials and designs of the various fasteners used on your Harley are not arrived at by chance or accident. Fastener design determines the type of tool required to work the fastener. Fastener material is carefully selected to decrease the possibility of physical failure.

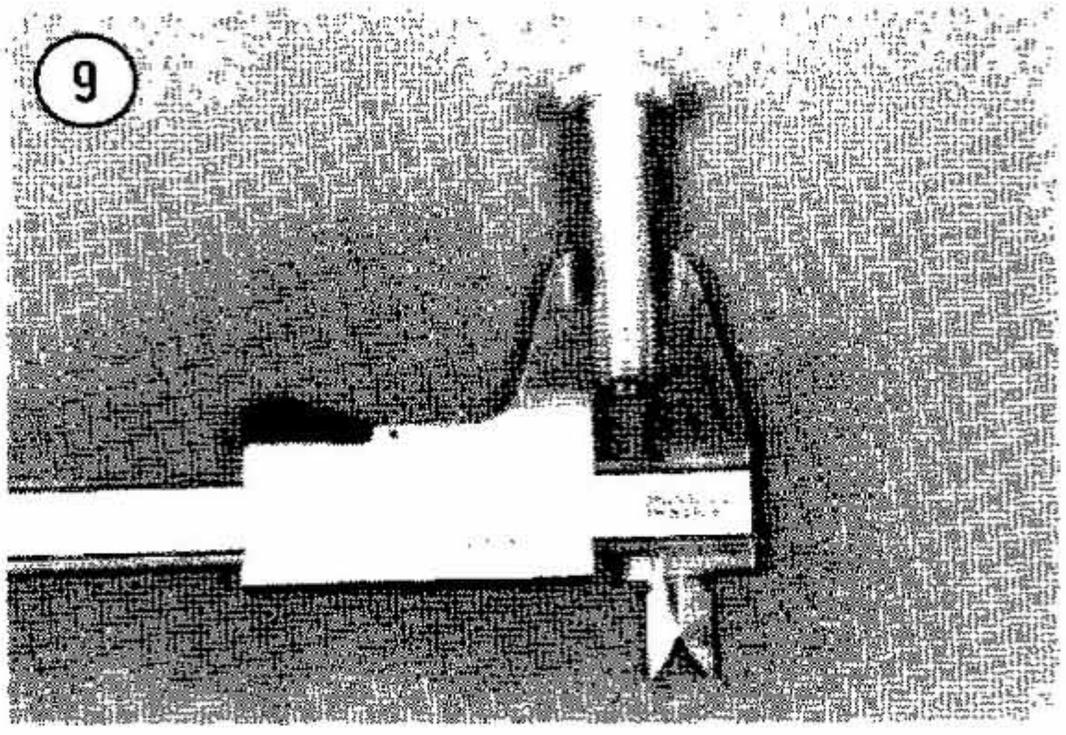
Nuts, bolts and screws are manufactured in a wide range of thread patterns. To join a nut and bolt, the diameter of the bolt and the diameter of the hole in the nut must be the same. It is just as important that the threads on both be properly matched.

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 10**) can also be used to determine pitch. Harley-Davidson motorcycles are manufactured with American standard fasteners. The threads are cut differently than metric fasteners (**Figure 11**).

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.

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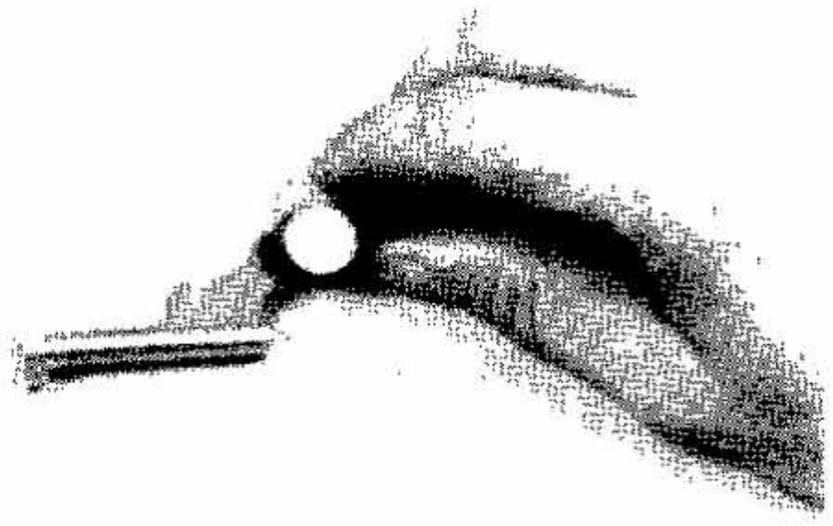

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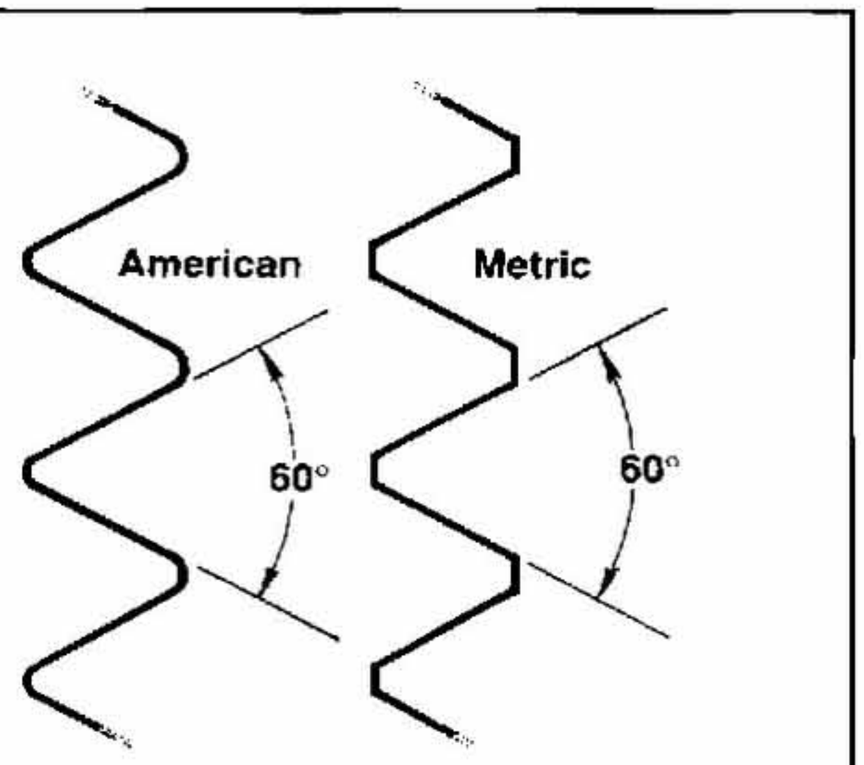

American Threads

American threads come in a coarse or fine thread. Because both coarse and fine threads are used for general use, it is important to match the threads correctly so you do not strip the threads and damage one or both fasteners.

American fasteners are normally described by diameter, threads per inch (TPI) and length; **Figure 12** shows the first 2 specifications. For example, 3/8-16 × 2 indicates a bolt 3/8 in. in diameter with 16 threads per inch, 2 inches long. The measurement across 2 flats on the head of the bolt or screw (**Figure 13**) indicates the proper wrench size to be used. **Figure 9** shows how to determine bolt diameter.

Markings found on American bolt heads indicate tensile strength. For example, a bolt with no head marking is usually made of mild steel, while a bolt with 2 or more markings indicates a higher grade material. **Figure 14** indicates the various head markings with SAE grade identification. When torquing SAE bolts not listed in a torque specification table, refer to the head marking (**Figure 13**) and then to **Table 6** for the torque specification.

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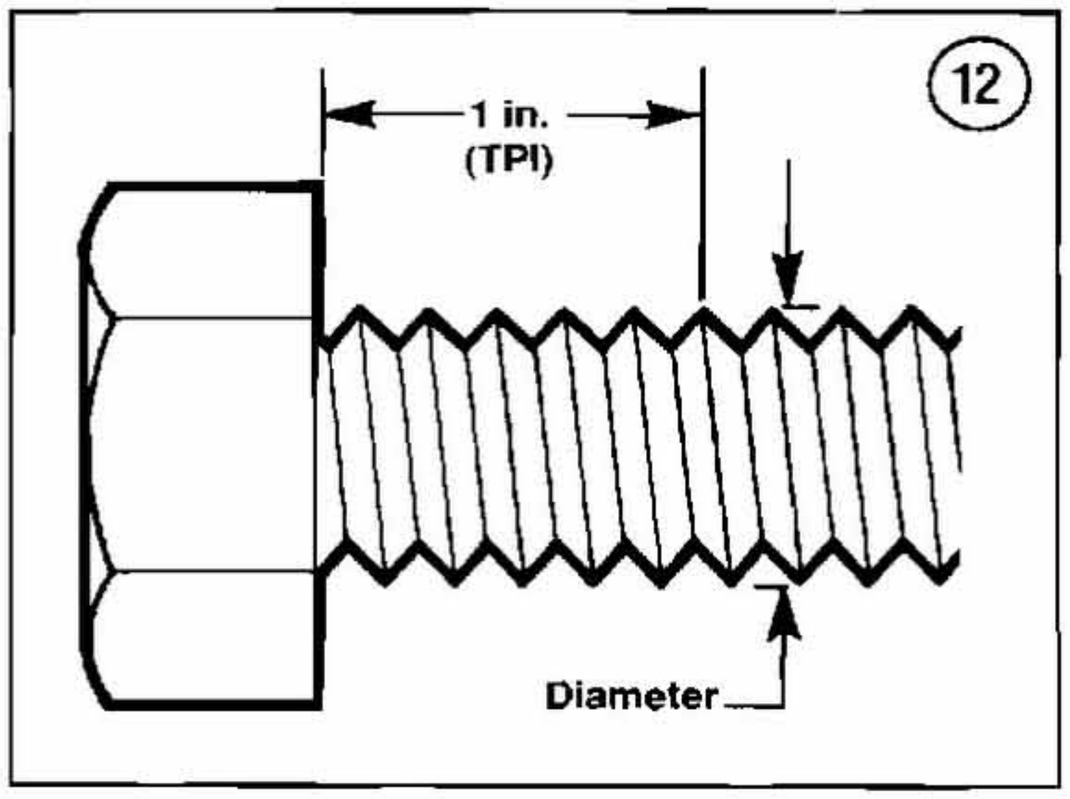

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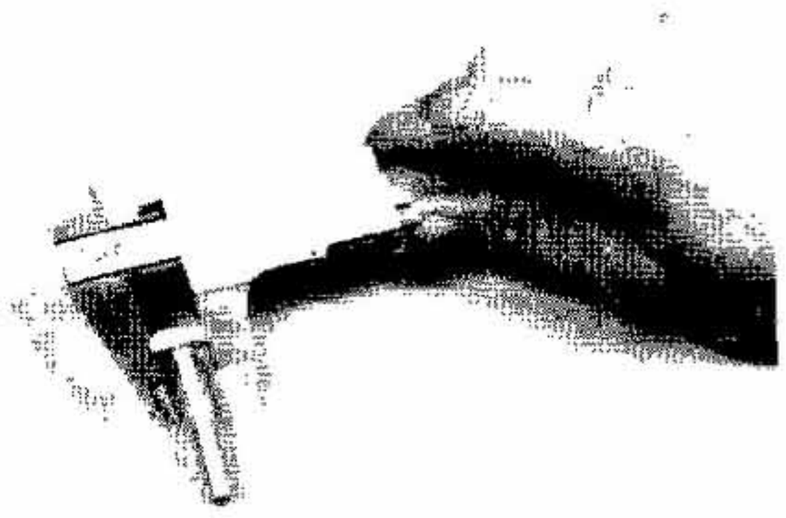

Determining Bolt Length

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 to measure the length starting from underneath the bolt head to the end of the bolt (**Figure 15**). Always measure bolt length in this manner to avoid purchasing bolts that are too long.

Machine Screws

Machine screw refers to a numbering system used to identify screws smaller than 1/4 of an inch. Machine screws are identified by gauge size (diameter) and threads per inch. For example, 12-28 indicates a 12 gauge screw with 28 threads per inch.

There are many different types of machine screws. **Figure 16** 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 17**.

Bolts

Commonly called bolts, the technical name for these fasteners is cap screw. Refer to *American Threads* in this section for additional information.

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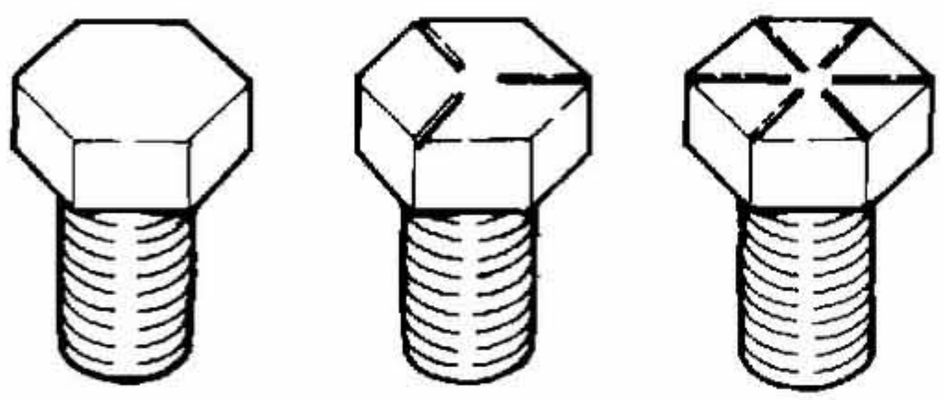
SAE BOLT HEAD MARKINGS



SAE 0-1-2 SAE 5 SAE 8

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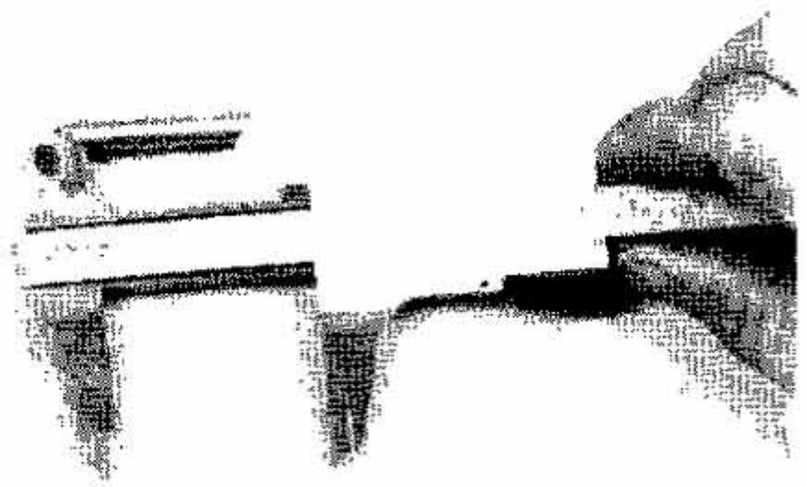

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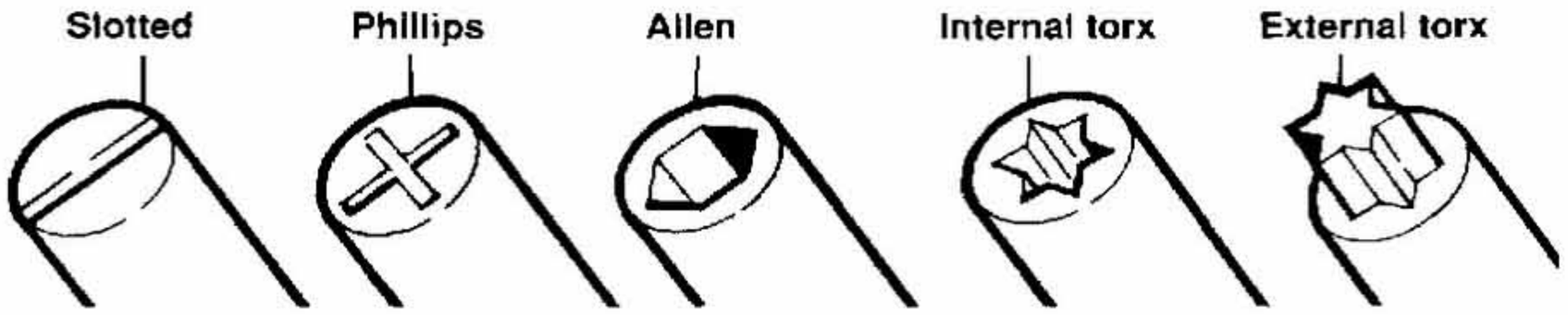
OPENINGS FOR TURNING TOOLS



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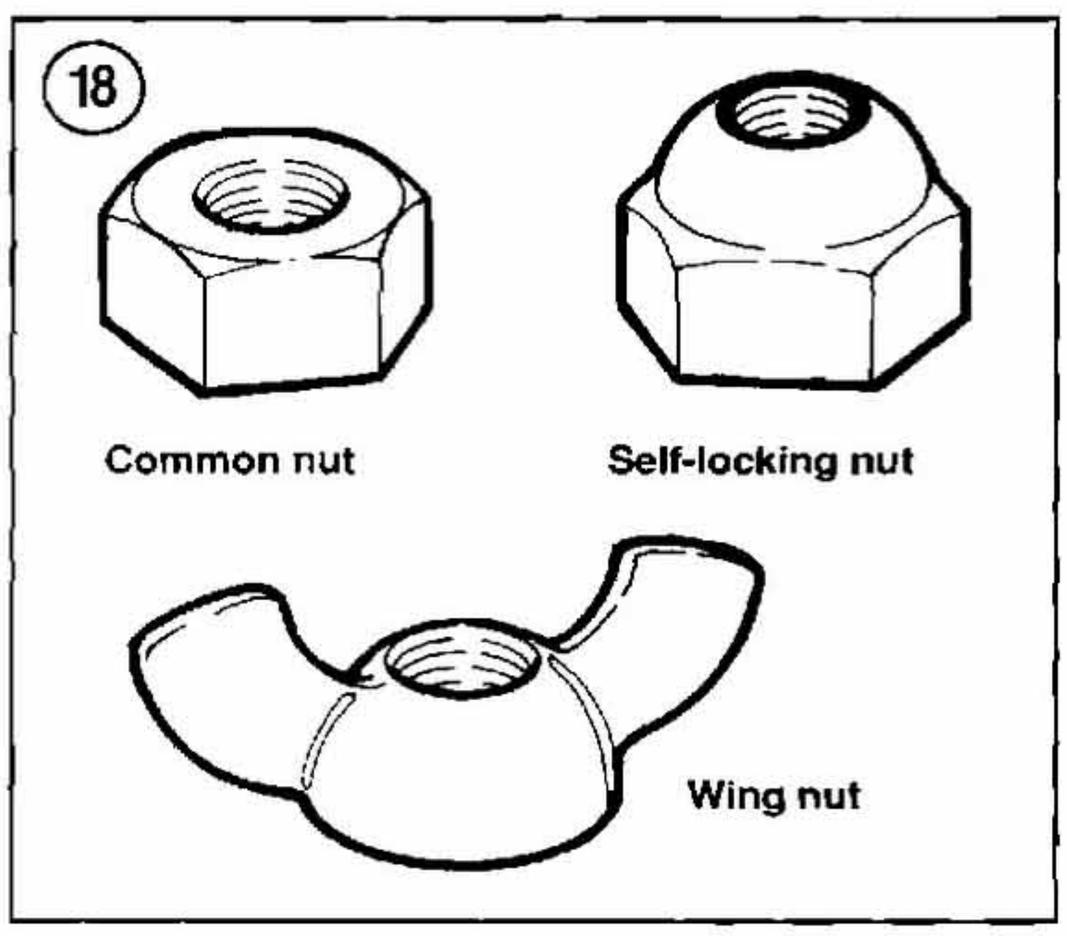
MACHINE SCREWS

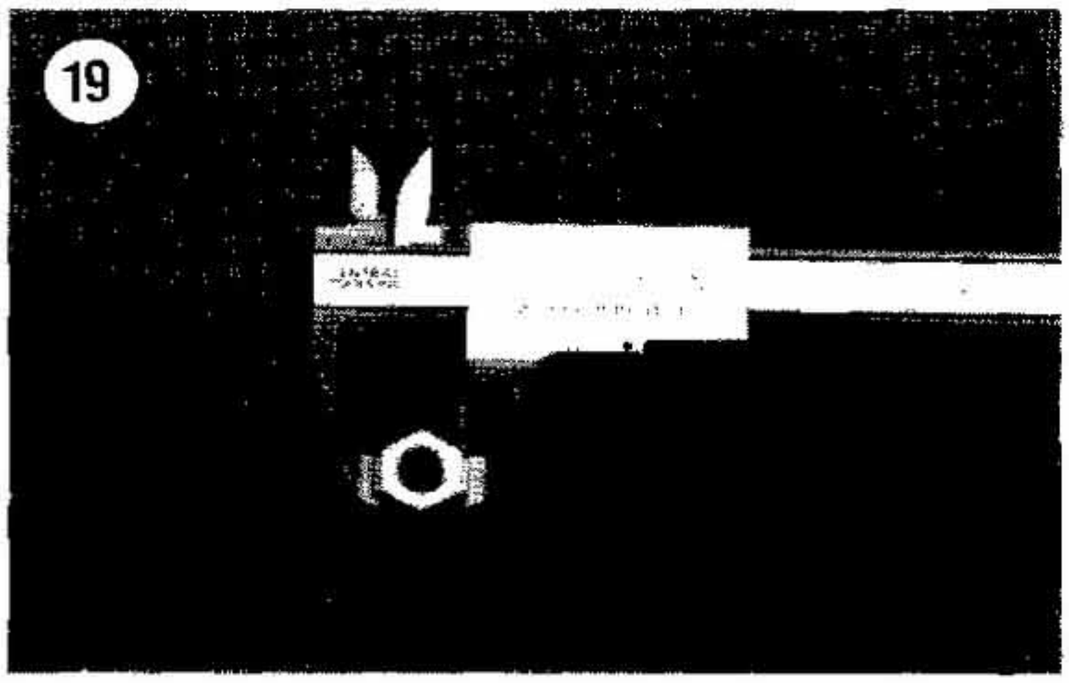
Nuts

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 18 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.



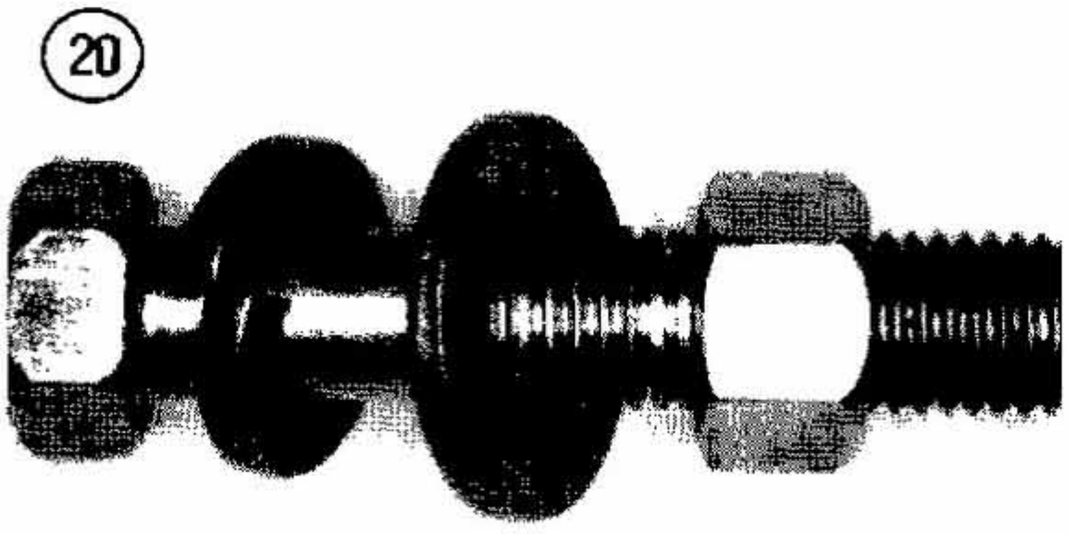
To indicate the size of a nut, manufacturers specify the diameter of the opening and the thread pitch. This is similar to bolt specifications, but without the length dimension. The measurement across 2 flats on the nut (**Figure 19**) indicates the proper wrench size to be used.



Self-locking 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.

Self-locking fasteners offer greater holding strength and better vibration resistance. Some self-locking 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 efficiency is greatly reduced. For greatest safety, it is recommended that you install new self-locking fasteners whenever they are removed.



Washers

There are 2 basic types of washers: flat washers and lockwashers. 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. Lockwashers should be installed between the bolt head or nut and a flat washer (**Figure 20**). **Figure 21** 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 fluid seals (copper or laminated washers).

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.

NOTE

As much care should be given to the selection and purchase of washers as that given to bolts, nuts and other fasteners. Beware of washers that are made of thin and weak materials. These will deform and crush the first time they are used in a high torque application.

Cotter Pins

Cotter pins (**Figure 22**) are used to secure fasteners in a special location. The threaded stud, bolt or axle must have a hole in it. Its nut or nut lock piece has castellations around its upper edge into which the cotter pin fits to keep it from loosening. When *properly* installed, a cotter pin is a positive locking device.

The first step in properly installing a cotter pin is to purchase one that will fit snugly when inserted through the nut and the mating thread part. This should not be a problem when purchasing cotter pins through a Harley-Davidson dealer; you can order them by their respective part numbers. However, when you stop off at your local hardware or automotive store, keep this in mind. The cotter pin should not be so tight that you have to drive it in and out, but you do not want it so loose that it can move or float after it is installed.

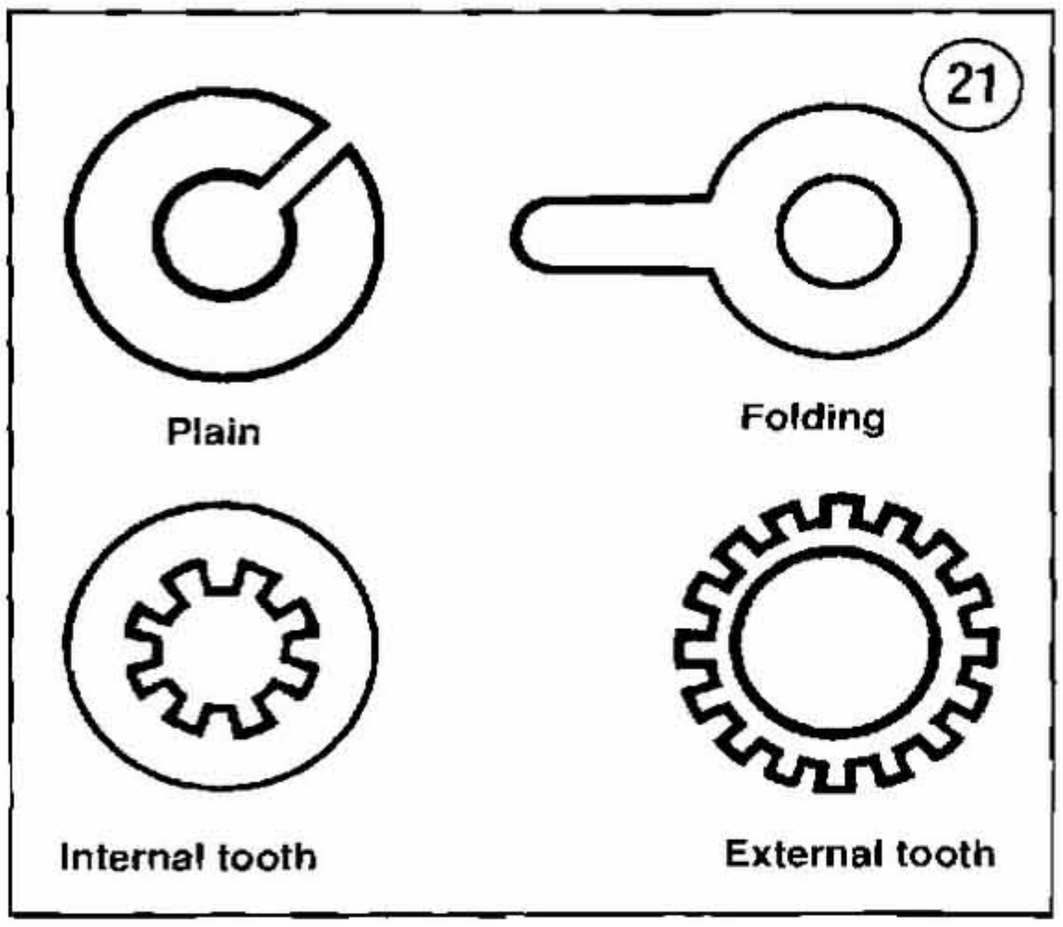
Before installing a cotter pin, tighten the nut to the recommended torque specification. If the castellations in the nut do not line up with the hole in the bolt or axle, tighten the nut until alignment is achieved. Do not loosen the nut to make alignment. Insert a *new* cotter pin through the nut and hole, then tap the head lightly to seat it. Bend one arm over the flat on the nut and the other against the top of the axle or bolt (**Figure 22**). Cut the arms to a suitable length to prevent them from snagging on clothing, or worse, your hands, arms or legs; the exposed arms will cut flesh easily. When the cotter pin is bent and its arms cut to length, it should be tight. If you can wiggle the cotter pin, it is improperly installed.

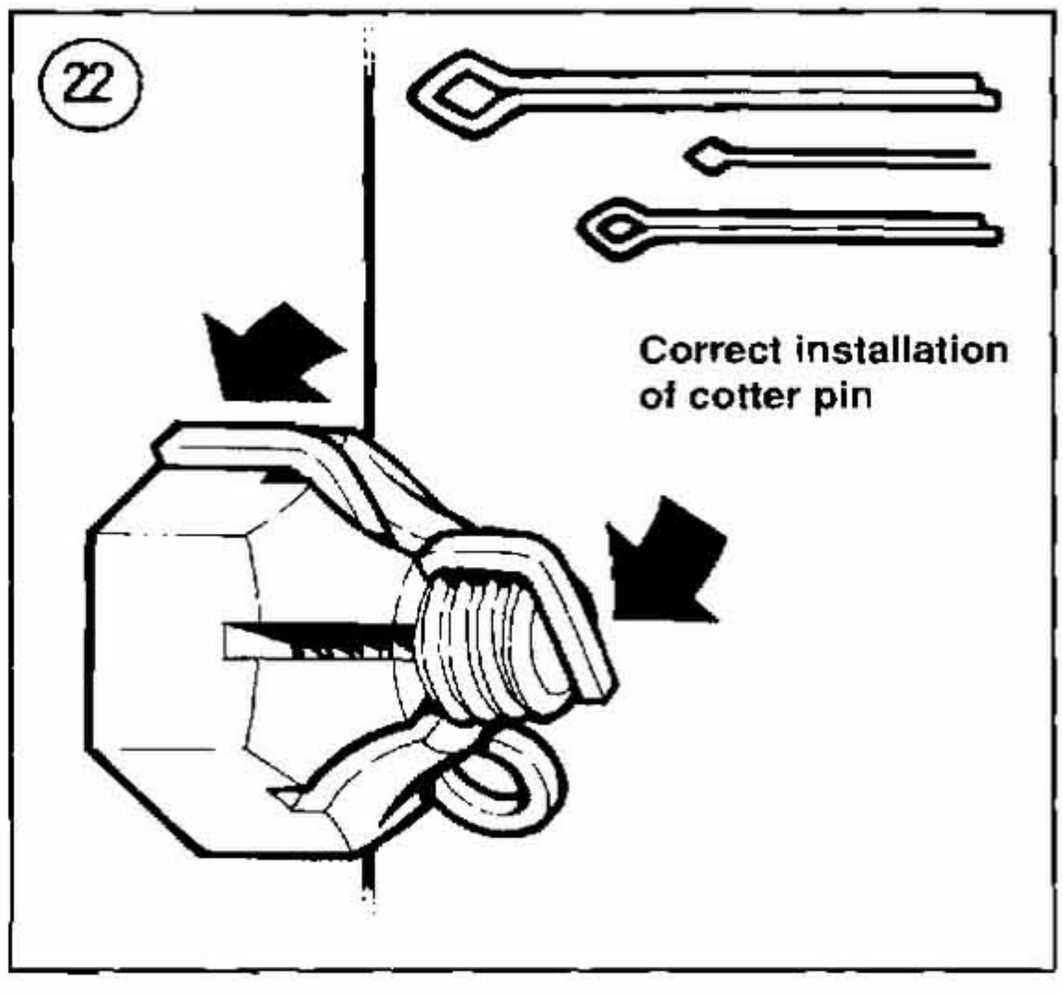
Cotter pins should not be reused as their ends may break and allow the cotter pin to fall out and perhaps the fastener to unscrew itself.

Circlips

Circlips can be of 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 23**) can be installed in either direction (shaft or housing) because both faces are machined, thus

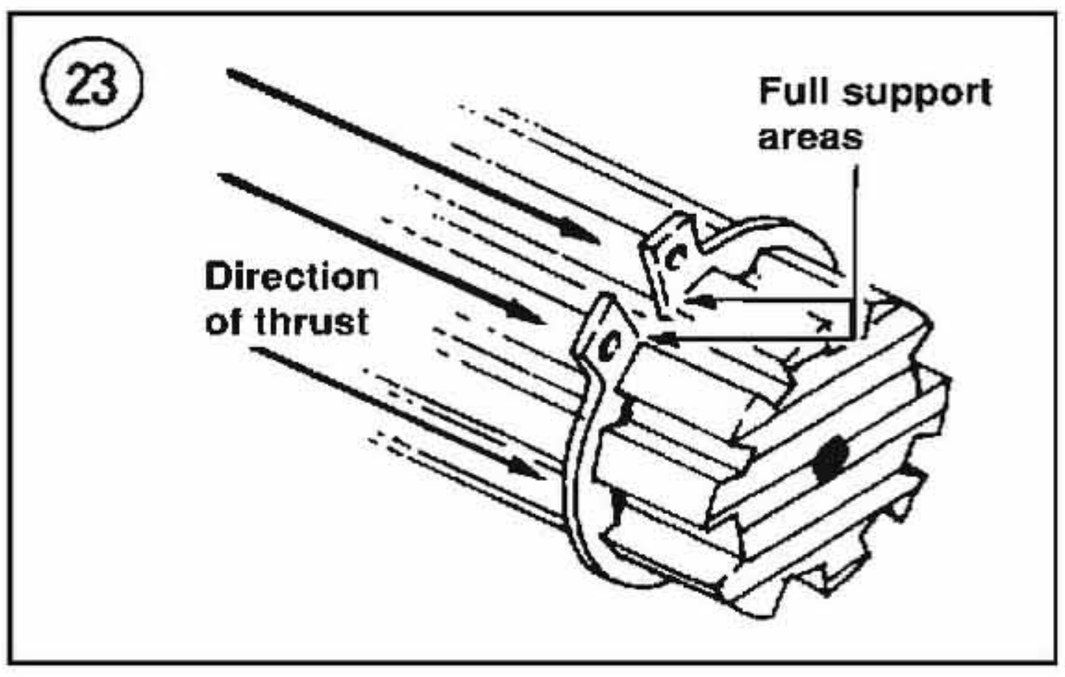


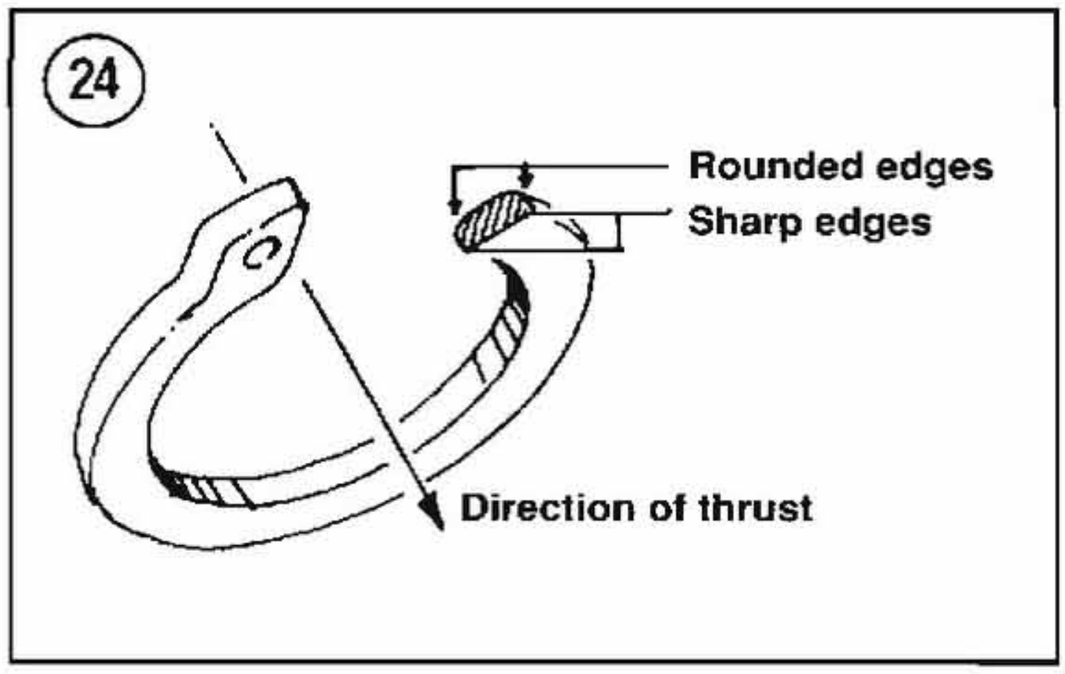


creating two sharp edges. Stamped circlips (**Figure 24**) are manufactured with one sharp edge and one rounded edge. When installing stamped circlips in a thrust situation, the sharp edge must face away from the part producing the thrust. When installing circlips, observe the following:

a. Circlips should be removed and installed with circlip pliers. See *Circlip Pliers* in this chapter.
b. Compress or expand circlips only enough to install them.
c. 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 to be 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. 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.

If any unique lubricant is recommended by Harley-Davidson, it is specified in the service procedure.

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 (**Figure 25**).

API oil grade is indicated by letters; oils for gasoline engines are identified by an "S."

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 engines 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).

Also recommended for axle and swing arm pivot shafts is an anti-seize lubricant (**Figure 26**). This is necessary to prevent the pivot points from corroding and locking up.

RTV GASKET SEALANT

Room temperature vulcanizing (RTV) sealant is used on some pre-formed gaskets and to seal some components. RTV is a silicone gel supplied in tubes and can be purchased in a number of different colors.

Moisture in the air causes RTV to cure. Always place the cap on the tube as soon as possible when using RTV. RTV has a shelf life of one year and will not cure properly when the shelf life has expired. Check the expiration date on RTV tubes before using and keep partially used tubes tightly sealed.

Applying RTV Sealant

Clean all gasket residue from mating surfaces. Surfaces should be clean and free of oil and dirt. Remove all RTV gasket material from blind attaching holes, as it can cause a "hydraulic" effect and affect bolt torque.

Apply RTV sealant in a continuous bead. Circle all mounting holes unless otherwise specified. Torque mating parts within 10 minutes after application.

THREADLOCK

A chemical locking compound should be used on all bolts and nuts, even if they are secured with lockwashers. A locking compound will lock fasteners against vibration loosening and seal against leaks. Loctite 242 (blue) and 271 (red) are recommended for many threadlock requirements described in this manual (**Figure 27**).

Loctite 242 (blue) is a medium strength threadlock and component disassembly can be performed with normal hand tools. Loctite 271 (red) is a high strength threadlock and heat or special tools, such as a press or puller, may be required for component disassembly.

Applying Threadlock

Surfaces should be clean and free of oil, grease, dirt and other residue; clean threads with an aerosol electrical contact cleaner before applying the Loctite. When applying Loctite, use a small amount. If too much is used, it can work its way down the threads and stick parts together not meant to be stuck.

GASKET REMOVER

Stubborn gaskets can present a problem during engine service as they can take a long time to re-

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move. Consequently, there is the added problem of secondary damage occurring to the gasket mating surfaces from the incorrect use of gasket scraping tools. To quickly and safely remove stubborn gaskets, use a spray gasket remover. Spray gasket remover can be purchased through automotive parts houses. Follow the manufacturer's directions for use.

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 silicone lubricants, contact cleaner and other products which make maintenance simpler and easier. Cleaning solvent or kerosene is available at some service stations or hardware stores.

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 drives 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.

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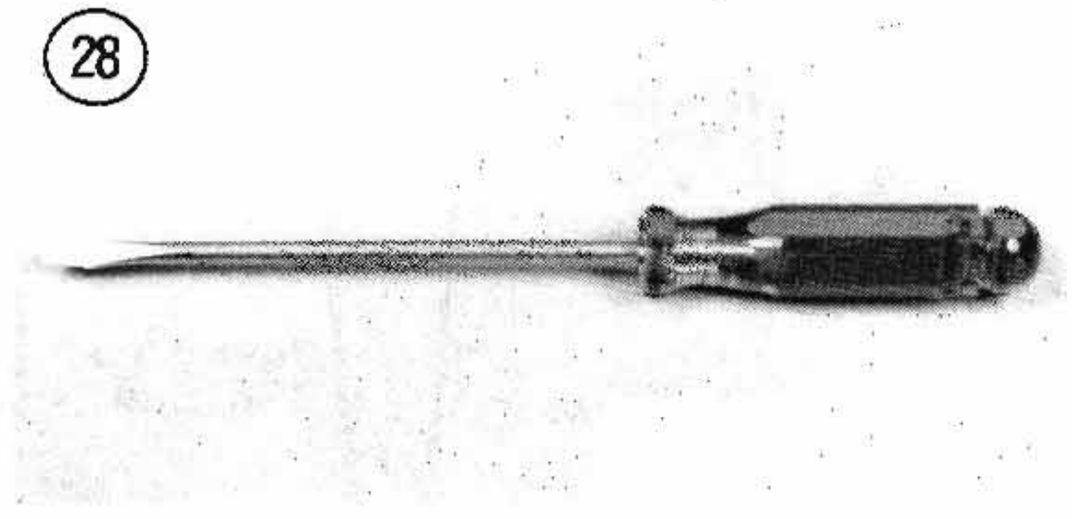

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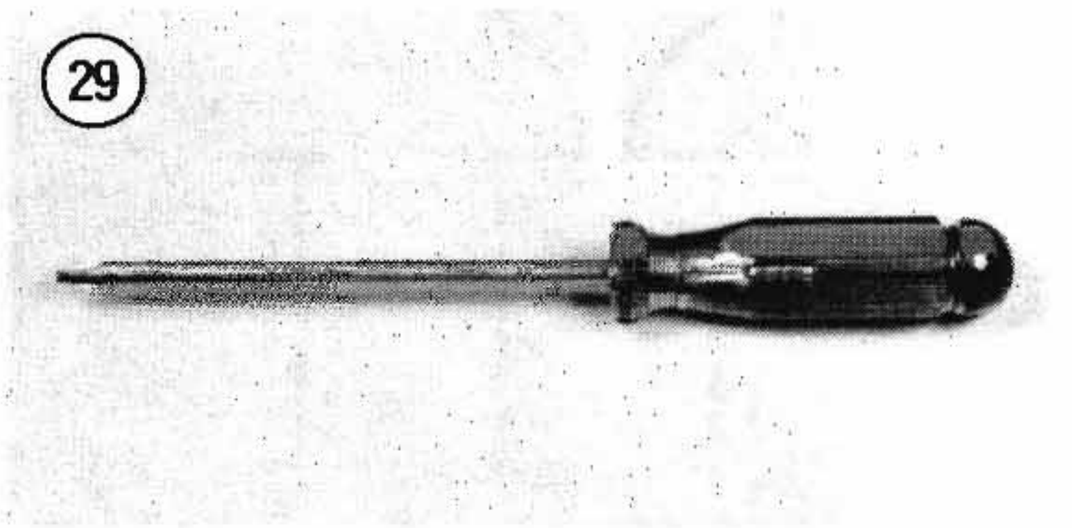


Top quality tools are essential; they are also more economical in the long run. If you are now starting to build your tool collection, stay away from the "advertised specials" featured at some parts houses, discount stores and chain drug stores. These are usually a poor grade tool that can be sold cheaply 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. Each tool is described and the recommended size given for starting a tool collection. Additional tools and some duplicates may be added as you become familiar with your Harley. Harley-Davidson motorcycles are built with American standard fasteners. If you are starting your collection now, buy American 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. Through improper use or selection, a screwdriver can damage the screw head, making removal of the screw difficult. A screwdriver must be selected to conform to the shape of the screw head used. Two basic types of screwdrivers are required: standard (flat- or slot-blade) screwdrivers (**Figure 28**) and Phillips screwdrivers (**Figure 29**).

Note the following when selecting and using screwdrivers:

a. The screwdriver must always fit the screw head. If the screwdriver blade is too small for the screw slot, damage may occur to the screw slot and screwdriver. If the blade is too large,

it cannot engage the slot properly and will result in damage to the screw head.

b. Standard screwdrivers are identified by the length of their blade. A 6-inch screwdriver has a blade six inches long. The width of the screwdriver blade will vary, so make sure that the blade engages the screw slot the complete width of the screw.

c. Phillips screwdrivers are sized according to their point size. They are numbered one, two, three and four. The degree of taper determines the point size; the No. 1 Phillips screwdriver will be the most pointed. The points become more blunt as their number increases.

NOTE

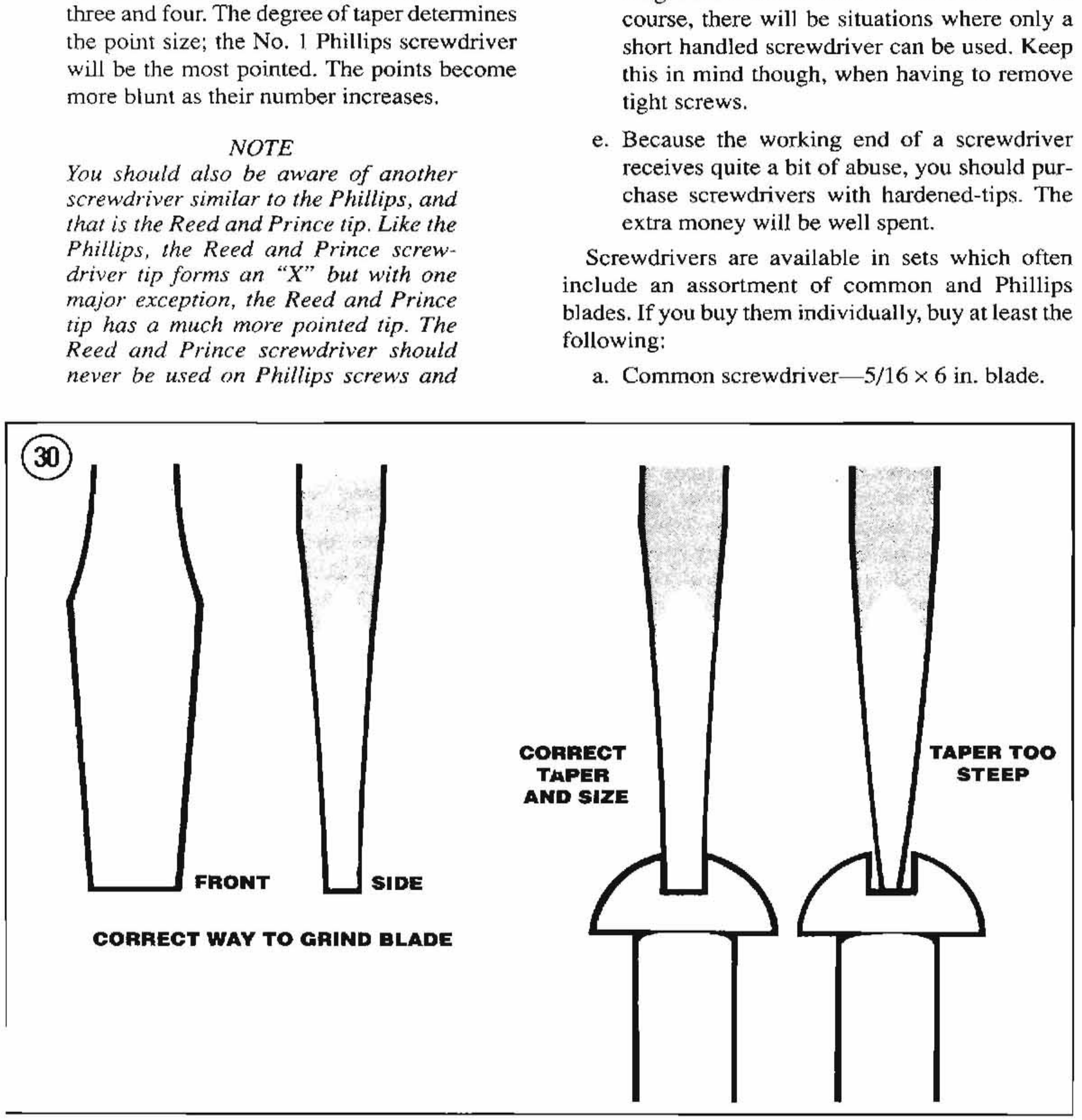
You should also be aware of another screwdriver similar to the Phillips, and that is the Reed and Prince tip. Like the Phillips, the Reed and Prince screwdriver tip forms an "X" but with one major exception, the Reed and Prince tip has a much more pointed tip. The Reed and Prince screwdriver should never be used on Phillips screws and vice versa.Intermixing these screwdrivers will cause damage to the screw and screwdriver. If you have both types in your tool box and they are similar in appearance, you may want to identify them by painting the screwdriver shank underneath the handle.

d. When selecting screwdrivers, note that you can apply more power with less effort with a longer screwdriver than with a short one. Of course, there will be situations where only a short handled screwdriver can be used. Keep this in mind though, when having to remove tight screws.

e. Because the working end of a screwdriver receives quite a bit of abuse, you should purchase screwdrivers with hardened-tips. The extra money will be well spent.

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.
d. Phillips screwdriver—size 3 tip, 6 and 8 in. blade.

Use screwdrivers only for driving screws. Never use a screwdriver for prying or chiseling metal. Do not try to remove a Phillips, Torx or Allen head screw with a standard 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 standard screwdriver in good condition. **Figure 30** 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 31** shows several pliers useful in repairing your Harley.

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. Needlenose pliers are used to hold or bend small objects. Water pump 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.

CAUTION
Pliers should not be used for loosening or tightening nuts or bolts. The pliers's sharp teeth will grind off the nut or bolt corners and damage it.

CAUTION
If slip-joint or water pump pliers are going to be used to hold an object with a finished surface, wrap the object with tape or cardboard for protection.

Vise-grip Pliers

Vise-grip pliers (**Figure 32**) are used to hold objects very tightly while another task is performed on the object. While vise-grip pliers work well, caution should be followed with their use. Because vise-grip pliers exert more force than regular pliers, their sharp jaws can permanently scar the object. In addition, when vise-grip pliers are locked into position, they can crush or deform thin-walled material.

Vise-grip pliers are available in many types for more specific tasks.

Circlip Pliers

Circlip pliers (**Figure 33**) are special in that they are only used to remove or install circlips. When purchasing circlip pliers, there are two kinds to choose 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 housing.

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

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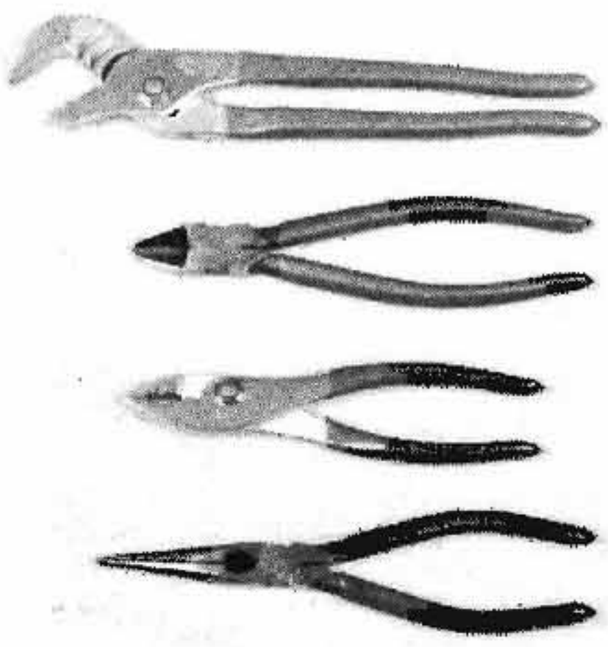

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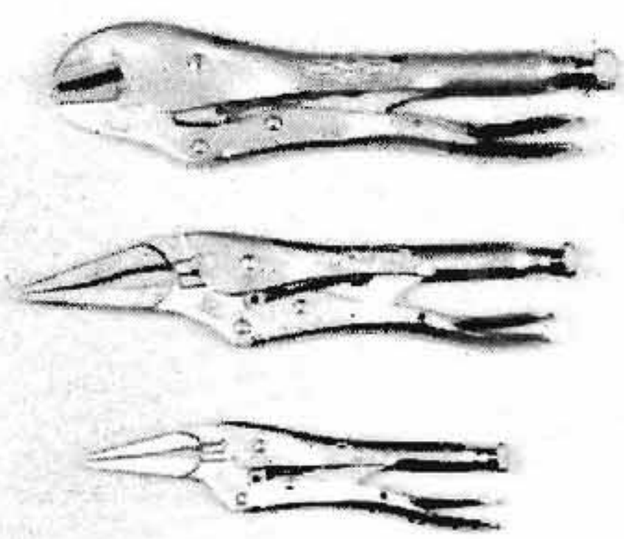


Box-end, Open-end and Combination Wrenches

Box-end and open-end wrenches (**Figure 34**) are available in sets or separately in a variety of sizes. The size number stamped near the end refers to the distance between 2 parallel flats on the hex head bolt or nut.

Box-end wrenches are usually superior to open-end wrenches. Open-end wrenches grip the nut on only 2 flats. Unless a wrench fits well, it may slip and round off the points on the nut. The box-end wrench grips on all 6 flats. Both 6-point and 12-point openings on box-end wrenches are available. The 6-point gives superior holding power; the 12-point allows a shorter swing.

Combination wrenches which are open on one side and boxed on the other are also available. Both ends are the same size.

No matter what style of wrench you choose, proper use is important to prevent personal injury. When using a wrench, get into the habit of pulling the wrench toward you. This technique will reduce the risk of injuring your hand if the wrench should slip. If you have to push the wrench away from you to loosen or tighten a fastener, open and push with the palm of your hand; your fingers and knuckles will be out of the way if the wrench slips. Before using a wrench, always think ahead as to what could happen if the wrench should slip or if the fastener strips or breaks.

Adjustable Wrenches

An adjustable wrench can be adjusted to fit nearly any nut or bolt head which has clear access around its entire perimeter. Adjustable wrenches 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. See **Figure 35**.

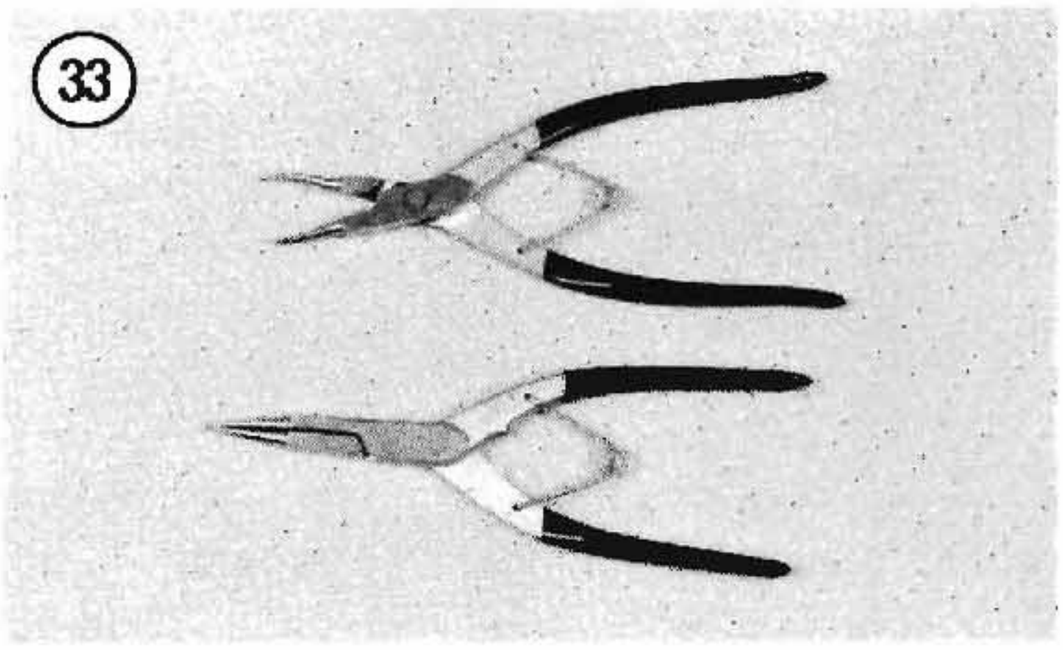
Adjustable wrenches have only two gripping surfaces which makes them more subject to slipping off the fastener and damaging the part and possibly your hand. See *Box-end, Open-end and Combination Wrenches* in this chapter.

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 inch range is recommended as an all-purpose wrench.

Socket Wrenches

This type is undoubtedly the fastest, safest and most convenient to use. Sockets which attach to a ratchet handle (**Figure 36**) are available with 6-point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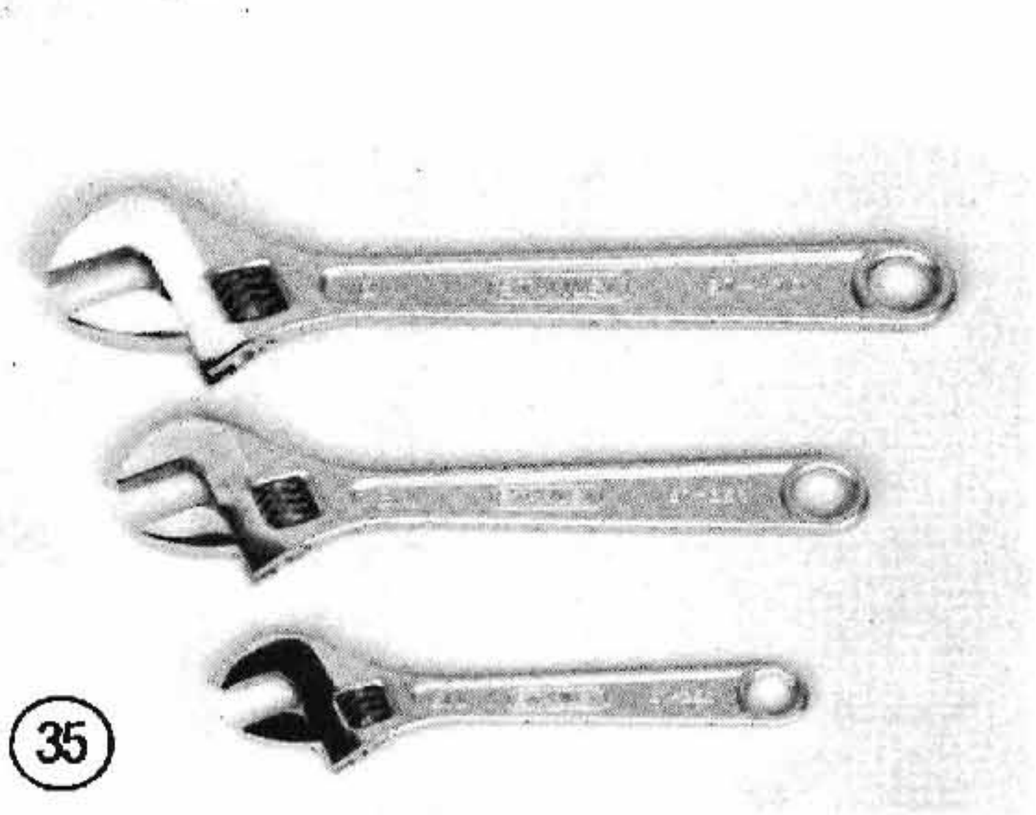
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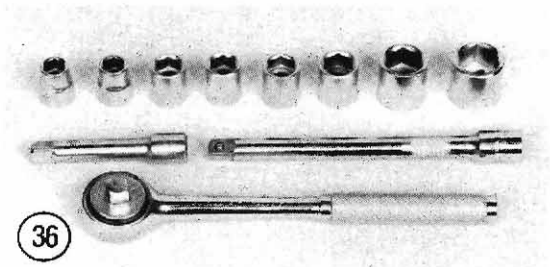
or 12-point openings and 1/4, 3/8, 1/2 and 3/4 in. drives. The drive size indicates the size of the square hole which mates with the ratchet handle.

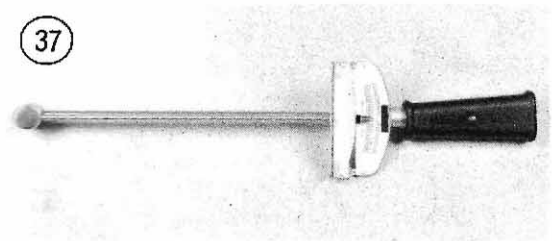
Torque Wrench

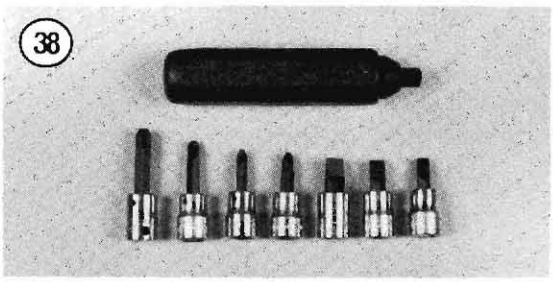
A torque wrench (**Figure 37**) is used with a socket to measure how tightly a nut or bolt is installed. They come in a wide price range and with either 3/8 or 1/2 in. square drives. The drive size indicates the size of the square drive which mates with the socket.

Impact Driver

This tool makes removal of tight fasteners easy and eliminates damage to bolts and screw slots. Impact drivers and interchangeable bits (**Figure 38**) are available at most large hardware and motorcycle dealers. Don't purchase a cheap one as they don't work as well and require more force than a moderately priced one. Sockets can also be used with a hand impact driver. However, make sure the socket is designed for use with an impact driver or air tool. Do not use regular hand type sockets, as they may shatter during use.







Hammers

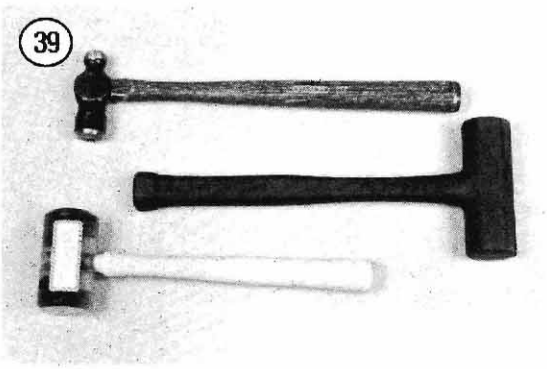
The correct hammer (**Figure 39**) is necessary for repairs. Use only a hammer with a face (or head) of rubber or plastic or the soft-faced type that is filled with buckshot. These are sometimes necessary in engine teardowns. *Never* use a metal-faced hammer on engine or suspension parts, as severe damage will result in most cases. Ball-peen or machinist's hammers will be required when striking another tool, such as a punch or impact driver. When striking a hammer against a punch, cold chisel or similar tool, the face of the hammer should be at least 1/2 in. larger than the head of the tool. When it is necessary to strike hard against a steel part without damaging it, a brass hammer should be used. A brass hammer can be used because brass will give when striking a harder object. Brass hammers are used when truing crankshafts.

When using hammers, note the following:

a. *Always* wear safety glasses when using a hammer.

b. Inspect hammers for damaged or broken parts. Repair or replace the hammer as required. Do *not* use a hammer with a taped handle.

c. Always wipe oil or grease off of the hammer *before* using it.



d. The head of the hammer should always strike the object squarely. Do not use the side of the hammer or the handle to strike an object.
e. Always use the correct hammer for the job.

Allen Wrenches

Allen wrenches (**Figure 40**) 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 SAE set. Allen bolts are sometimes called socket bolts.

Harley-Davidson uses Allen bolts throughout the bike. Some times the bolts are difficult to reach and it is suggested that a variety of Allen wrenches be purchased (e.g. socket driven, T-handle and extension type) as shown in **Figure 40**.

Tap and Die Set

A complete tap and die set (**Figure 41**) is a relatively expensive tool. But when you need a tap or die to clean up a damaged thread, there is really no substitute. Be sure to purchase one for American Standard (SAE) threads when working on your Harley.

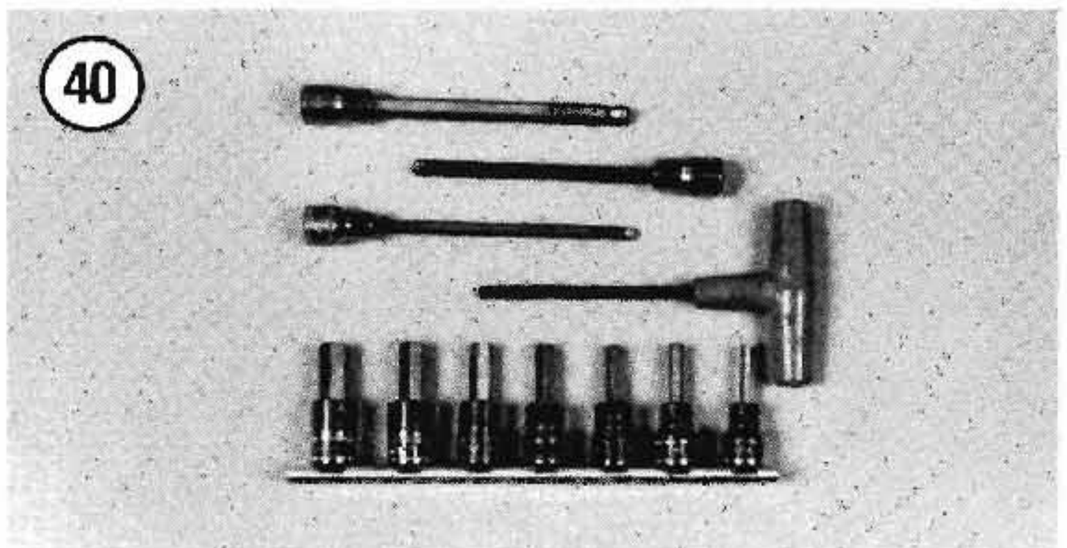
Tire Levers

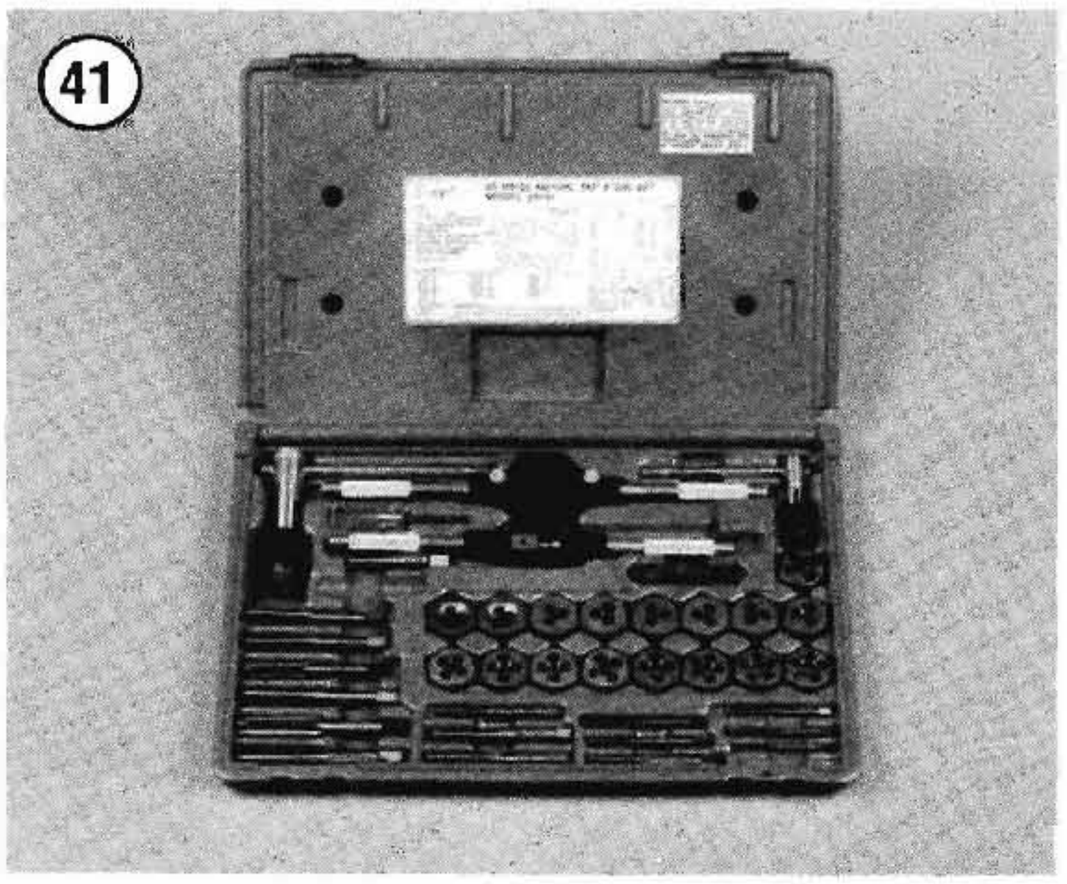
When changing tires, use a good set of tire levers (**Figure 42**). Never use a screwdriver in place of a tire lever; refer to Chapter Ten for tire changing procedures using these tools. Before using the tire levers, check the working ends of the tool and remove any burrs. Don't use a tire lever for prying anything but tires. **Figure 42** shows a regular pair of 10 in. long tire levers. However, for better leverage when changing tires on your Harley, you may want to invest in a set of 16 in. long tire irons. These can be ordered through your dealer.

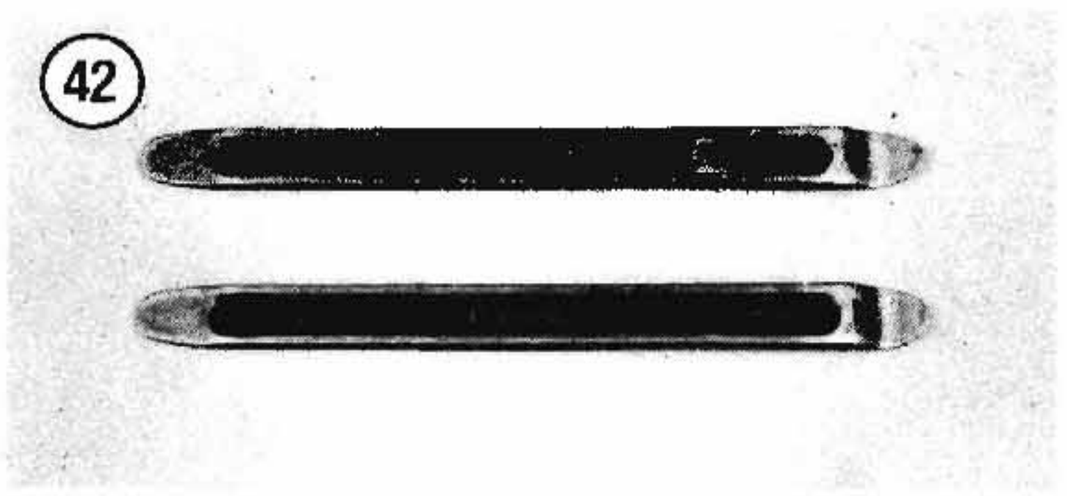
Bike Stand

Because Harley-Davidson motorcycles are not equipped with centerstands, you will need some safe means of raising your Harley's wheels off of the ground during many of the service procedures described in this manual. And when raising your Harley, you do not want to improvise a bike stand with available materials to just get you by. Consider the physical damage that can occur if your bike falls onto a cement floor.

There are a number of accessory bike stands that can be used to raise and support your Harley safely during service. Most are designed for shop use only. The bike stand shown in **Figure 43** was made out of heavy duty pipe. Aftermarket stands are available that are both useful and innovative. Along with using it in your shop or garage, some stands can be folded into a compact size and packed with your other travel gear and taken along for emergency use on the road. When selecting a bike stand, make sure that it can be used on Harley-Davidson motorcycles. Al-



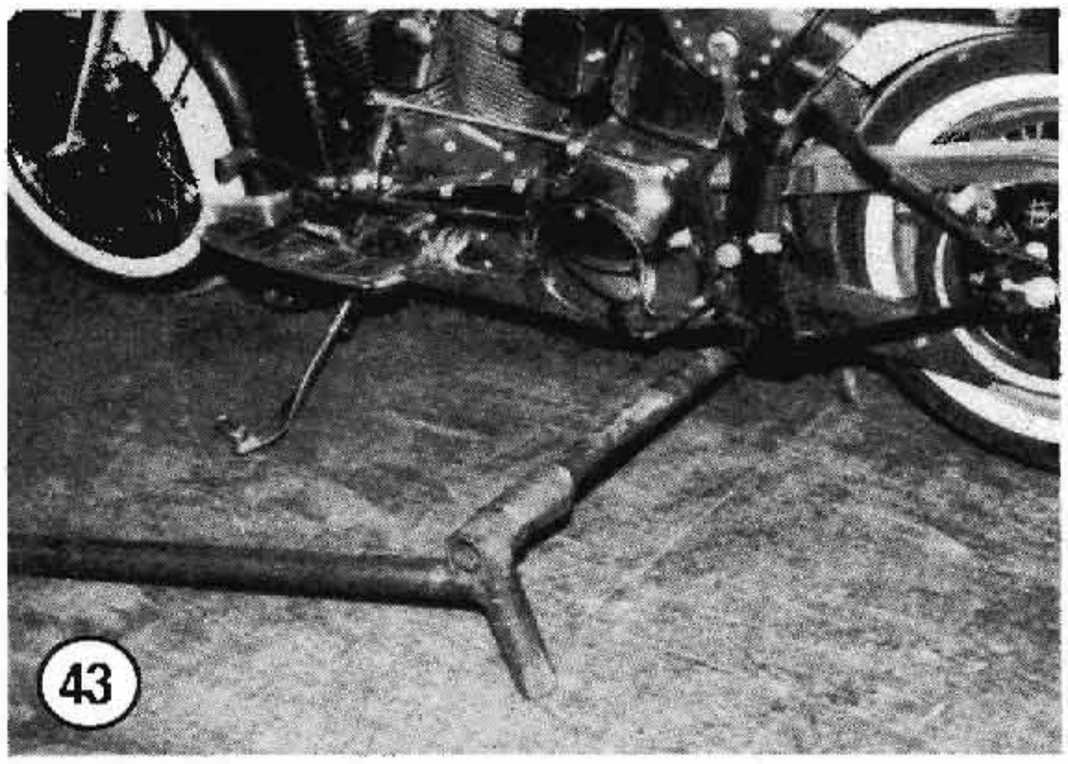




ways check the stability of the bike stand before walking away from the bike or when working it.

Drivers and Pullers

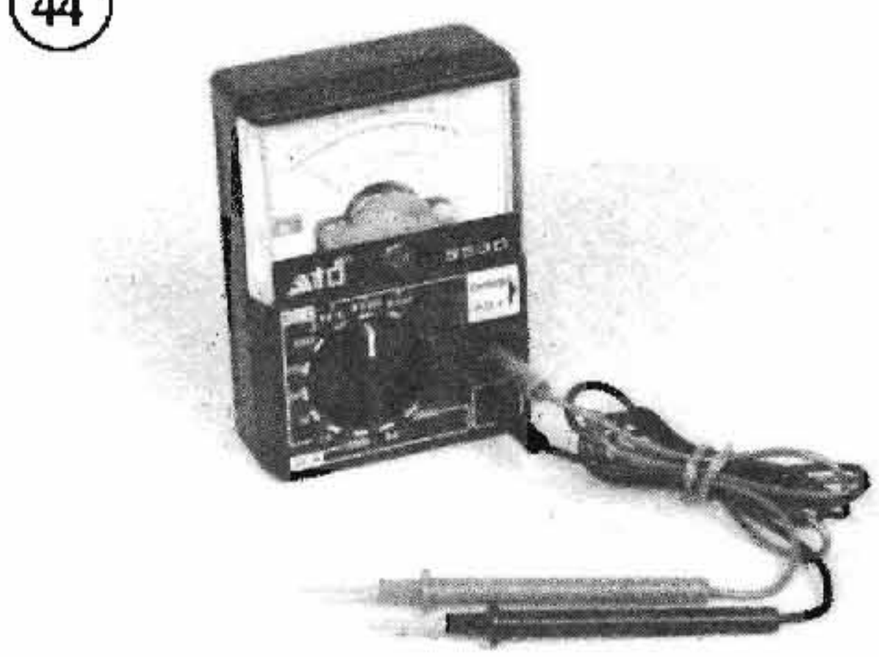
These tools are used to remove and install oil seals, bushings, bearings and gears. These will be called out during service procedures in later chapters as required.



TEST EQUIPMENT

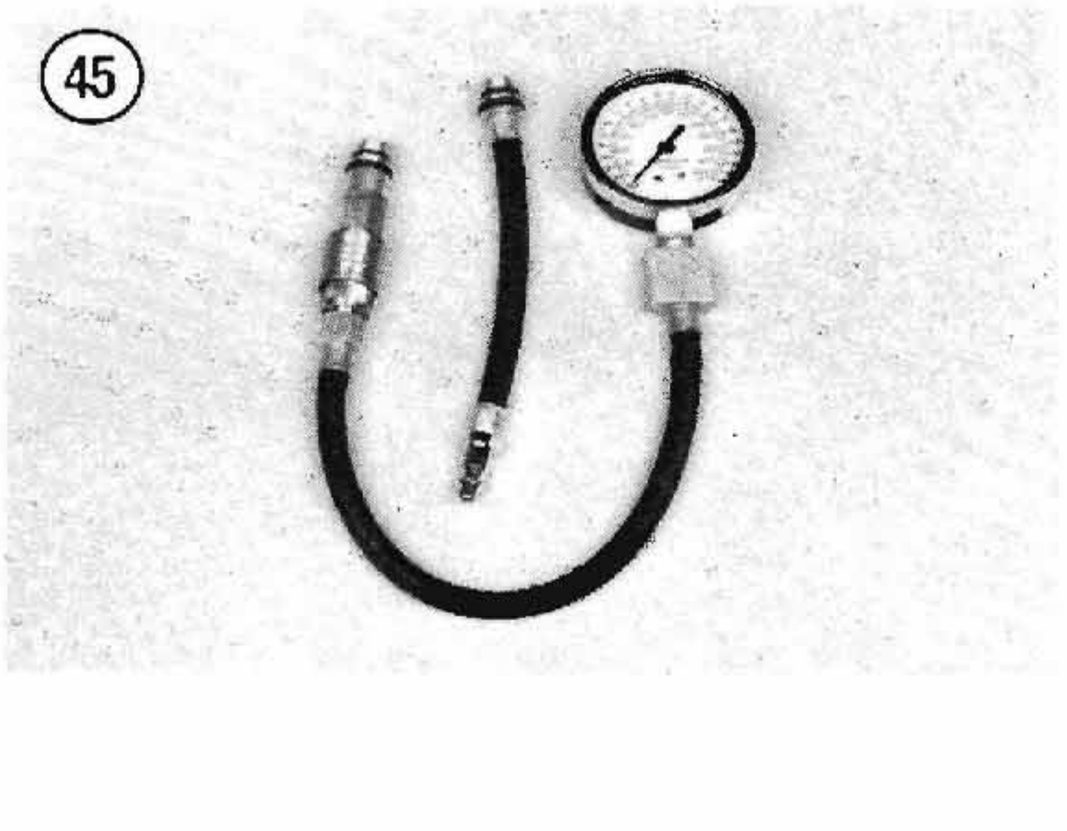
Multimeter or Volt-ohm Meter

This instrument (**Figure 44**) is invaluable for electrical system troubleshooting and service. A few of its functions may be duplicated by homemade test equipment, but for the serious mechanic it is a must. Its uses are described in the applicable section of the book.



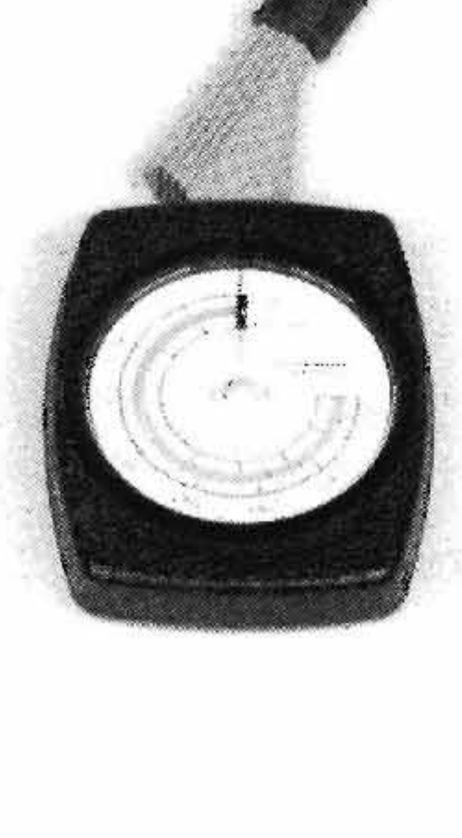
Compression Gauge

An engine with low compression cannot be properly tuned and will not develop full power. A compression gauge measures engine compression. The one shown in **Figure 45** has a flexible stem with an extension that can allow you to hold it while cranking the engine over. Press-in rubber tipped types (**Figure 46**) are also available. Open the throttle all the way when checking engine compression. See Chapter Three.



Cylinder Leak Down Tester

By positioning a cylinder on its compression stroke so that both valves are closed and then pressurizing the cylinder, you can isolate engine problem areas (eg. leaking valve, damaged head gasket, broke, worn or stuck piston rings) by listening for escaping air through the carburetor, exhaust pipe,



cylinder head mating surface, etc. To perform this procedure, a leak down tester and an air compressor are required. This procedure is described in Chapter Three as it pertains to the Harley Evolution engines. Cylinder leak down testers can be purchased through Harley-Davidson dealers, accessory tool manufacturers and automotive tool suppliers.

Battery Hydrometer

A hydrometer (**Figure 47**) is the best way to check a battery's state of charge. A hydrometer measures the weight or density of the sulfuric acid in the battery's electrolyte in specific gravity.

Portable Tachometer

A portable tachometer is necessary for tuning (**Figure 48**). Ignition timing and carburetor adjustments must be performed at specified engine speeds. The best instrument for this purpose is one with a low range of 0-1,000 or 0-2,000 rpm and a high range of 0-4,000. Extended range (0-6,000 or 0-8,000 rpm) instruments lack accuracy at lower speeds. The instrument should be capable of detecting 25 rpm on the low range.

Timing Light

Suitable timing lights range from inexpensive neon bulb types to powerful xenon strobe lights (**Figure 49**). A light with an inductive pickup is recommended to prevent any possible damage to ignition wiring.

PRECISION MEASURING TOOLS

Measurement is an important part of servicing your Harley. 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 engine compression and spark plug gap. As you become more involved with engine disassembly and service, measurements will be required to determine the condition of the piston and cylinder bore, crankshaft runout and so on. When

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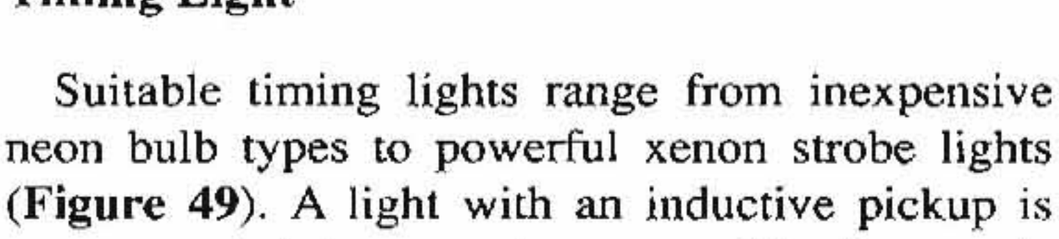

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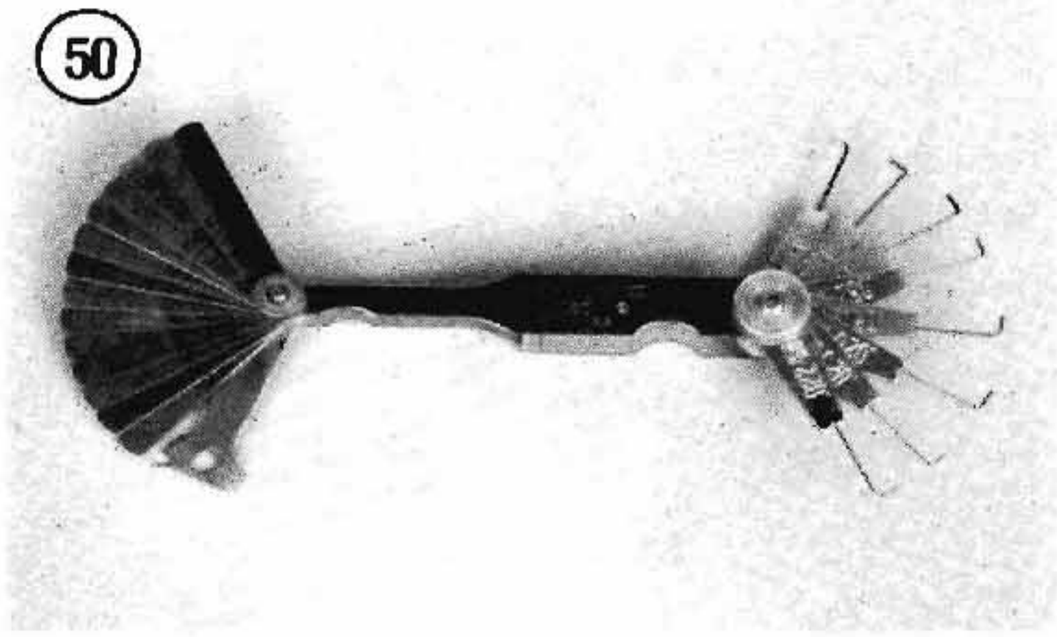

making these measurements, the degree of accuracy will dictate which tool is required. Precision measuring tools are expensive. If this is your first experience at engine service, it may be more worthwhile to have the checks made at a dealer. However, as your skills and enthusiasm increase for doing 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 overhaul.

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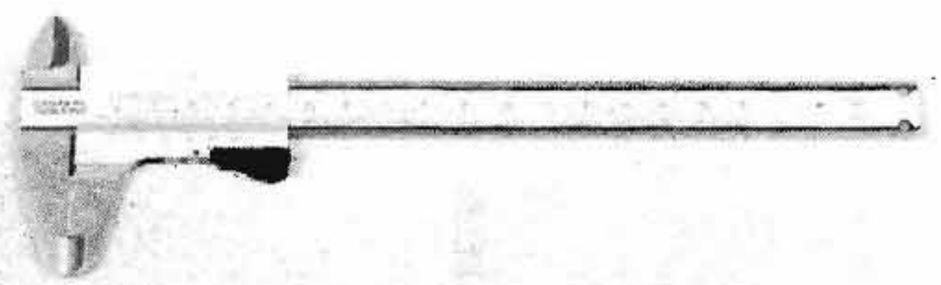

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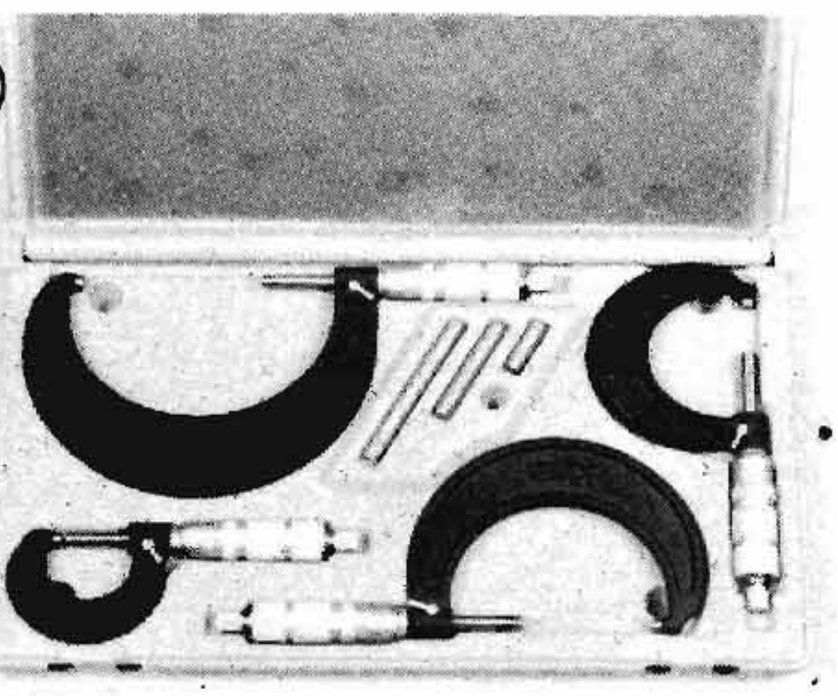

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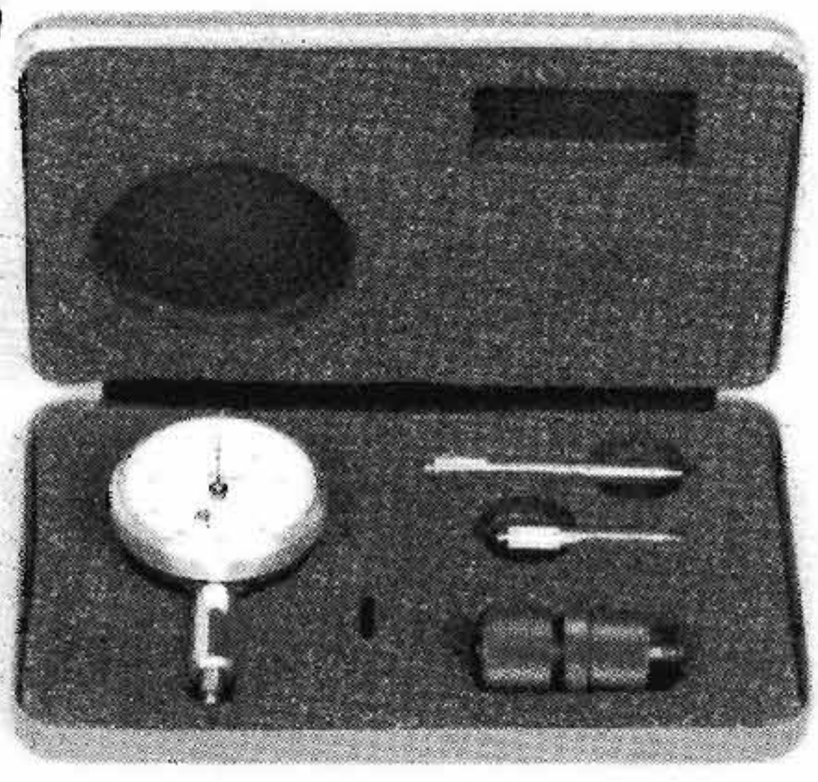


Feeler Gauge

The feeler gauge (**Figure 50**) 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. Flat gauges are used for all other measurements.

Vernier Caliper

This tool (**Figure 51**) is invaluable when it is necessary to measure inside, outside and depth measurements with close precision. It can be used to measure the thickness of shims and thrust washers. It is perhaps the most often used measuring tool in the motorcycle service shop. Vernier calipers are available in a wide assortment of styles and price ranges.

Outside Micrometers

The outside micrometer (**Figure 52**) is used for very exact measurements of close-tolerance components. It can be used to measure the outside diameter of a piston as well as for shims and thrust washers. Outside micrometers will be required to transfer measurements from bore, snap and small hole gauges. Micrometers can be purchased individually or in a set.

Dial Indicator

Dial indicators (**Figure 53**) are precision tools used to check crankshaft and drive shaft runout limits. For motorcycle repair, select a dial indicator with a continuous dial (**Figure 54**).

Cylinder Bore Gauge

The cylinder bore gauge is a very specialized precision tool. The gauge set shown in **Figure 55** 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. An outside micrometer must be

used together with the bore gauge to determine bore dimensions.

Telescoping Gauges

Telescoping gauges (**Figure 56**) can be used to measure hole diameters from approximately 5/16 in. to 6 in. Like the small hole gauge, the telescoping gauge does not have a scale gauge for direct readings. Thus an outside micrometer is required to determine bore dimensions.

Small Hole Gauges

A set of small hole gauges (**Figure 57**) allows you to measure a hole, groove or slot ranging in size up to 1/2 in. An outside micrometer must be used together with the small hole gauge to determine bore dimensions.

Screw Pitch Gauge

A screw pitch gauge (**Figure 58**) 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.

Surface Plate

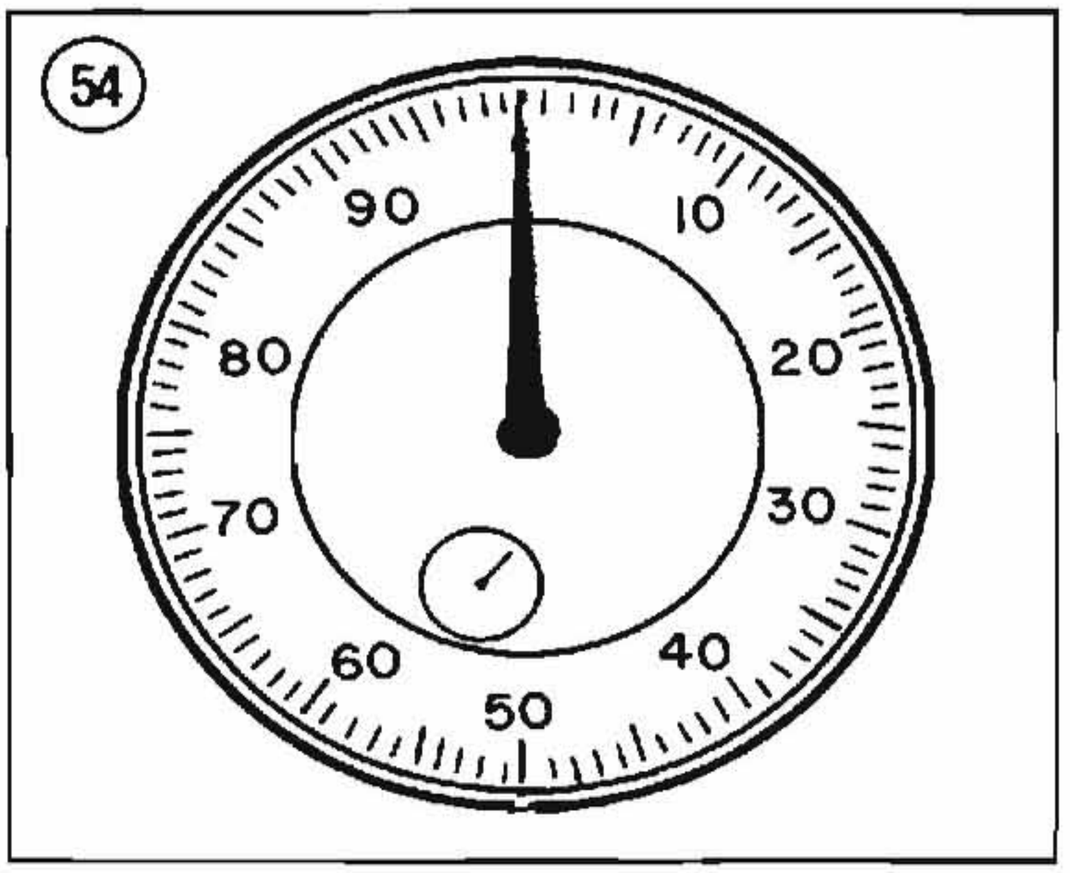
A surface plate can be used to check the flatness of parts or to provide a perfectly flat surface for minor resurfacing of cylinder head or other critical gasket surfaces. While industrial quality surface plates are quite expensive, the home mechanic can improvise. A thick metal plate can be put to use as a surface plate. The metal surface plate shown in **Figure 59** has a piece of sandpaper glued to its surface that is used for cleaning and smoothing cylinder head and crankcase mating surfaces.

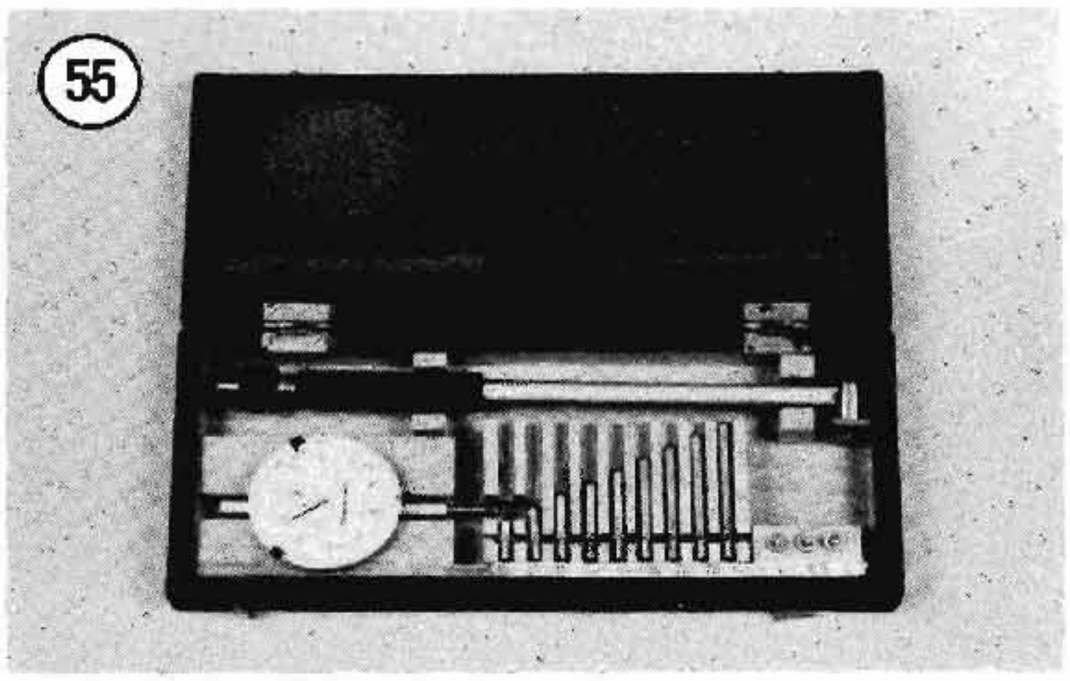
NOTE

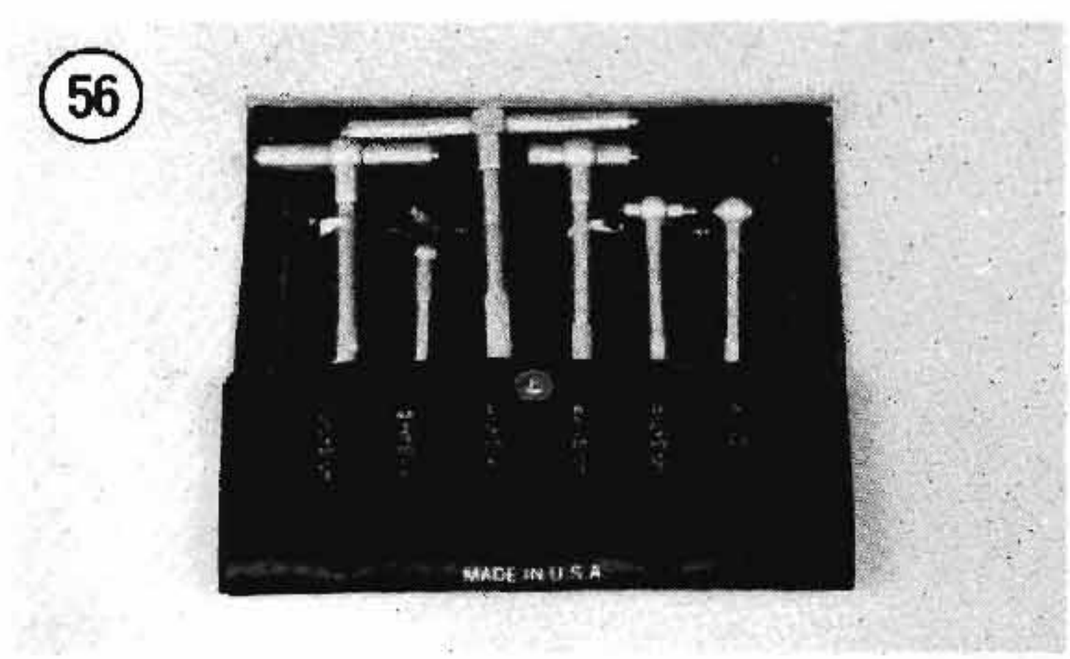
Check with a local machine shop on the availability and cost of having a metal plate resurfaced for use as a surface plate.

CLEANING SOLVENT

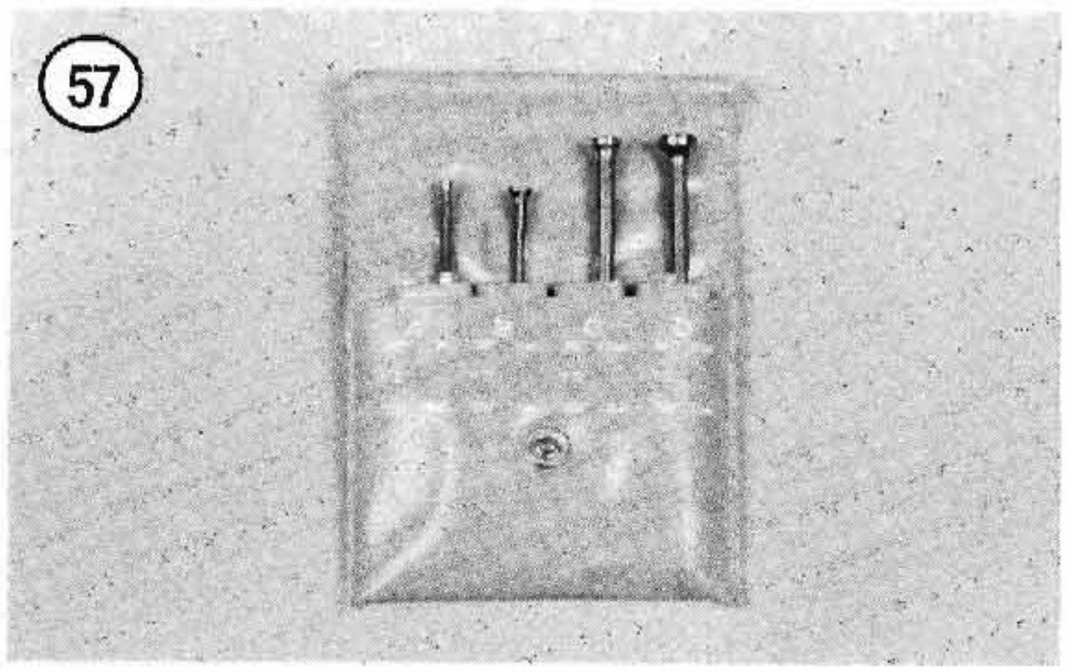
With the environmental concern that is prevalent today concerning the disposal of hazardous solvents, the home mechanic should select a water soluble, biodegradable solvent. These solvents can be purchased through dealers, automotive parts houses and large hardware stores.

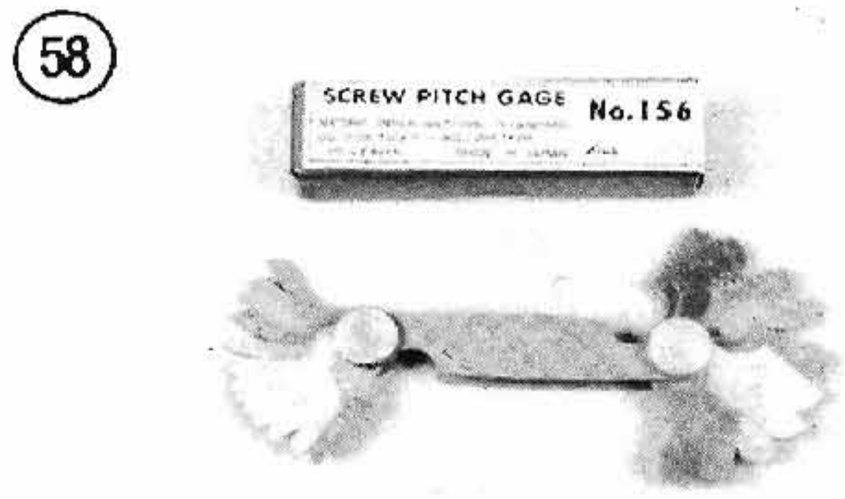


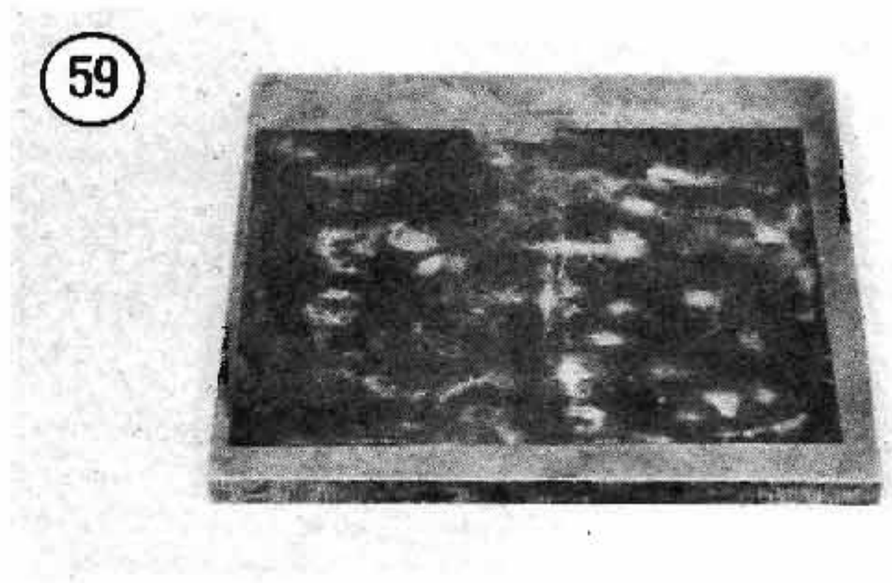




Selecting a solvent is only one of the problems facing the home mechanic when it comes to cleaning parts. You need some type of tank to clean parts as well as to store the solvent. There are a number of manufacturers offering different types and sizes of parts cleaning tanks. While a tank may seem a luxury to the home mechanic, you will find that it will quickly pay for itself through its efficiency and convenience. When selecting a parts washer, look for one that can recycle and store the solvent, as well as separate the sludge and contamination from the clean solvent. Most important, check the warranty, if any, as it pertains to the tank's pump. Like most tools, when purchasing a parts washer, you get what you pay for.







WARNING

Having a stack of clean shop rags on hand is important when performing engine 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.

OTHER SPECIAL TOOLS

A few other special tools may be required for major service. These are described in the appropriate chapters and are available from Harley-Davidson dealers or other manufacturers as indicated.

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 normal way. If the screw head is too chewed up to use this method, grip the head with vise-grip pliers and twist the screw out.

Avoid applying heat unless specifically instructed, as it may melt, warp or remove the temper from parts.

Remedying Stripped Threads

Occasionally, threads are stripped through carelessness or impact damage. Often the threads can be cleaned up by running a tap (for internal threads on nuts) or die (for external threads on bolts) through the threads. See **Figure 60**. To clean or repair spark plug threads, a spark plug tap can be used.

If an internal thread is damaged, it may be necessary to install a Helicoil (**Figure 61**) or some other type of thread insert. These kits have all of the necessary parts to repair a damaged internal thread.

If it is necessary to drill and tap a hole, refer to **Table 7** for SAE tap drill sizes.

Removing Broken Screws or Bolts

When the head breaks off a screw or bolt, several methods are available for removing the remaining portion.

If a large portion of the remainder projects out, try gripping it with Vise-grip pliers. If the projecting portion is too small, file it to fit a wrench or cut a slot in it to fit a screwdriver. See **Figure 62**.

If the head breaks off flush, use a screw extractor. To do this, centerpunch the exact center of the remaining portion of the screw or bolt. Drill a small hole in the screw and tap the extractor into the hole. Back the screw out with a wrench on the extractor. See **Figure 63**.

Removing Broken or Damaged Studs

If a stud is broken or the threads severely damaged, perform the following. A tube of Loctite 271 (red), 2 nuts, 2 wrenches and a new stud will be required during this procedure (**Figure 64**).

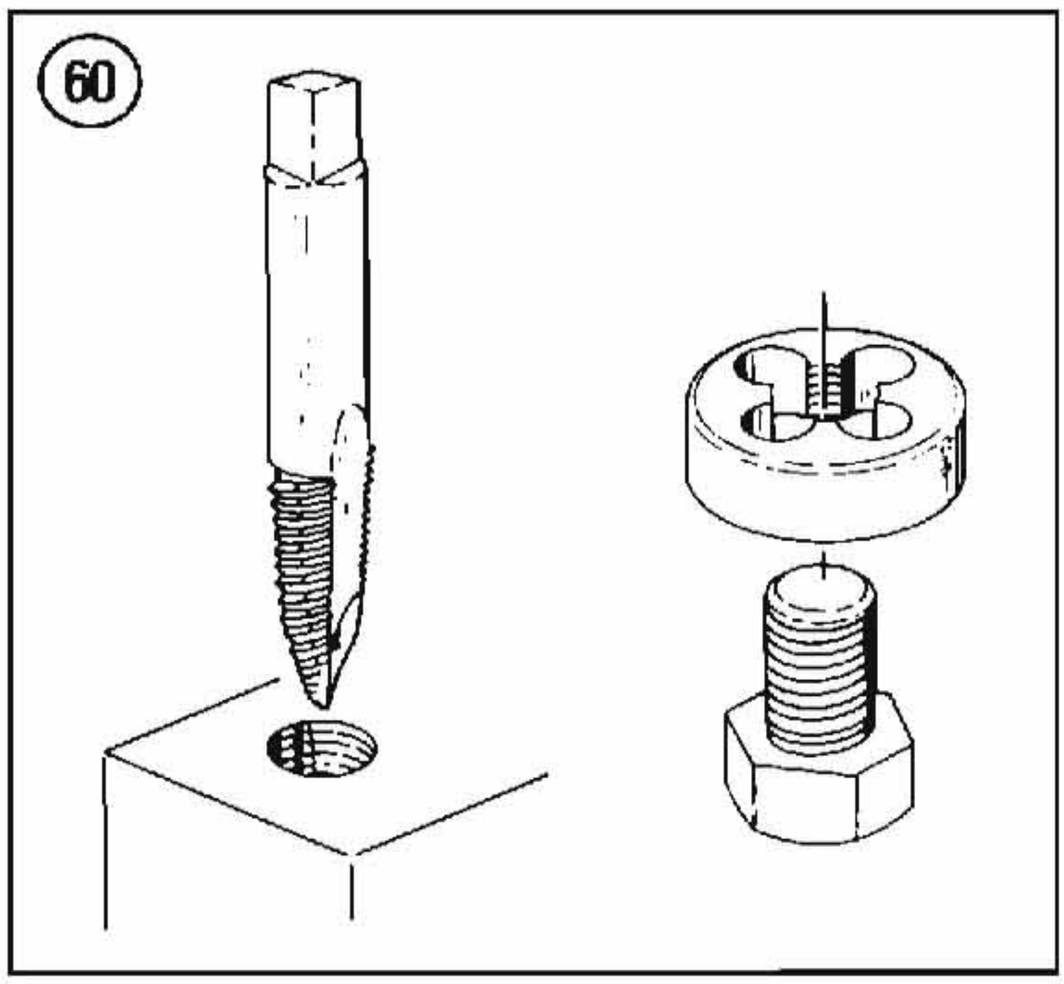
NOTE

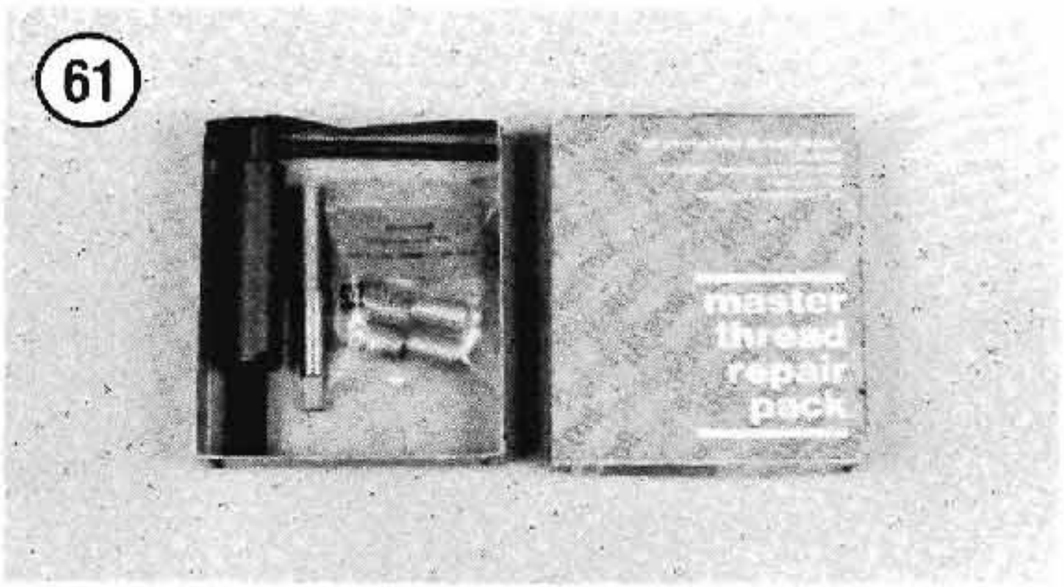
The following steps describe general procedures for replacing a typical stud. However, if you are replacing cylinder studs, refer to ***Cylinder Stud Replacement*** *in Chapter Four. Do* ***not*** *use the following steps to replace cylinder studs. The improper installation of cylinder studs can cause cylinder head leakage.*

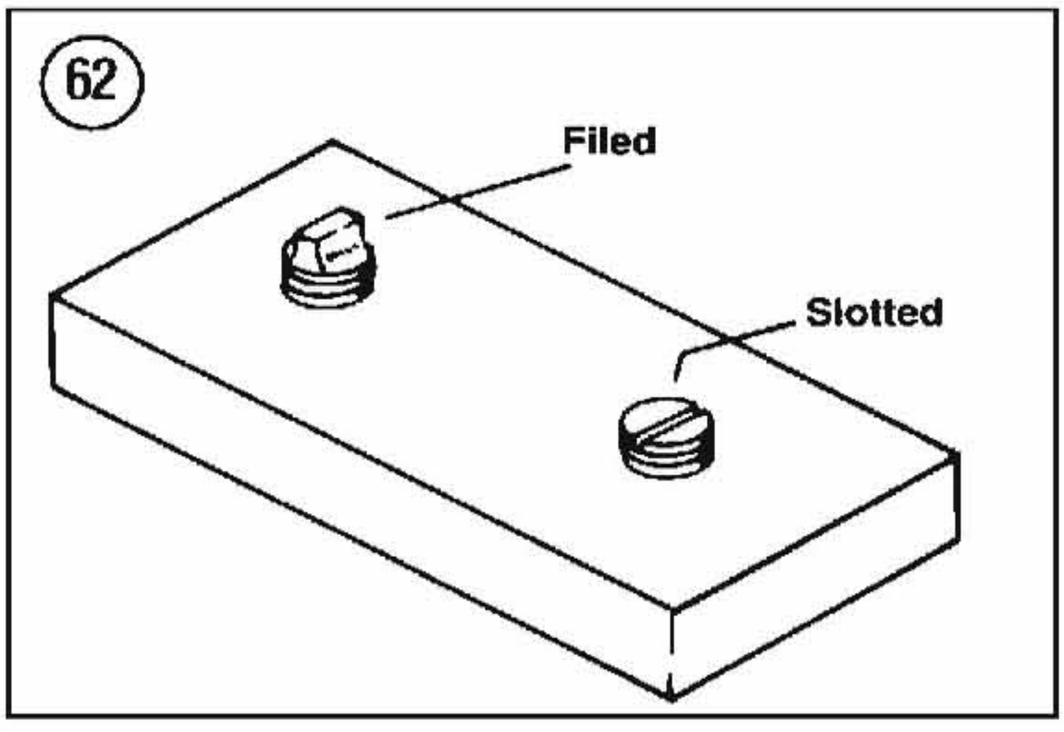
1. Thread two nuts onto the damaged stud. Then tighten the 2 nuts against each other so that they are locked.

NOTE

If the threads on the damaged stud do not allow installation of the 2 nuts, you







will have to remove the stud with a pair of Vise-grip pliers.

2. Turn the bottom nut counterclockwise and unscrew the stud.

3. Threaded holes with a bottom surface should be blown out with compressed air as dirt buildup in the bottom of the hole may prevent the stud from being torqued properly. If necessary, use a bottoming tap to true up the threads and to remove any deposits.

4. Install 2 nuts on the top half of the new stud as in Step 1. Make sure they are locked securely.

5. Coat the bottom half of a new stud with Loctite 271 (red).

6. Turn the top nut clockwise and thread the new stud securely.

7. Remove the nuts and repeat for each stud as required.

8. Follow Loctite's directions on cure time before assembling the component.

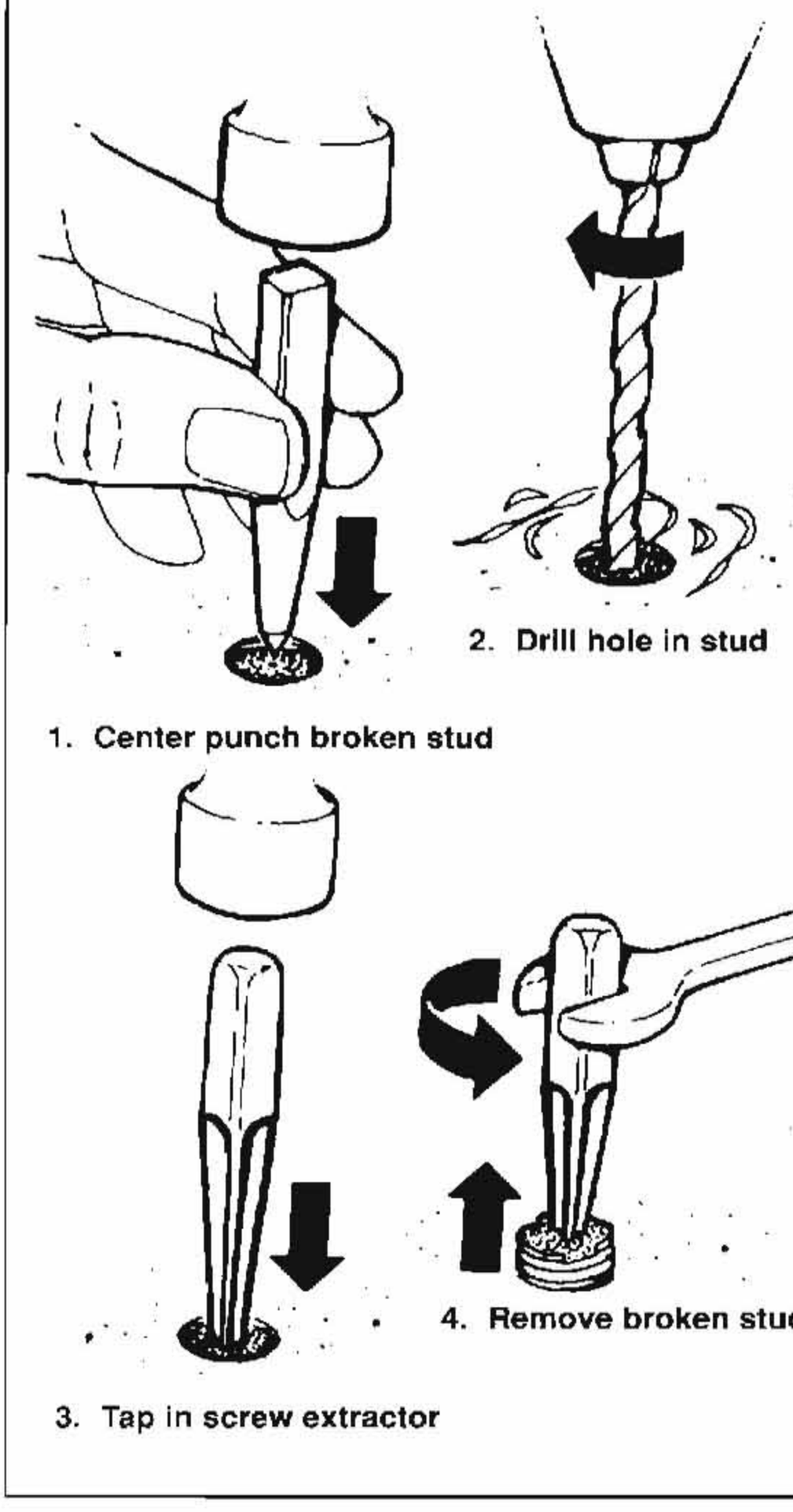
BALL BEARING REPLACEMENT

Ball bearings (**Figure 65**) are used throughout your Harley's engine and chassis to reduce power loss, heat and noise resulting from friction. Because ball bearings are precision made parts, they must be maintained by proper lubrication and maintenance. When a bearing is found to be damaged, it should be replaced immediately. However, when installing a new bearing, care should be taken to prevent damage to the new bearing. While bearing replacement is described in the individual chapters where applicable, the following can be used as a guideline.

NOTE

Unless otherwise specified, install bearings with the manufacturer's mark or number on the bearing facing outward.

63 **REMOVING BROKEN SCREWS AND BOLTS**



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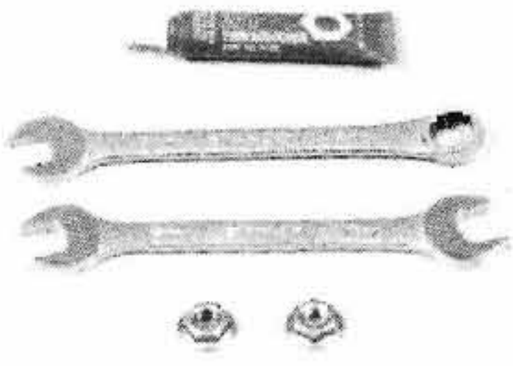

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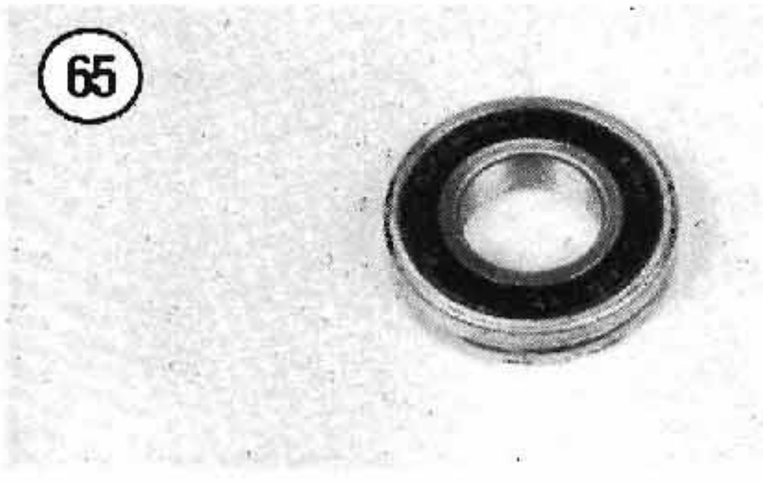


Bearing Removal

While bearings are normally removed only when damaged, there may be times when it is necessary to remove a bearing that is in good condition. Depending on the situation, you may be able to remove the bearing without damaging it. However, bearing removal in some situations, no matter how careful you are, will cause bearing damage. Care should always be given to bearings during their removal to prevent secondary damage to the shaft or housing. Note the following when removing bearings.

1. When using a puller to remove a bearing on a shaft, care must be taken so that shaft damage does not occur. Always place a piece of metal between the end of the shaft and the puller screw. In addition, place the puller arms next to the inner bearing race. See **Figure 66.**

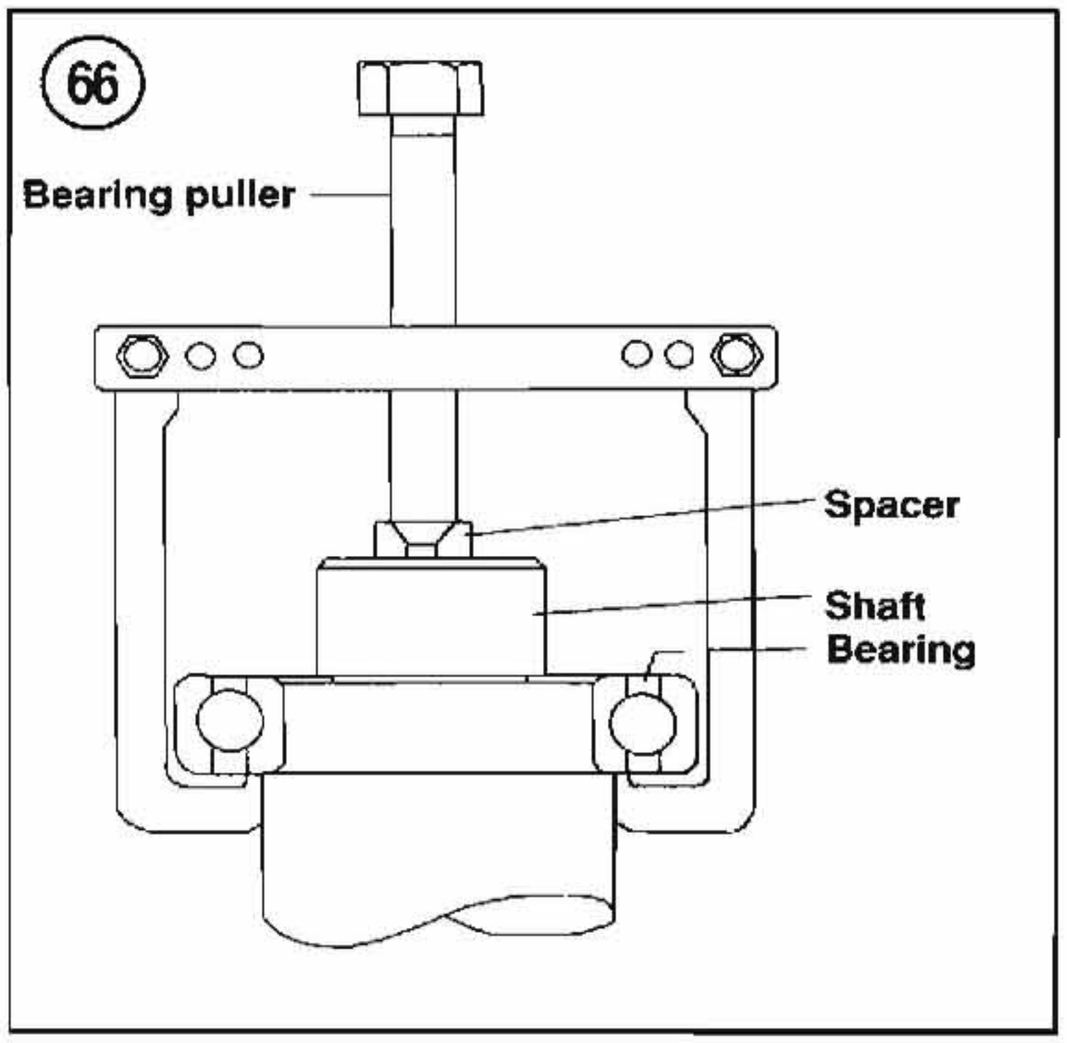
2. When using a hammer to remove a bearing on a shaft, do not strike the hammer directly against the shaft. Instead, use a brass or aluminum spacer between the hammer and shaft (**Figure 67**). In addition, make sure to support *both* bearing races with wood blocks as shown in **Figure 67**.

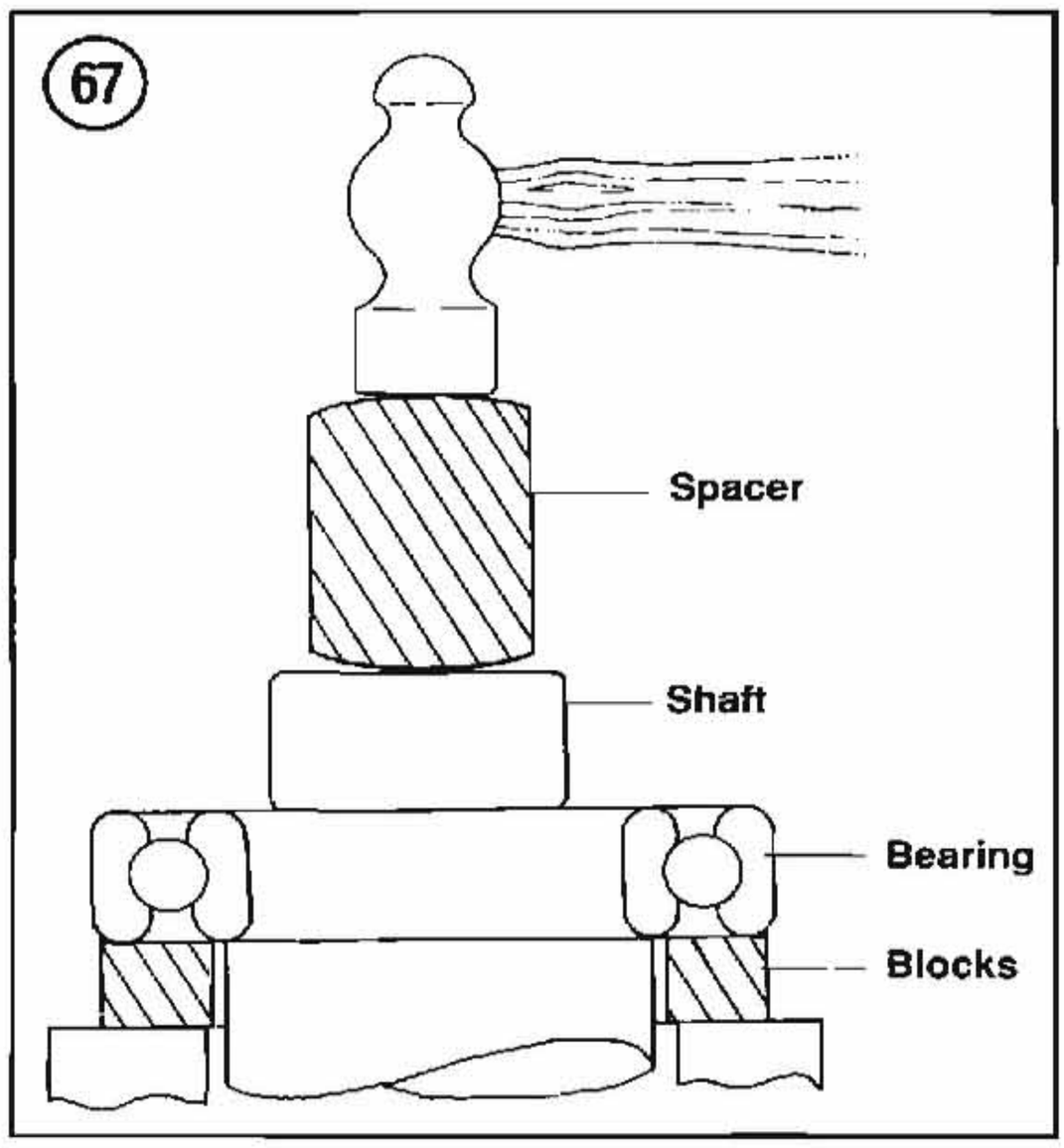
3. The most ideal method of bearing removal is with a hydraulic press. However, certain procedures must be followed or damage may occur to the bearing, shaft or case half. Note the following when using a press:

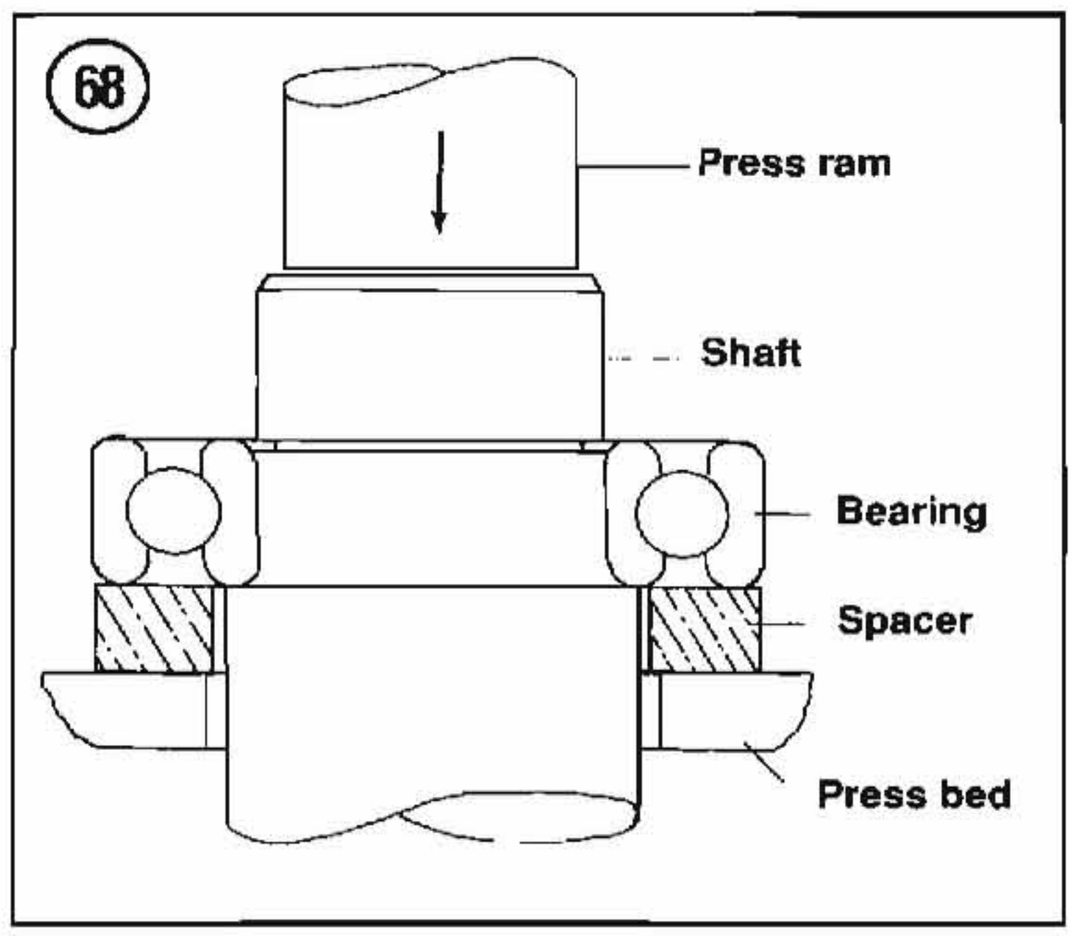
   a. Always support the inner and outer bearing races with a suitable size wood or aluminum spacer ring (**Figure 68**). If only the outer race is supported, the balls and/or the inner race will be damaged.

   b. Always make sure the press ram (**Figure 68**) aligns with the center of the shaft. If the ram is not centered, it may damage the bearing and/or shaft.

   c. The moment the shaft is free of the bearing, it will drop to the floor. Secure or hold the shaft to prevent it from falling.

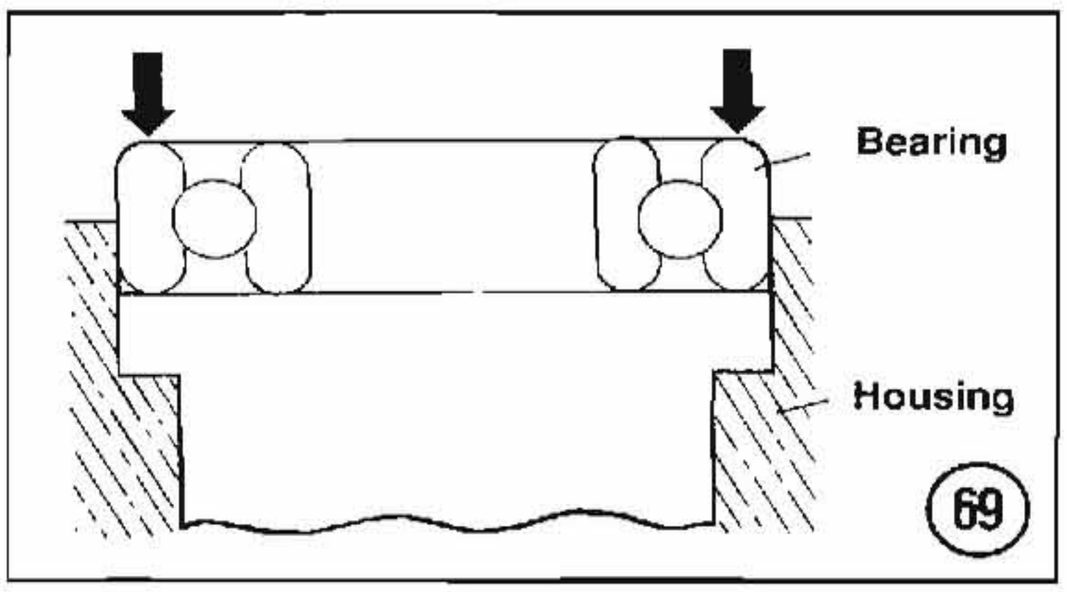


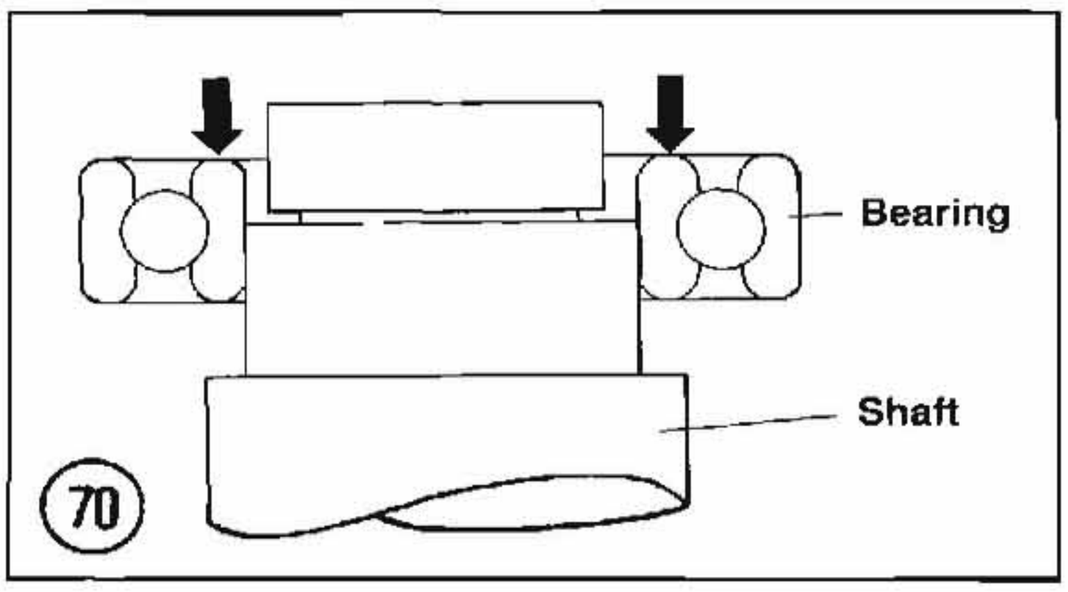




Bearing Installation

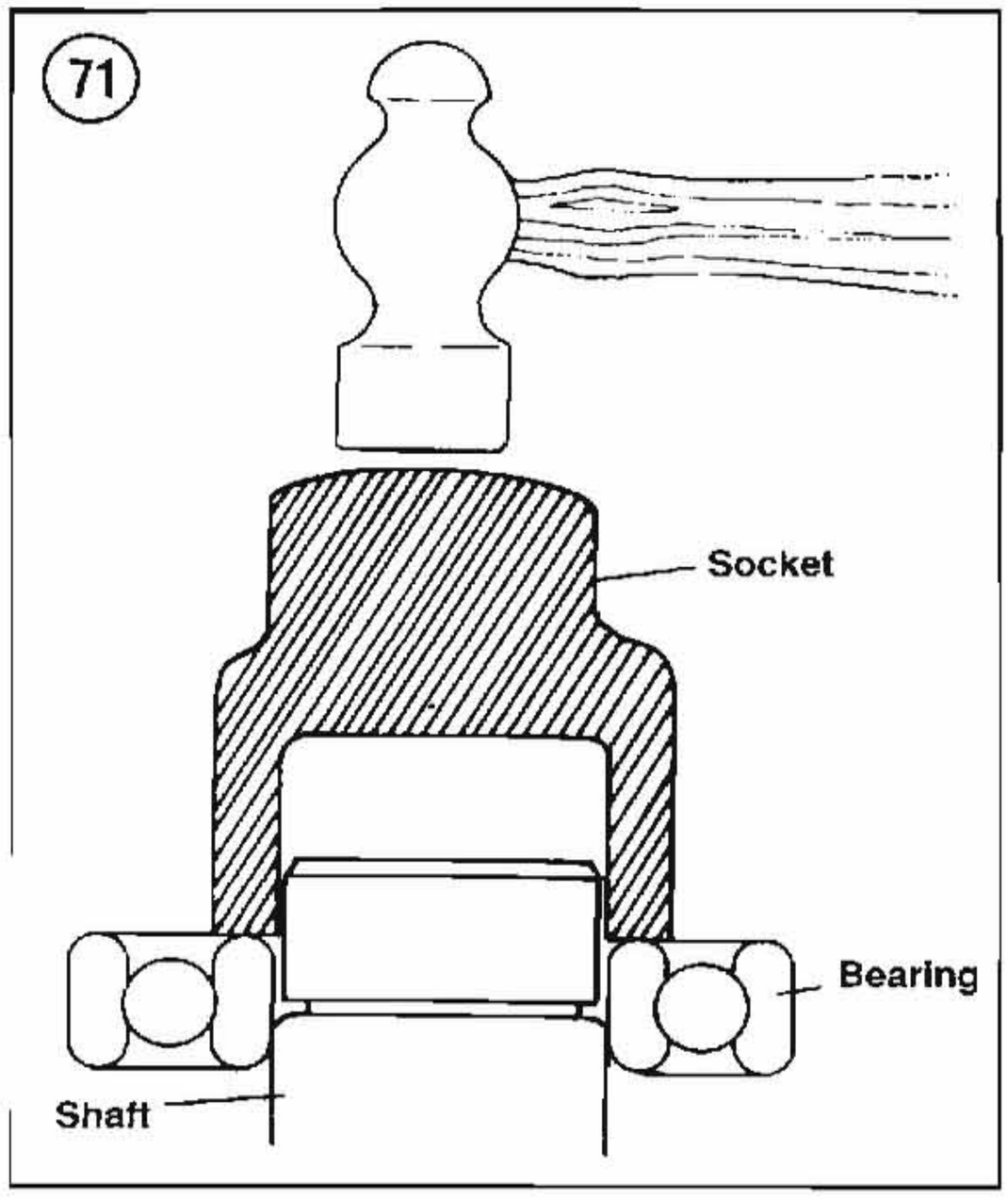
1. When installing a bearing in a housing, pressure must be applied to the *outer* bearing race (**Figure 69**). When installing a bearing on a shaft, pressure must be applied to the *inner* bearing race (**Figure 70**).

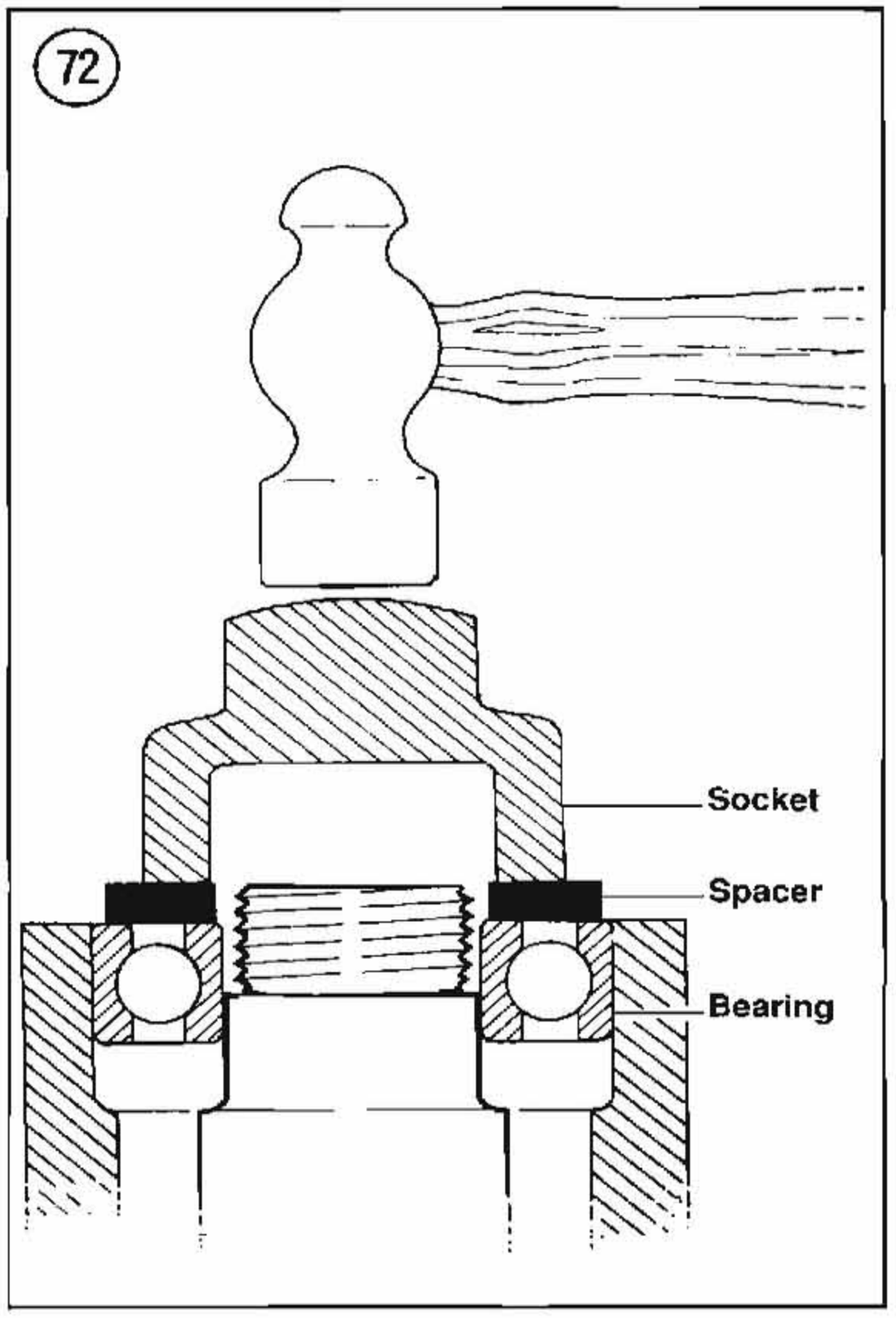




2. When installing a bearing as described in Step 1, some type of driver will be required. Never strike the bearing directly with a hammer or the bearing will be damaged. When installing a bearing, a piece of pipe or a socket with an outer diameter that matches the bearing race will be required. **Figure 71** shows the correct way to use a socket and hammer when installing a bearing over a shaft.

3. Step 1 describes how to install a bearing in a case half and over a shaft. However, when installing a bearing over a shaft and into a housing at the same time, a snug fit will be required for both outer and inner bearing races. In this situation, a spacer must be installed underneath the driver tool so that pressure is applied evenly across *both* races. See **Figure 72**. If the outer race is not supported as shown in **Figure 72**, the balls will push against the outer bearing track and damage it.





Shrink Fit

1. *Installing a bearing over a shaft*: When a tight fit is required, the bearing inside diameter will be smaller than the shaft. In this case, driving the bearing on the shaft using normal methods may cause bearing damage. Instead, the bearing should be heated before installation. Note the following:

a. Secure the shaft so that it can be ready for bearing installation.
b. Clean the bearing surface on the shaft of all residue. Remove burrs with a file or sandpaper.
c. Fill a suitable pot or beaker with clean mineral oil. Place a thermometer (rated higher than 248° F) in the oil. Support the thermometer so that it does not rest on the bottom or side of the pot.
d. Remove the bearing from its wrapper and secure it with a piece of heavy wire bent to hold it in the pot. Hang the bearing in the pot so that it does not touch the bottom or sides of the pot.
e. Turn the heat on and monitor the thermometer. When the oil temperature rises to approximately 248° F, remove the bearing from the pot and quickly install it. If necessary, place a socket on the inner bearing race and tap the bearing into place. As the bearing chills, it will tighten on the shaft so you must work quickly when installing it. Make sure the bearing is installed all the way.

2. *Installing a bearing in a housing*: Bearings are generally installed in a housing with a slight interference fit. Driving the bearing into the housing using normal methods may damage the housing or cause bearing damage. Instead, the housing should be heated before the bearing is installed. Note the following:

CAUTION

Before heating the crankcases in this procedure to remove the bearings, wash the cases thoroughly with detergent and water. Rinse and rewash the cases as required to remove all traces of oil and other chemical deposits.

a. The housing must be heated to a temperature of about 212° F in an oven or on a hot plate. An easy way to check to see that it is at the proper temperature is to drop tiny drops of water on the case as it heats; if they sizzle and evaporate immediately, the temperature is correct. Heat only one housing at a time.

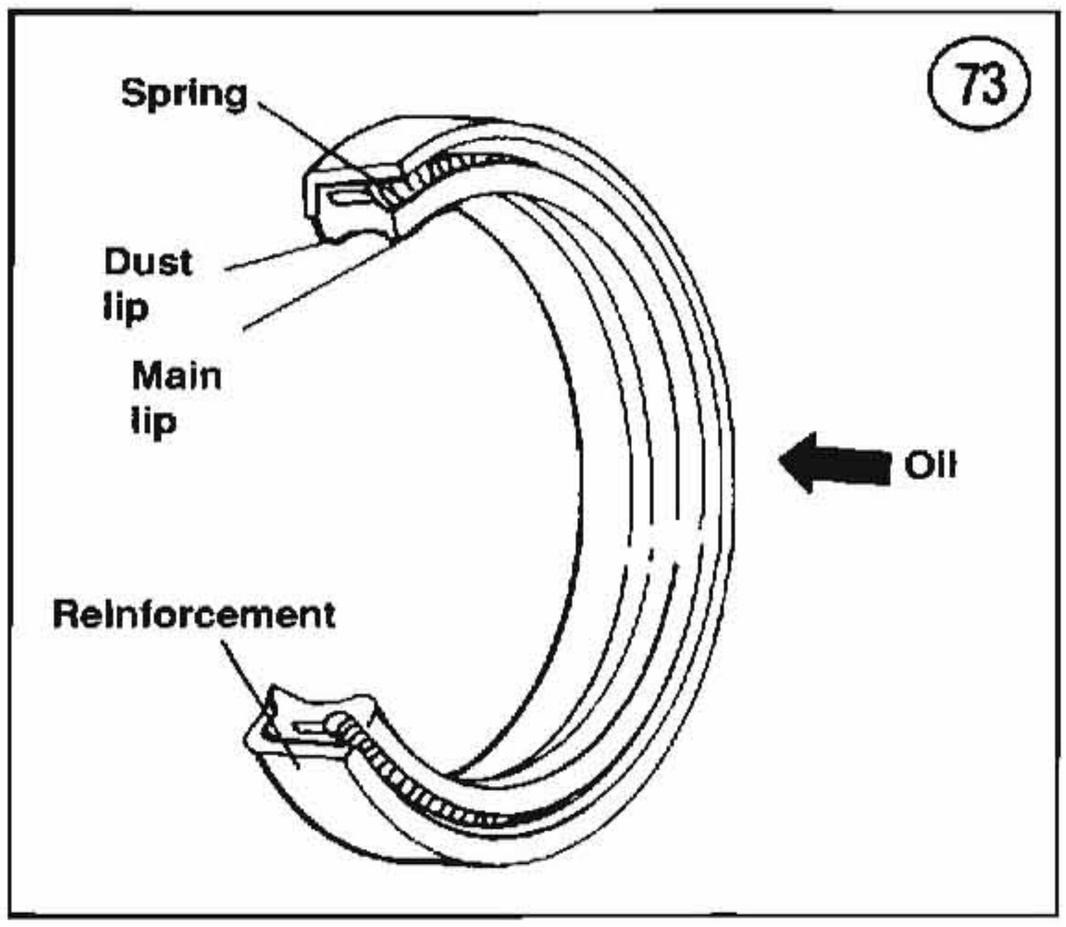
CAUTION

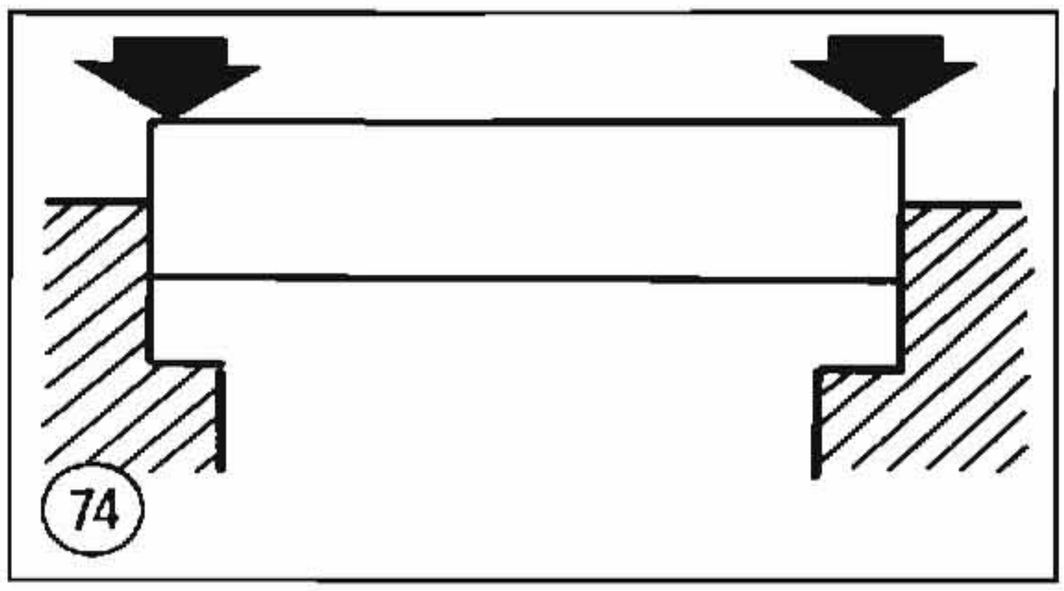
Do not heat the housing with a torch (propane or acetylene)—never bring a flame into contact with the bearing or housing. The direct heat will destroy the case hardening of the bearing and will likely warp the housing.

b. Remove the housing from the oven or hot plate and hold onto the housing with a kitchen pot holder, heavy gloves or heavy shop cloths—*it is hot.*

NOTE

A suitable size socket and extension works well for removing and installing bearings.





c. Hold the housing with the bearing side down and tap the bearing out. Repeat for all bearings in the housing.
d. While heating the housing halves, place the new bearings in a freezer if possible. Chilling them will slightly reduce their overall diameter while the hot housing assembly is slightly larger due to heat expansion. This will make installation much easier.

NOTE
Always install bearings with the manufacturer's mark or number facing outward.

e. While the housing is still hot, install the new bearing(s) into the housing. Install the bearings by hand, if possible. If necessary, lightly tap the bearing(s) into the housing with a socket placed on the outer bearing race. *Do not* install new bearings by driving on the inner bearing race. Install the bearing(s) until it seats completely.

OIL SEALS

Oil seals (**Figure 73**) are used to contain oil, water, grease or combustion gasses in a housing or shaft. Improper removal of a seal can damage the housing or shaft. Improper installation of the seal can damage the seal. Note the following:

a. Prying is generally the easiest and most effective method of removing a seal from a housing. However, always place a rag underneath the pry tool to prevent damage to the housing.
b. Grease should be packed in the seal lips before the seal is installed.
c. Oil seals should always be installed so that the manufacturer's numbers or marks face out.
d. Oil seals should be installed with a socket placed on the outside of the seal as shown in **Figure 74**. Make sure the seal is driven squarely into the housing. Never install a seal by hitting against the top of the seal with a hammer.

Table 1 MODEL IDENTIFICATION

1984 FXST 1985 FXST 1986 FXST FXST (Custom) 1987 FXST FXSTC (Custom) FLST 1988 FXST FXSTC (Custom) FLST FLSTC (Classic) 1989 FXST FXSTC (Custom) FXSTS (Springer) FLST FLSTC (Classic)	1990 FXST FXSTC (Custom) FXSTS (Springer) FLST FLSTC (Classic) FLSTF (Fat Boy) 1991 FXSTC (Custom) FXSTS (Springer) FLSTC (Classic) FLSTF (Fat Boy) 1992 FXSTC (Custom) FXSTS (Springer) FLSTC (Classic) FLSTF (Fat Boy) 1993-on FXSTC (Custom) FXSTS (Springer) FLSTC (Classic) FLSTF (Fat Boy) FLSTN (Heritage Softail Special)

Table 2 GENERAL SPECIFICATIONS

Item	In.	mm
Wheel base		
1984-1992		
FXST (all)	66.30	1684
FLST/F & FLSTC	62.50	1587
1993-on		
FXSTC	66.50	1689
FLSTF/N	63.89	1623
FLSTC	63.90	1623
FXSTS	64.41	1636
Length		
1984-1992		
FXST (all)	94.30	2395
FLST/F & FLSTC	93.80	2382
1993-on		
FXSTC	94.92	2411
FLSTF/N	93.85	2384
FLSTC	94.02	2388
FXSTS	92.52	2350
Width		
1984-1992		
FXST (all)	29.00	736
FLST/F & FLSTC	38.00	965
1993-on		
FXSTC & FXSTS	29.00	736
FLSTF/N & FLSTC	38.00	965
Height		
1984-1992		
FXST (all)	47.00	1194
FLST/F	49.00	1245
FLSTC	59.40	1509
1993-on		
FXSTC & FXSTS	47.00	1194
FLST/F	49.00	1245
FLSTC	59.40	1509
	lbs.	**kg.**
Weight		
1984-1992		
1984 FXST	612	278
1985-on FXST/C	618	281
FXSTS	625	284
FLST/F	650	295
FLSTC	710	323
1993-on		
FXSTC	618	281
FLSTF/N	710	323
FLSTC	710	323
FXSTS	625	284

Table 3 GROSS VEHICLE WEIGHT RATINGS

Gross vehicle weight rating (GVWR)	1,085 lbs. (493 kg)
Gross axle weight ratings (GAWR)	
Front	390 lbs. (177 kg)
Rear	695 lbs. (316 kg)

*GVWR is the maximum allowable vehicle weight. This weight includes combined vehicle, rider(s) and accessory weight.