WARNING

Some of the modifications in this booklet will shorten the life of the engine. YAMAHA INTERNATIONAL CORPORATION can not be held responsible for damage to engine or parts as a result of modifications presented in this book.

Engines that are raced or run extremely hard should be inspected frequently for evidence of wear or damage. Inspection at regular intervals and replacement of any worn parts will extend the life of a racing engine.

An engine that blows up will usually have extensive damage and will be expensive to rebuild. Some engine failures may cause temporary loss of control, resulting in injury to the rider.

This book is designed to provide information to the racer who is interested in obtaining higher performance from his production Yamaha motorcycle.

Some of the parts called out in this book are no longer available; others have never been in production. However, production parts are available that can be modified for use according to specifications in this book.

When considering an engine modification, remember that low end power will be adversely affected. The whole power curve will be changed. Engine power will start at a higher rpm and extend to a higher power peak.

Before modifying an engine, one must decide if he wants more low end torque or more peak horsepower. It is often impossible to get both.

INTRODUCTION

The modifications described in this book apply to changes you can make to the combustion zone of your engine to improve performance. Changes in gear ratios, sprocket ratios, wheel sizes, etc., are not discussed in this book.

The combustion zone modifications discussed in this book are:

- CYLINDER HEAD MODIFICATIONS – The cylinder head [1] may be modified to make adjustment for compression ratio change if piston [5] or ports [2,3] have been modified. Page 1-6.

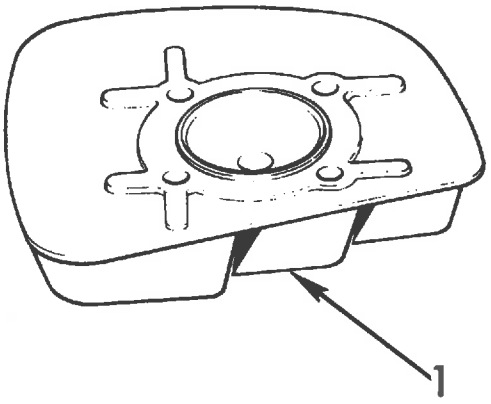
- PORTING MODIFICATIONS – The intake port [2] is lowered so that the port opens earlier and stays open longer. The exhaust and transfer ports [3] are raised so that the ports open earlier and stay open longer. The port passages are polished to decrease resistance to flow of gases. Page 1-10.

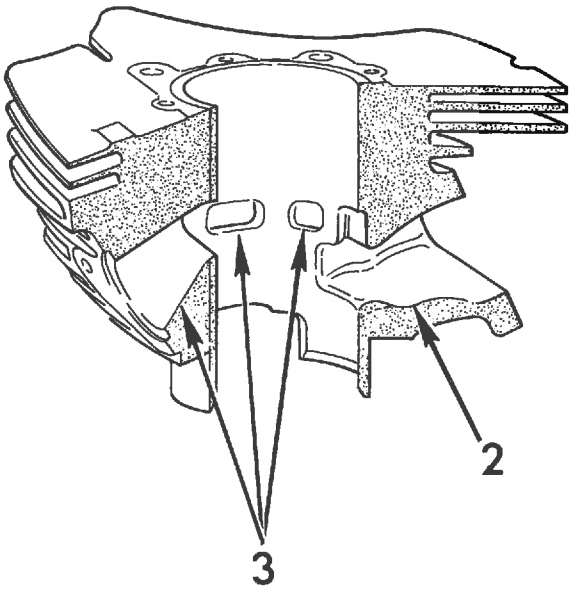
- The time that the port is open or closed is called port timing. When the port opens earlier than stock, this condition is called early port timing. Stock port opening is called late port timing.

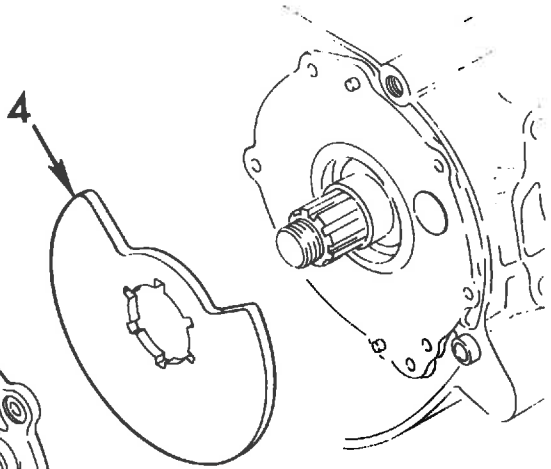
- PISTON MODIFICATIONS – A convenient way to make slight changes to port timing is to modify the top of the piston [5]. Page 1-15.

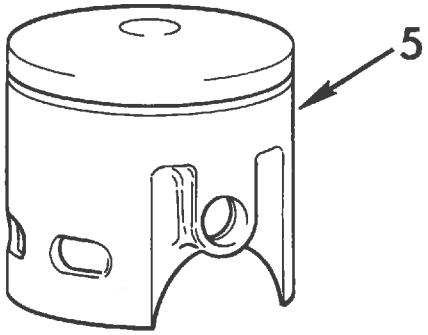
- Piston ring gap must be located between the rear transfer port and rear boost port. If the ports have been widened, ring gap may need to be relocated. Page 1-16.

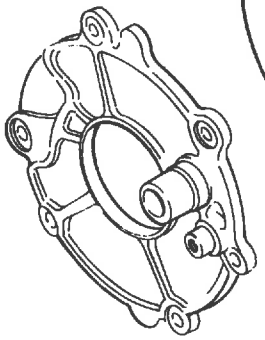
- ROTARY VALVE MODIFICATIONS – The rotary valve [4] may be modified so that the intake port opens earlier and stays open longer. Page 1-17.









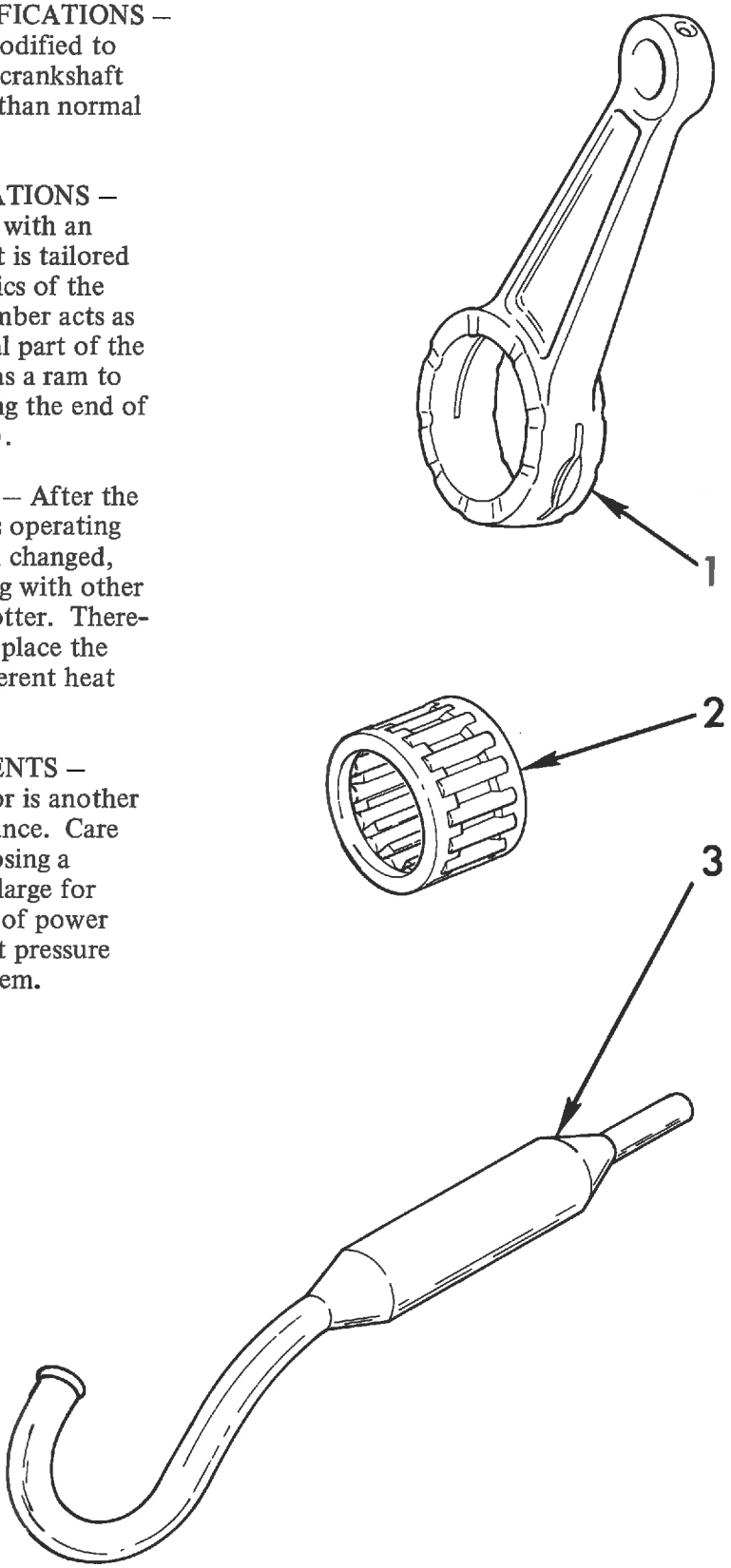


- CONNECTING ROD MODIFICATIONS – The connecting rod [1] is modified to allow the bearing [2] at the crankshaft end to be exposed to better than normal lubrication. Page 1-18.

- EXHAUST PIPE MODIFICATIONS – The exhaust pipe is replaced with an Expansion Chamber [3] that is tailored to the breathing characteristics of the engine. The Expansion Chamber acts as an extractor during the initial part of the exhaust cycle, and also acts as a ram to boost cylinder pressure during the end of the exhaust cycle. Page 1-20.

- SPARK PLUG SELECTION – After the engine has been modified, its operating characteristics will have been changed, as should be expected. Along with other things, the engine will run hotter. Therefore it will be necessary to replace the spark plug with one of a different heat range. Page 1-22.

- CARBURETOR ADJUSTMENTS – A larger than stock carburetor is another source of improved performance. Care must be exercised when choosing a carburetor. If venturi is too large for your engine application, loss of power may result due to insufficient pressure changes in the induction system. Page 1-24.



USING A DEGREE WHEEL

When making some of the modifications described in this book, you will need an accurate reference for piston position from Top Dead Center. A degree wheel provides an easy and accurate reference.

1. Assemble connecting rod, crankshaft, piston and cylinder to crankcase. Install piston stop [1] at top of cylinder.

2. Attach degree wheel [3] to crankshaft. Attach pointer [2] to crankcase. The pointer provides a fixed reference point and therefore must be attached so that it will not be moved accidentally.

3. Turn crankshaft until piston touches piston stop.

4. While holding piston against piston stop, turn degree wheel until pointer aligns with 0 degree mark [B].

5. Turn crankshaft in opposite direction until piston again touches piston stop. Record reading on degree wheel [C].

Reading on degree wheel is twice the angular distance of the piston from Top Dead Center ($X1^{o}$ Before TDC + $X2^{o}$ After TDC).

6. While holding piston against piston stop, turn degree wheel until pointer aligns with one half of recorded reading [A].

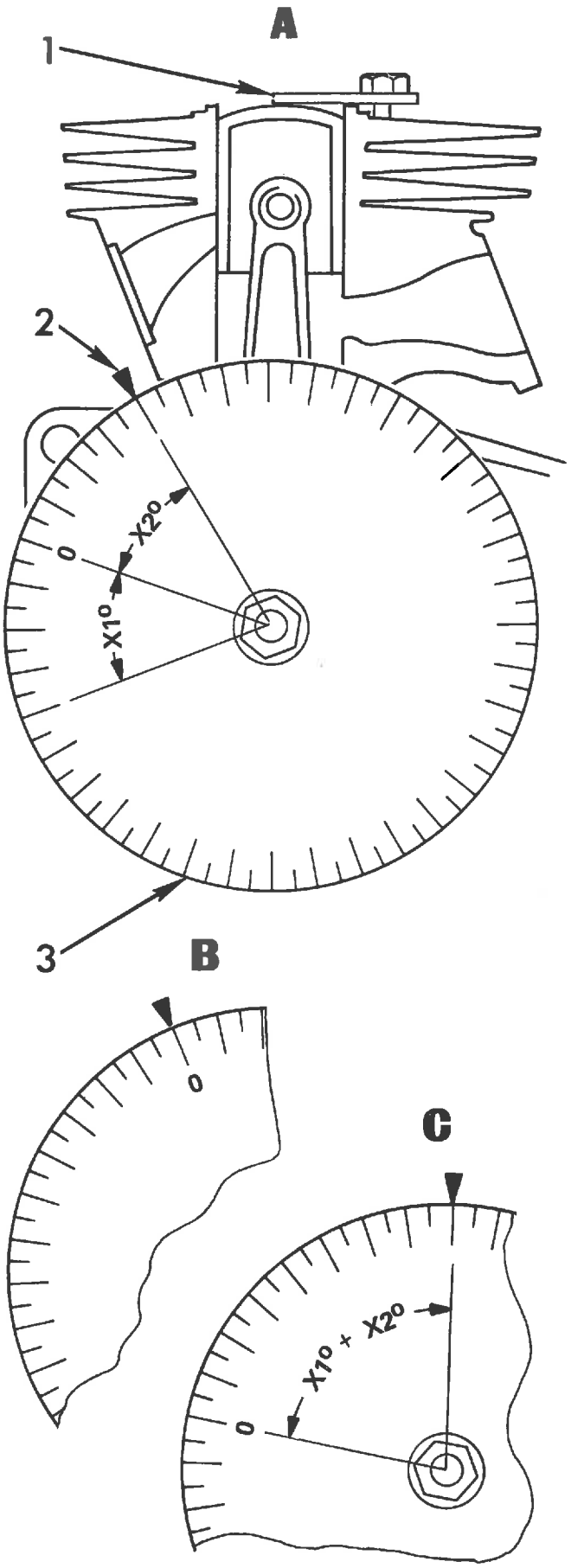
7. Turn crankshaft in opposite direction until piston touches piston stop. Check that reading on degree wheel is the same as in Step 6 ($X1^{o} = X2^{o}$).

If reading on degree wheel is the same ($X1^{o} = X2^{o}$), go to Step 9.

8. Turn degree wheel until pointer aligns with one half of difference between $X1^{o}$ and $X2^{o}$. Repeat Step 7.

9. Remove piston stop.

You now have an accurate reference for piston position from Top Dead Center. When crankshaft is turned so that pointer is aligned with 0^{o} mark on degree wheel, piston is at TDC.



TIPS FOR CUTTING PARTS

Many of the modifications discussed in this book require reworking a stock part or dimension to a different shape or size.

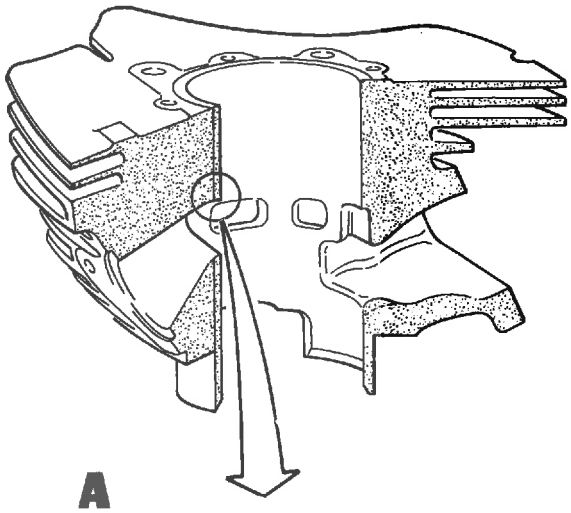
Cutting and grinding tools of various kinds are used to perform rework modifications. A word about tools and techniques:

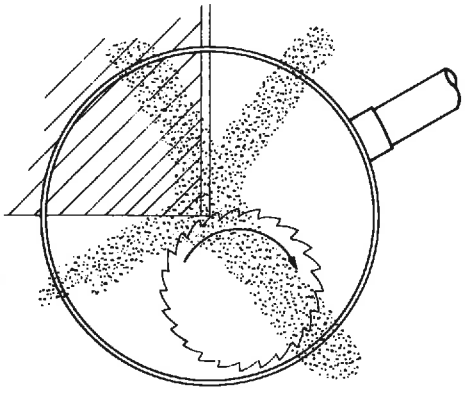
- Before you start, decide what type of work you want to do. Refer to the Specification Section for modifications applied to your engine.
- Cover area to be worked with machinist dye. Using a sharp scribe, mark the desired new shape according to the Specification Section applying to your engine.
- A variety of cutting tools will be required depending on the kind and amount of material to be removed, access to the area from which material is to be removed, etc.

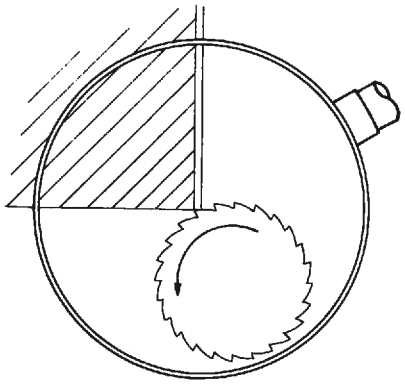
WARNING

In all cases, use your safety glasses.

- When modifying iron parts, a carbide burr works best. Be sure to use generous amounts of lubricant to keep tool and part cool and to carry away chips.
- When modifying aluminum parts, no special cutting tips will be required. Cutting tips should be kept sharp and well lubricated to prevent clogging.
- Very soft material can clog a grinding tool. A grinding tool that is clogged will be out of balance and may disintegrate at high speed.
- When cutting plated material, be sure to cut in the direction toward the plating [B]. Cutting against the direction of the plating [A] may weaken the bond between plating and parent material. To prevent this, always make cut across plated area into underlying material.
- Work slowly and carefully. Work in stages. Remove a small amount of material at a time, measure frequently until you reach the desired dimension.
- Hold tool firmly. A slip may destroy the part or cause rework of an area that should not be modified.
- Use cutting tools that are sharp. Use a high speed motor of good quality that will be able to handle a heavy load.







CYLINDER HEAD MODIFICATIONS

Following tools and supplies will be required to modify the cylinder head:

Measuring beaker or Burette – graduated in cc
Sheet of thick, clear plastic
Solvent
Molding clay

Cylinder heads can provide an additional source of power. Decreasing cylinder head volume will increase compression and horsepower.

If piston or ports have been modified the cylinder head may be modified to make adjustment for compression ratio change.

Excessively high compression will cause the engine to overheat and burn the piston or spark plug.

Small displacement cylinders can have as high as 12 to 1 ratios, although the best performance will be obtained from a ratio of 8.0 to 1.

Large displacement cylinders such as 250cc singles can only use high compression for very short bursts of power. Prolonged use at high power setting will rapidly increase operating temperature and damage engine. The best ratio for large displacement cylinders is 7.0 – 7.5 to 1.

CYLINDER HEAD MODIFICATIONS

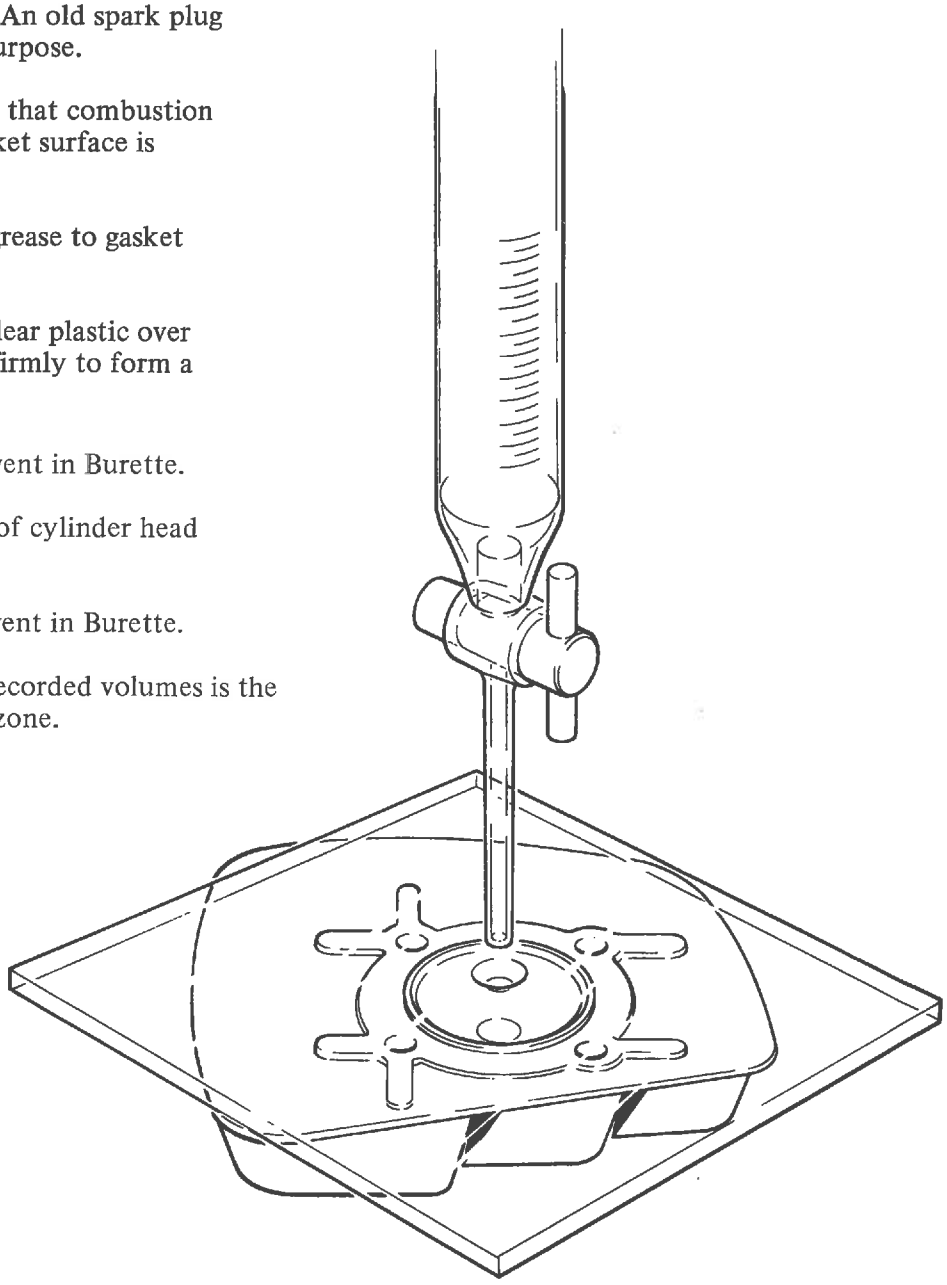
Measuring Cylinder Head Volume.

When modifying cylinder heads, you may need to measure the volume of the combustion zone, depending on size of engine.

To measure the volume of the combustion zone, replace the air in the combustion zone with solvent, then measure the volume of solvent used. There are several ways to do this. Our shop uses a Burette to fill the combustion zone through a hole drilled in a plastic sheet.

1. Plug spark plug hole. An old spark plug can be used for this purpose.
2. Place cylinder head so that combustion zone faces up and gasket surface is horizontal.
3. Apply a light film of grease to gasket surface.
4. Place sheet of thick, clear plastic over gasket surface. Press firmly to form a watertight seal.
5. Record volume of solvent in Burette.
6. Fill combustion zone of cylinder head with solvent.
7. Record volume of solvent in Burette.

The difference in the two recorded volumes is the volume of the combustion zone.



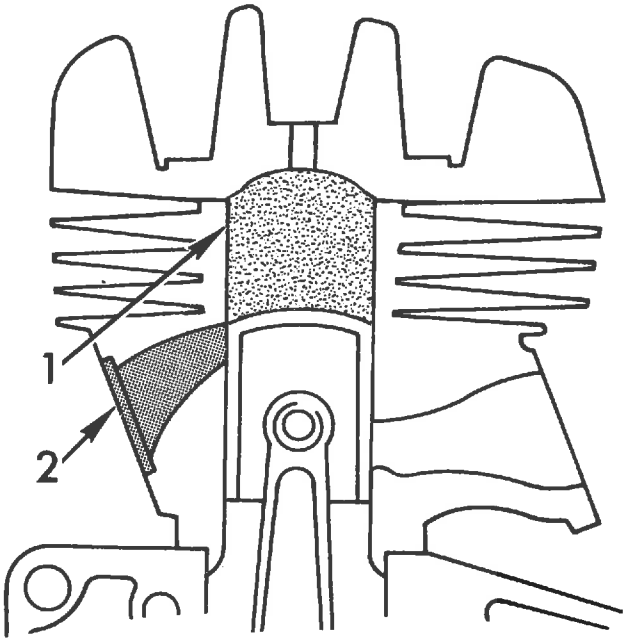
CYLINDER HEAD MODIFICATIONS

Measuring Compression Ratio.

Before modifying the cylinder head, you must know the exact compression ratio of the engine. Remember, if the exhaust port has been modified, the compression ratio has been lowered or decreased.

To find engine compression ratio:

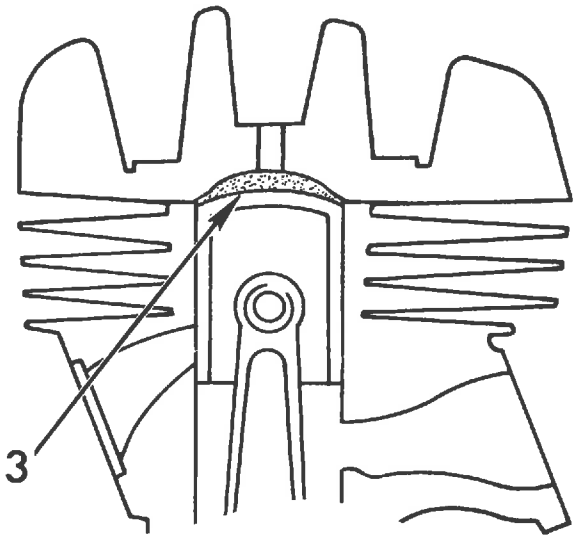
1. With the engine assembled, turn crankshaft until piston just closes exhaust port [2].
2. Using beaker or Burette, fill cylinder with solvent through spark plug hole. Measure and record volume [1] of solvent.
3. Drain solvent from cylinder.
4. Turn crankshaft until piston is at Top Dead Center.
5. Using beaker or Burette, fill cylinder with solvent through spark plug hole. Measure and record volume [3] of solvent.
6. Drain solvent from cylinder.
7. To find compression ratio divide volume [1] by volume [3].

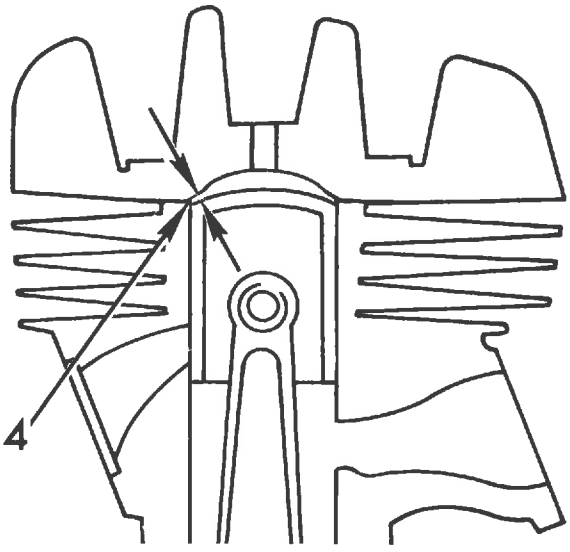


Measuring Piston to Head Clearance.

Before modifying the cylinder head, the minimum clearance [4] between top of piston and cylinder head must be measured. This clearance must be maintained after head is modified.

1. Attach a strip of molding clay to top of piston.
2. Install cylinder head.
3. Turn crankshaft until piston at TDC.
4. Remove cylinder head.
5. Measure thickness of clay.





CYLINDER HEAD MODIFICATIONS

Modifying Cylinder Head.

1. Measure compression ratio. Page 1-8.

NOTE

Before modifying cylinder head, the minimum distance between top of piston and cylinder head must be measured. This minimum distance must be maintained after head is modified.

2. Measure piston to head clearance. Page 1-8.

3. Remove approximately 0.020-inch from head-to-cylinder mating surface of cylindear head.

4. Remove material as required to maintain piston to head clearance. Page 1-8.

5. Install head. Measure compression ratio.

Repeat Steps 2 through 5 until the desired compression ratio is obtained.

Be sure to remove molding clay and clean all parts before assembling engine.

PORTING MODIFICATIONS

Following tools and supplies will be required to modify the ports in the cylinder:

High speed motor

An assortment of grinding tools –

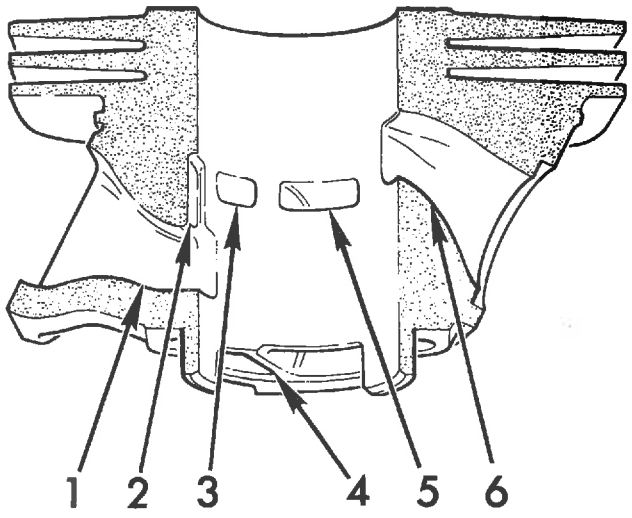
- Carbide burrs
- Cutting tips
- Rotary files
- Sanding drums

Protractor
Vise
Inside caliper
Measuring beaker (at least the size of your engine displacement) calibrated in cc
Degree wheel
Slide caliper
Machinist dye
Lubricant (for cooling grinding tools)
Sandpaper

Use port diagram pertaining to your engine in the Specification Section for port dimensions.

Each cylinder port will be modified separately and will be referred to by the following names:

- Intake Port [1]
- Rear Boost Port [2]
- Rear Transfer Port [3]
- Transfer Port Divider [4]
- Main Transfer Port [5]
- Exhaust Port [6]



PORTING MODIFICATIONS

The width of the ports may be measured in degrees as follows:

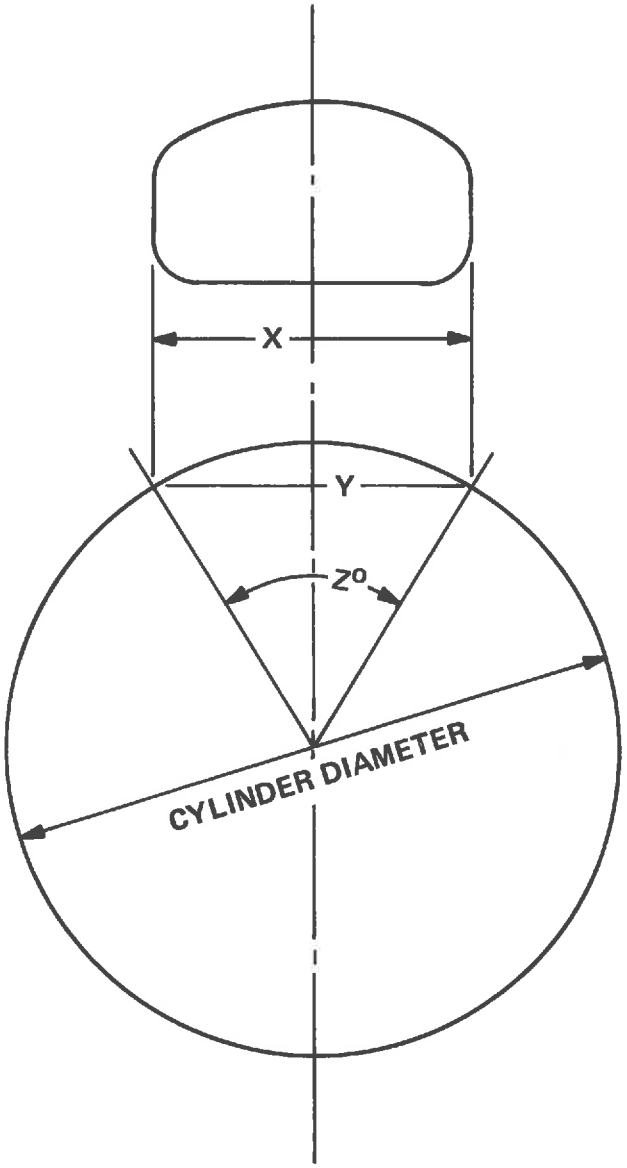
1. Draw a circle the same diameter as your cylinder.

2. Using inside calipers, measure width [X] of the port.

3. Mark a chord [Y] across the circle. The length of chord [Y] is to be the same as the width [X] of the port.

4. From the two points on the circle where the chord meets the circumference, draw lines to the center of the circle.

5. Using a protractor, measure angle [Z] between two lines. This angle is the port width in degrees.

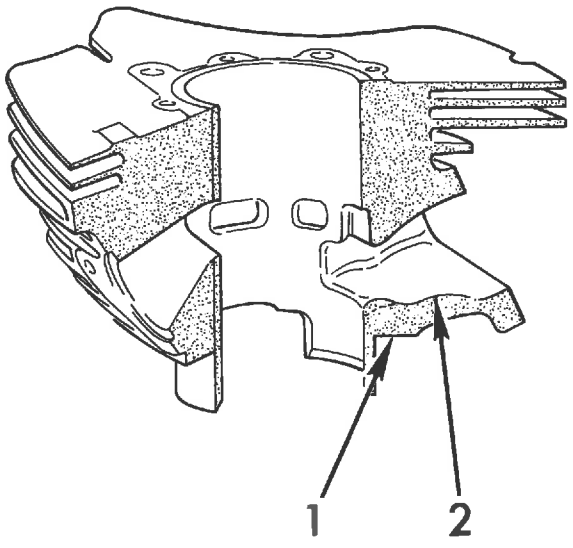


PORTING MODIFICATIONS

Modifying Intake Port.

When modifying intake port [2]:

- Casting irregularities such as ridges, steps, lips, etc., should be removed from the intake port to provide smooth, uninterrupted flow of intake gases.
- Modification of intake port will require widening and lowering of the port.
- When lowering the intake port, be careful not to let the bottom of port go below the cylinder-to-case mating surface [1].
- Cylinders less than 70mm in diameter are considered to be small cylinders. Cylinders more than 70mm in diameter are considered to be large cylinders.
- When modifying intake port on small cylinders, port may be widened as far as 80^{o} to 85^{o} without detrimental effect to piston, ring or port.
- When modifying intake port on larger cylinders, port width of more than 80^{o} will have detrimental effect on piston, ring and port. Port width of 75^{o} to 80^{o} works best on larger volume cylinders.

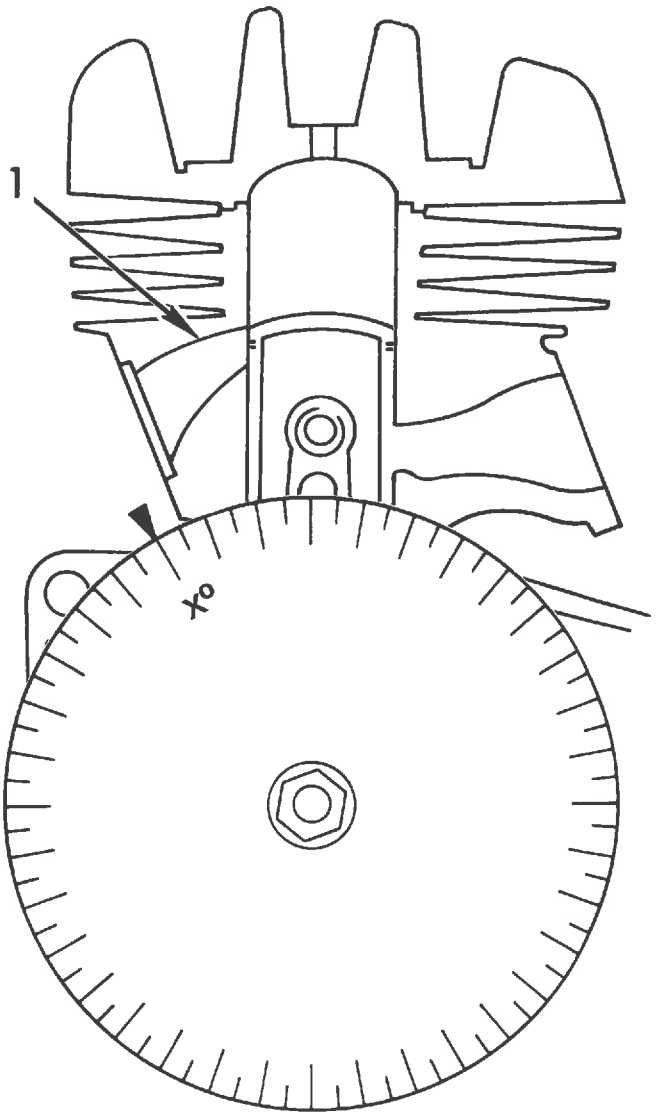


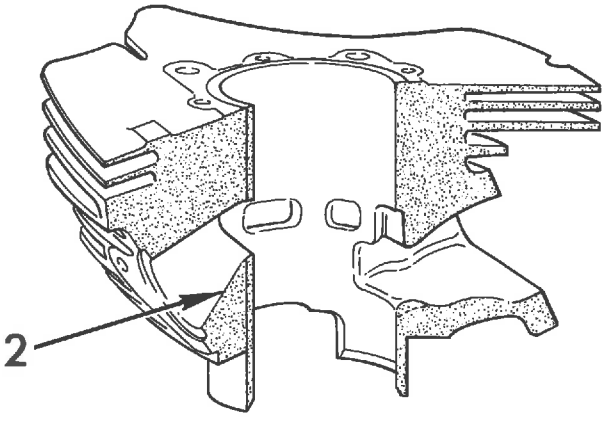
PORTING MODIFICATIONS

Modifying Exhaust Port.

Modifying exhaust port [1]:

- Width of the exhaust port should be close to the width of the intake port. (i.e., 75° to 80° for large cylinders, 80° to 85° for small cylinders.)
- Bottom of port should be even with top of piston when piston is BDC.
- For low speed running, an exhaust port timing of 105° gives good results, as with JT1 Mini Enduro.
- For high speed running, an exhaust port timing of 81° gives good results, as with TR 2-B Road Racer.
- Casting irregularities such as ridges, steps, lips, etc., should be removed from the exhaust port passage [2] to provide smooth, uninterrupted flow of exhaust gases.
- Irregularities should also be removed from from exhaust pipe mating surface so that gas flow from the exhaust passage to the exhaust pipe is smooth and uninterrupted.
- A light polish of the exhaust passage will help keep carbon buildup at a minimum, but will not increase power.



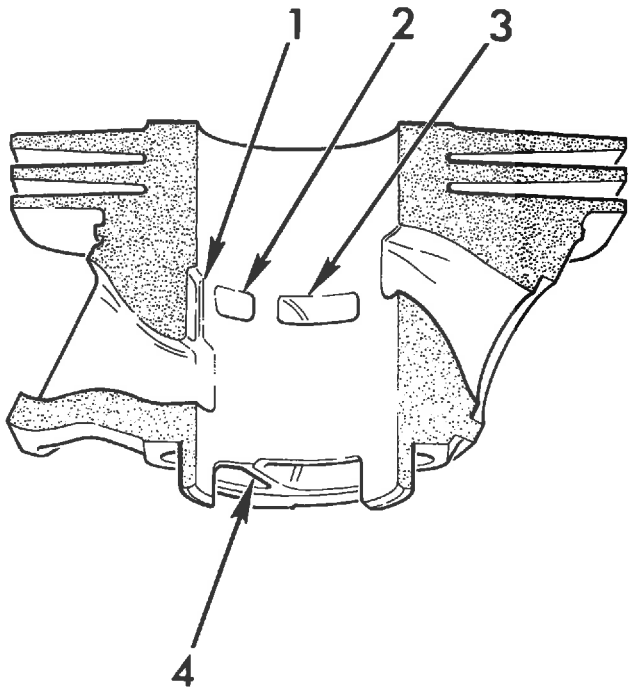


PORTING MODIFICATIONS

Modifying Transfer and Boost Ports.

When modifying the main transfer [3] and rear transfer [2] ports:

- Casting irregularities such as ridges, steps, lips, etc., should be removed from transfer passages [2,3] to provide smooth, uninterrupted flow of gases.
- The shape and direction of the transfer ports is important. If modifying these ports will alter the direction of the porting, it is best NOT to modify these ports.
- The main transfer port [3] can be raised slightly and, in some cases, widened a little.
- Depending on engine size, the rear transfer port [2] will be raised, widened, and – in some cases – lowered a little.



When modifying transfer port dividers [4]:

- The transfer port divider may be reworked, but must not be removed.
- The flat area of the divider that faces the incoming fuel/air flow offers poor shape for good flow of gases.
- The flat area may be reworked to a pointed ridge or wedge shape to decrease resistance to flow of gases.

When modifying the rear boost port [1]:

- Casting irregularities such as ridges, steps, lips, etc., should be removed from the boost port [1] to provide smooth, uninterrupted flow of gases.
- Boost port [1] can be raised to the height of the rear transfer ports [2].
- When widening boost port [1], be sure to leave at least 8mm between the boost port and the transfer port [2] next to it. If boost port is widened too much, it will be necessary to alter the piston to relocate the ring gap. Page 1-16.

PISTON MODIFICATIONS

Following tools and supplies will be required to modify pistons:

Vernier caliper
Hack saw
File
Sandpaper
Machinist dye

A convenient way to make slight changes to port timing is to modify the top of the piston.

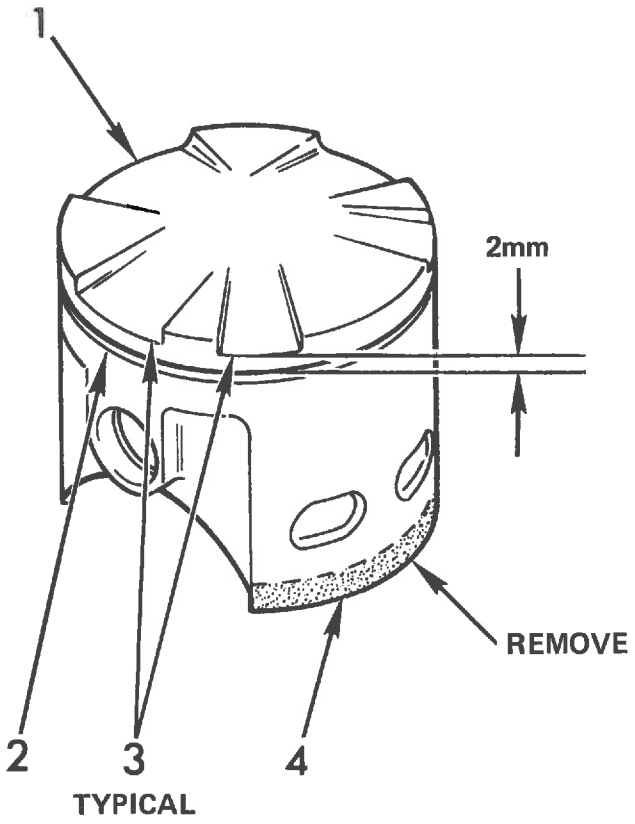
The area on top of the piston next to the exhaust port [1] or transfer ports [3] may be cut so that exhaust or transfer ports will open earlier and stay open longer.

Do not cut piston closer than 2mm to ring groove [2].

The piston skirt [4] may be shortened so that intake port will open earlier and stay open longer.

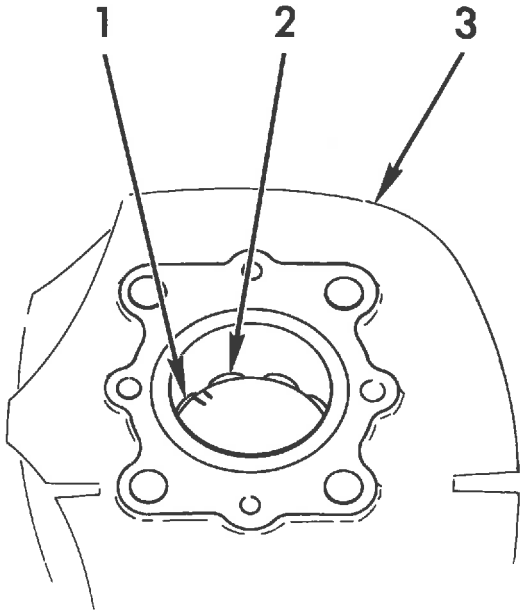
When shortening piston skirt, care must be taken not to cut off too much since this will cause piston to rock in the cylinder causing damage to piston and cylinder.

Use piston diagram pertaining to your engine in Specification Section for piston dimensions.



PISTON MODIFICATIONS

Piston ring gap must be located between rear transfer port [2] and rear boost port [1]. If rear boost port has been widened, piston ring gap may need to be relocated.



1. Using felt pen, mark top of piston [4] in line with pin [6].

2. Temporarily place piston, without ring, on rod. Temporarily place cylinder [3] at installed position.

3. Check that mark [4] is located between rear transfer port [2] and rear boost port [1].

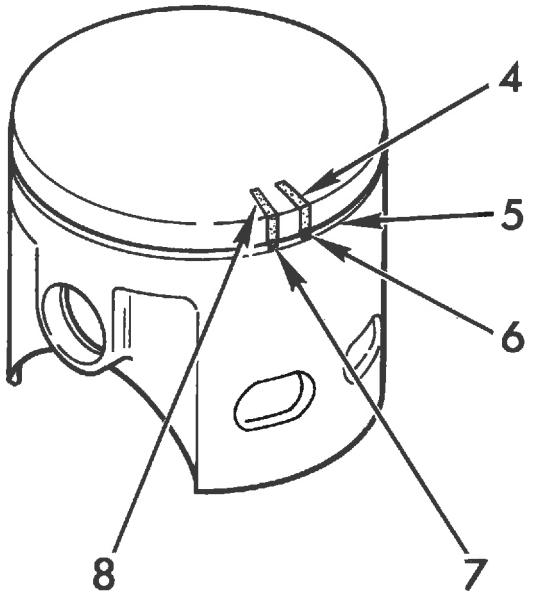
If mark is located between rear transfer port and rear boost port, ring gap need not be relocated. Omit Steps 4 through 9.

4. Make another mark [8] on top of piston.

5. Remove cylinder and piston.

6. Mark upper edge of ring groove [5] in line with new mark [8].

7. Fill ring groove with soft material (aluminum, brass, etc.) to aid in drilling new pin hole.



Be sure that pin [7] is installed tightly to prevent ring gap from moving around in cylinder bore and damaging cylinder and piston.

8. Drill a hole for press-fit at new mark on edge of ring land. Press in new pin [7].

9. Press in old pin [6] until it is flush with bottom of ring land.

ROTARY VALVE MODIFICATIONS

Following tools will be required to modify rotary valve:

Hack saw
File
Bench grinder

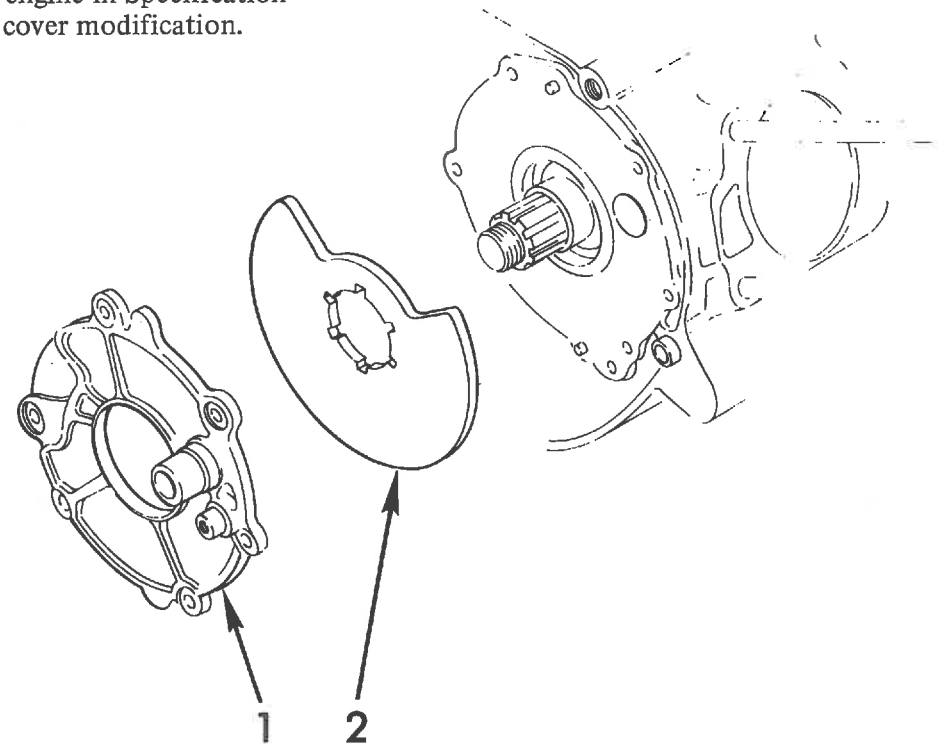
Rotary valve modifications will permit engine power to start at a high rpm and extend to a higher power peak.

The rotary valve [2] is made out of a fiber type material and installed only in a few models.

Rotary valves can easily be modified using a bench grinder, hack saw or file. It is best to remove a little of the material at a time and make performance checks so that timing can be tailored to your needs.

Use rotary valve diagram pertaining to your engine in Specification Section for rotary valve dimensions.

If larger carburetor is to be used, rotary valve cover [1] must be modified. Use detail instructions pertaining to your engine in Specification Section for rotary valve cover modification.



CONNECTING ROD MODIFICATIONS

Following tools and supplies will be required to modify connecting rods:

Dial indicator
High speed motor
Fiber wheel cutting discs
Vernier caliper
Feeler gauge – 0.5mm
Sandpaper (various grades)
Lubricating oil (lubricant-coolant)

Connecting rods [1] should be modified to improve oil flow to crankshaft end of connecting rod.

1. Remove connecting rods and bearings as per service manual.

2. Place rod in vise.

CAUTION

Be sure to use sufficient amount of lubricating oil while cutting slots in rod to prevent overheating and excessive wear of cutting disc and connecting rod.

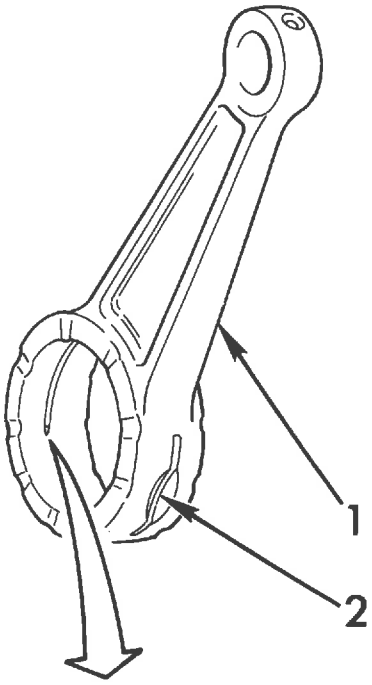
Connecting rods are very hard and will probably wear out more than one cutting disc.

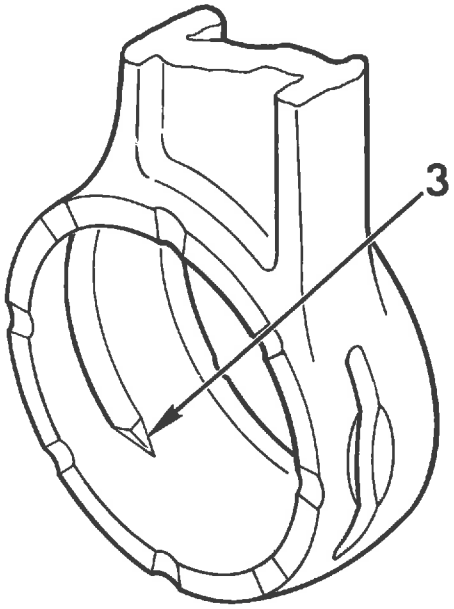
3. Holding a high speed motor with cutting disc in both hands, carefully cut one slot [2] on each side of big end of rod, approximately 2mm wide and 10 to 14mm long.

It is also recommended to make an inside cut into the finished slot. This cut should be very light to clean up slot and remove burrs.

4. Using high speed motor with cutting disc, cut two small oil grooves [3] on inside of rod.

5. Remove rod from vise. Clean rod with solvent.





CONNECTING ROD MODIFICATIONS

Stock rod bearings are copper in color. High speed bearings are silver in color. High speed bearings should be used on a crank assembly for high stress loads.

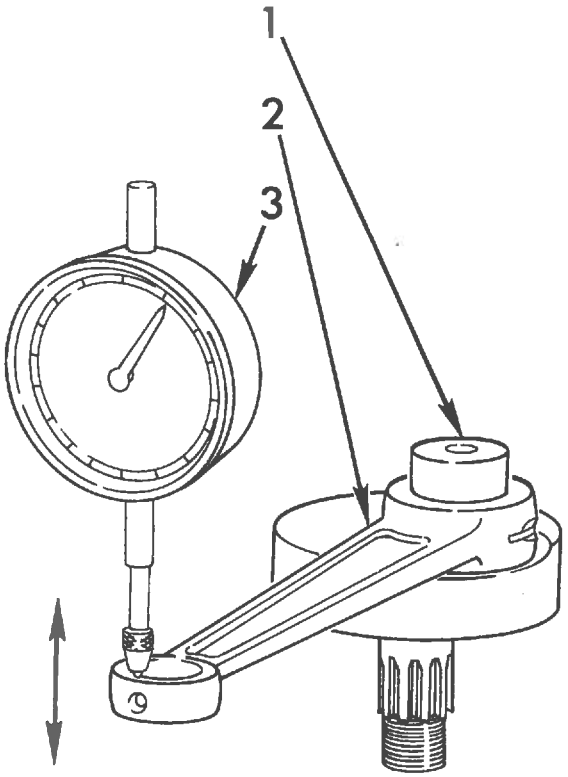
Both copper and silver rod bearings will sometimes share the same part number, so it is best to check the bearing for proper color as well as number.

1. Install high speed bearing on rod as per service manual.

2. Assemble connecting rod [2] on crankpin [1] as per service manual. DO NOT PRESS UNITS TOGETHER!

If modifying single cylinder engine less than 125cc or two cylinder engine less than 200cc displacement, rod end play check will not be necessary. Go to Step 5.

In next step, dial indicator [3] may be used to measure rod end play.



3. Place crankshaft in vise. Move end of rod up and down. Check that end play is not less than 0.8mm.

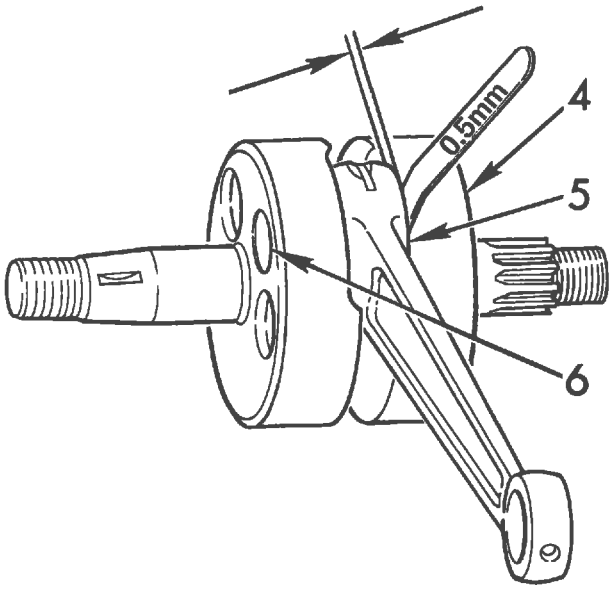
If rod end play is less than 0.8mm, go to Step 4.

If rod end play is not less than 0.8mm, go to Step 5.

4. Remove rod from crankshaft. Lightly hone crankshaft end of rod. Repeat Steps 1, 2, and 3.

5. Assemble crankshaft as per service manual.

6. Measure side play of connecting rod by placing feeler gauge between crankshaft end of rod [5] and crank wheel [4]. Check that side play clearance is 0.5mm.



If side play clearance is less than 0.5mm, go to Step 7.

If side play clearance is more than 0.5mm, go to Step 8.

7. Apply slight pressure to crank pin [6] until proper side play clearance is obtained.

8. Apply slight pressure to crank wheel [4] until proper side play clearance is obtained.

EXPANSION CHAMBERS

Following tools and supplies will be required to construct an expansion chamber:

Welding equipment (including welding rod)
Cones

Making an expansion chamber [1] is not easy, since each expansion chamber is custom made and carefully fitted to the Yamaha motorcycle. Therefore, the shape and size of each expansion chamber will be different for each Yamaha model.

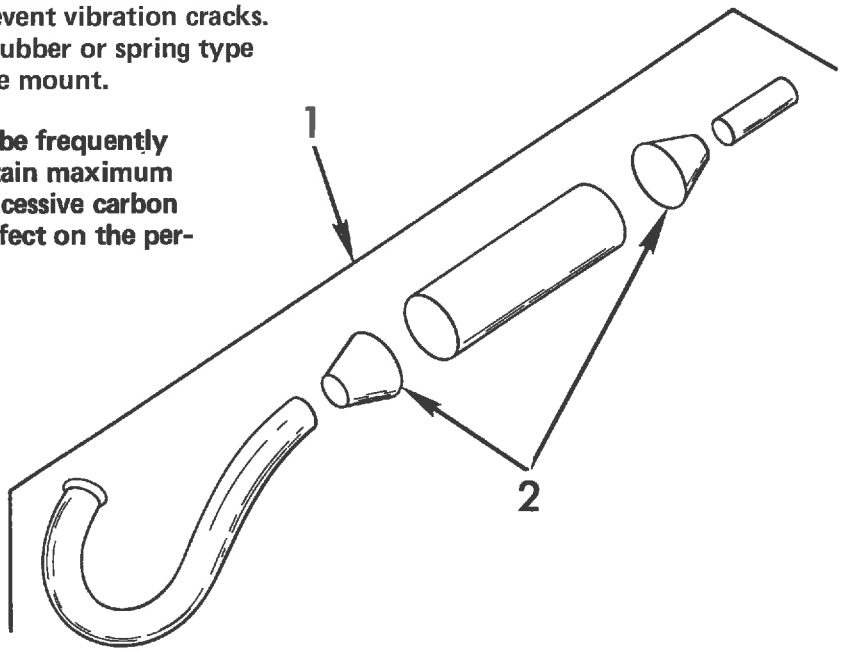
Each expansion chamber is made up of cones [2] in various shapes and sizes. It is best to have these cones custom made to Yamaha's specification.

Use expansion chamber diagram pertaining to your engine in Specification Section for dimension.

CAUTION

When installing expansion chambers, a flexible mount should be used to prevent vibration cracks. It is recommended to use a rubber or spring type mount instead of a solid type mount.

Expansion chambers should be frequently inspected and cleaned to obtain maximum performance from pipes. Excessive carbon build-up will have adverse affect on the performance of your engine.



EXPANSION CHAMBERS

There are a few general theories on the shapes of expansion chambers:

- For low end torque, large volume expansion chambers are best. Large diameter stingers [1] will decrease back pressure and will perform better at low rpm. Expansion chamber with this type of stinger is called a torque pipe.

- For high rpm peak power, small volume expansion chambers are best. Small diameter stingers and short head pipes [2] should also be used.

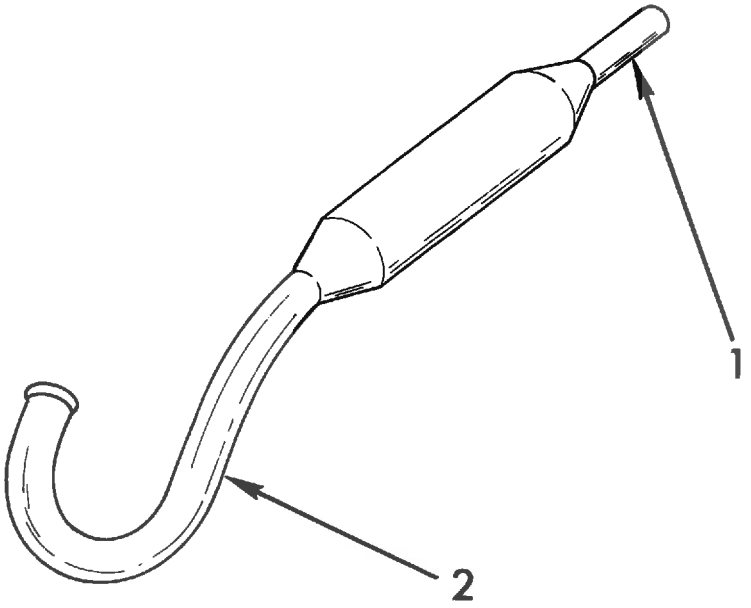
When using expansion chambers, remember these important items:

- The expansion chamber is matched with the breathing characteristics of the engine.

- Use torque pipe with late port timing.

- Use small volume expansion chamber with early port timing.

- Mismatching expansion chamber and port timing will result in poor engine performance.



SPARK PLUG SELECTION

The spark plug has the following functions:

- Igniting the mixture in the combustion chamber.
- Retaining enough heat to keep itself clean.
- Transmitting excess heat to outside the engine.

Many performance problems may be caused by using a spark plug of the wrong heat range.

A cold spark plug is one with a short temperature path.

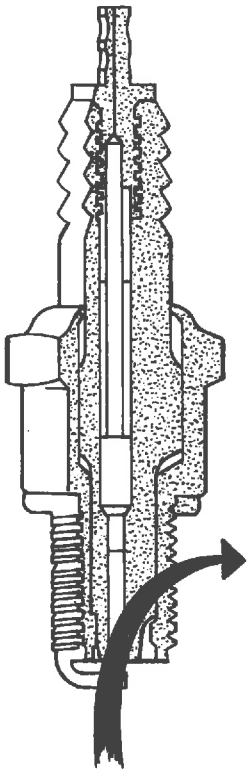
A hot spark plug is one with a long temperature path.

A spark plug that is too cold for your engine will foul with carbon build-up resulting in:

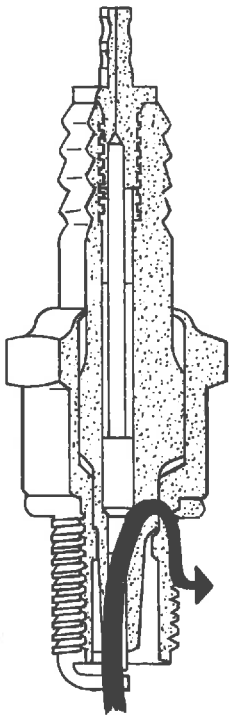
- Misfiring.
- No spark if build-up is too heavy.

A spark plug that is too hot for your engine will cause:

- Burning and/or blistering of spark plug.
- Erosion of electrodes of spark plug.
- Possible burning of piston crown.



COLD TYPE



HOT TYPE

SPARK PLUG SELECTION

As a general rule, a hot spark plug is used for low speed riding, a cold spark plug is used for high speed riding.

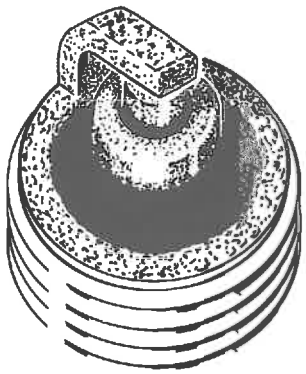
To select the right type spark plug for your engine, check the color and condition of the spark plug that you removed.

- If tip of plug is covered with black or greasy deposits, plug is too cold. Install hotter plug.
- If tip of plug is burned or blistered, or if wear on electrodes is high, plug is too hot. Install colder plug.
- If there are light deposits on the tip of plug and white porcelain is tinted light brown or orange, plug is of proper heat range.

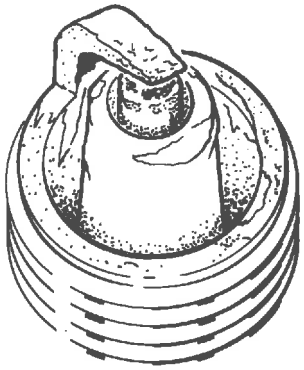
There are many acceptable colors, depending on the heat range of the spark plug. Check a good spark plug chart for different acceptable colorations.

Check a good spark plug chart for selection of the proper heat range spark plug for your application.

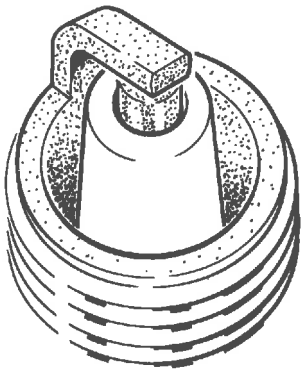
Also, check the color of the deposits in your exhaust pipe. Spark plug and exhaust pipe deposits are an indication of carburetor adjustment. Be sure carburetor is properly adjusted.



TOO COLD



TOO HOT



NORMAL

CARBURETOR ADJUSTMENTS

Carburetor adjustments are important to the performance of your engine. These adjustments are made to correct two problems:

- Fuel/air mixture too rich.
- Fuel/air mixture too lean.

If mixture is too rich, there is too much gasoline for the amount of air being drawn into the engine. Rich mixture will result in:

- Poor acceleration
- Misfire
- Smoky exhaust
- "Flat feeling" of engine (no power)
- Very deep exhaust tone
- Fouling of spark plug with carbon

If mixture is too lean, there is not enough gasoline for the amount of air being drawn into the engine. Lean mixture will result in:

- "Pinging" or "rattling" noise in engine
- Erratic acceleration
- Engine acting as though it were running out of gas
- Engine running hot which, in turn, causes rapid spark plug wear and possible engine damage due to high operating temperature.

CARBURETOR ADJUSTMENTS

Mixture adjustments are made by changing size or adjustment of various metering devices. Different operating ranges require adjustments to different metering devices.

If adjustment is required in the 3/4 to full throttle operating range, the main jet [6] should be changed.

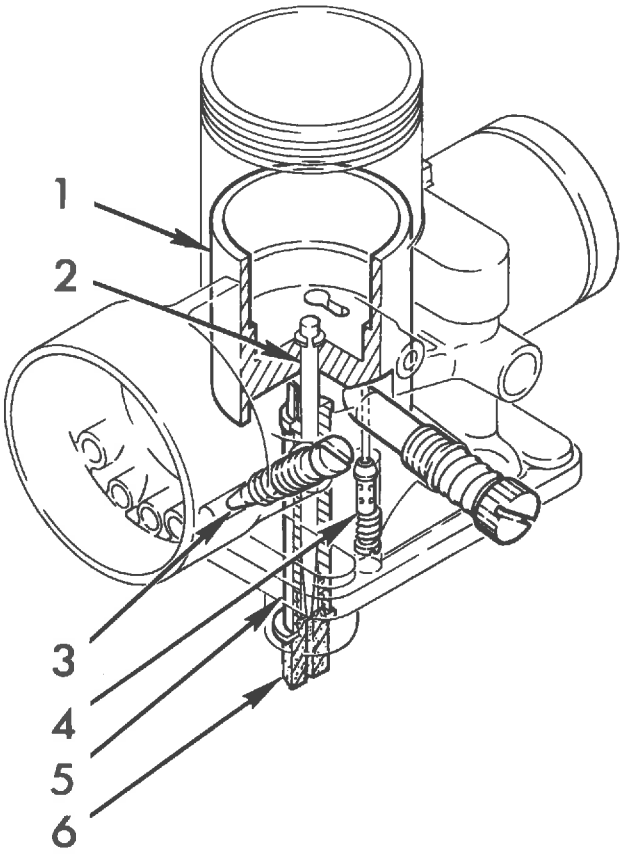
Adjustment in the 1/8 to 3/4 throttle range is accomplished in two phases. Mixture adjustments in the 1/4 to 3/4 throttle range are controlled with the needle jet [5]/jet needle [2] combination. Mixture adjustments in the 1/8 to 1/2 throttle range are controlled by the throttle slide [1].

If adjustment is required in the 0 to 1/8 throttle range, the pilot jet [4] or air screw [3] should be adjusted.

Often, these adjustment devices work together. An adjustment change to one device may require an adjustment change of another device.

Adjust carburetor in steps:

1. Make adjustment as required for 3/4 to full throttle range. Page 1-26.
2. Make adjustments as required for 1/4 to 3/4 throttle range. Page 1-27.
3. Make adjustment as required for 1/8 to 1/2 throttle range. Page 1-28.
4. Make adjustments as required for 0 to 1/8 throttle range. Page 1-29.



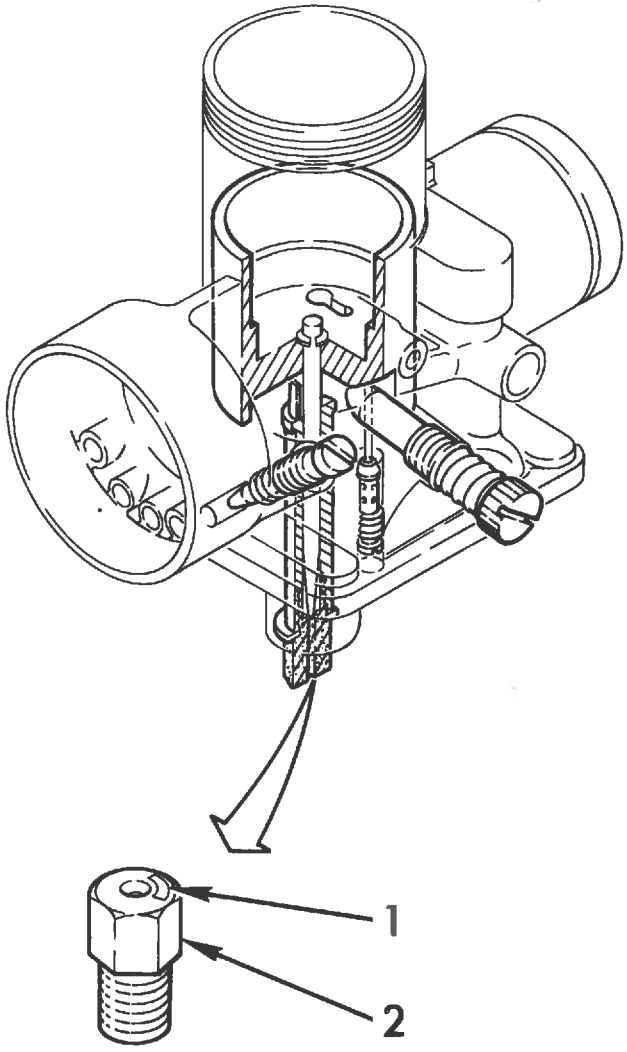
CARBURETOR ADJUSTMENTS

To make adjustments in the 3/4 to full throttle range, remove the main jet [2] and replace it with one of another size.

The main jet is stamped with a two or three digit number [1]. This number refers to the size of the hole in the jet.

- As number becomes larger, the hole size becomes larger, and the mixture becomes richer.
- As the number becomes smaller, the hole size becomes smaller, and the mixture becomes leaner.

Change main jet sizes in steps, or a little change at a time, until desired results are obtained in the 3/4 to full throttle range.



CARBURETOR ADJUSTMENTS

Mixture in the 1/4 to 3/4 throttle position is partially controlled by the jet needle [2]. Often, a change in the position of the circlip [1] will result in the desired performance change.

The needle has five circlip grooves at its upper end. These grooves help determine the needle positions for obtaining a richer or leaner mixture, as follows:

- Moving circlip to the next lower groove will raise the needle and expose more area of the needle jet, resulting in richer mixture.
- Moving circlip to the next higher groove will lower the needle and reduce the exposed area of the needle jet, resulting in leaner mixture.

Change circlip position one step at a time until desired results are obtained.

If desired results cannot be obtained by changing position of the circlip, the needle jet [3] may be changed.

Generally, the needle jet will not need to be changed unless larger mixture changes are desired.

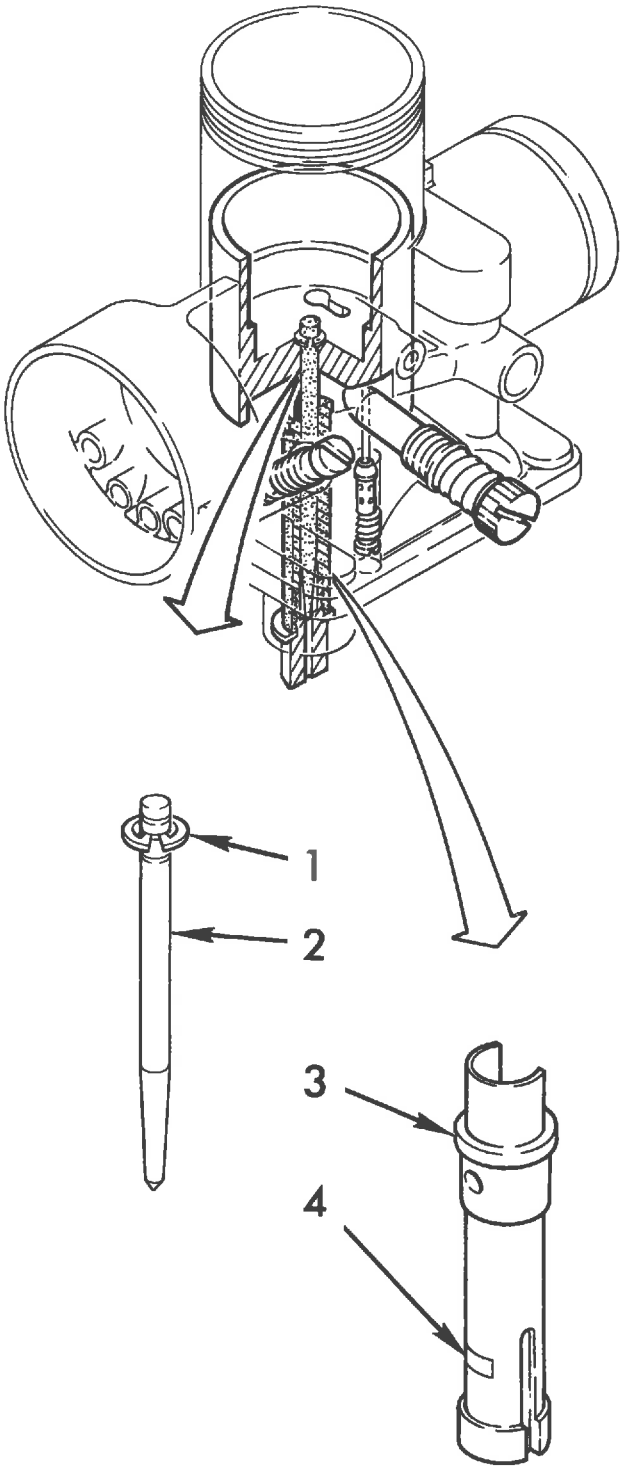
If needle jet replacement is required, check the two-digit number [4] on the side of the jet. The first digit will be a letter. The second digit will be a number.

The two-digit number reflects the size of the hole in the jet. The hole will be small for a lean mixture and large for a rich mixture.

The letters go from A (leanest) to Z (richest). The letters are graduated in ten increments (A0 - A1 - A2 - A3 . . . A9), indicating the actual jet sizes as follows:

(leanest) (richest)
A0, A1, A2 . . . A9, B0, B1 . . . Z8, Z9

Change needle jet size one step at a time. After replacing needle jet, make final adjustment using jet needle.



CARBURETOR ADJUSTMENTS

If performance in the 1/4 to 3/4 throttle position is satisfactory after adjustment of needle and needle jet, the 1/8 to 1/2 throttle position may be adjusted by replacing the throttle slide [3].

The angle of throttle slide cut away [2] will help control mixture and smooth out the performance in the low to midrange throttle position.

The angle of the cut away portion is coded with a two-digit number [1] stamped on the bottom side of the slide. The two-digit numbers will be whole or half numbers (ending in 0.0 or 0.5).

Mixture adjustment is made by:

- Using a smaller number-angle to make mixture richer
- Using a larger number-angle to make mixture leaner

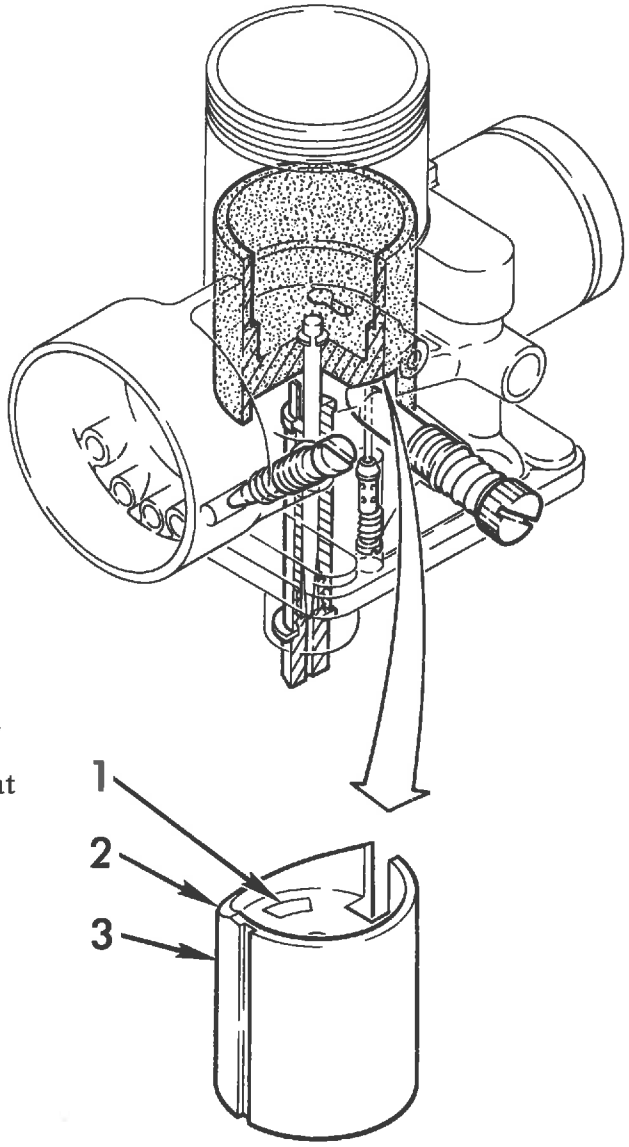
Replace throttle slide with one of a larger number if:

- Engine pick-up is slow.
- There is too much black smoke in exhaust.
- Spark plug fouls with carbon.
- Deep exhaust tone is present.

Replace throttle slide with one of a smaller number if:

- Engine seems "flat" then suddenly picks up.
- Engine seems to hesitate when accelerating at low speeds.

Change throttle slide one step at a time until desired performance change is obtained.



CARBURETOR ADJUSTMENTS

The mixture in the 0 to 1/8 throttle position is controlled by the air mixture screw [1] or the pilot jet [3].

To make the idle mixture leaner, turn air mixture screw out, one half turn at a time, until desired results are obtained.

To make the idle mixture richer, turn air mixture screw in, one half turn at a time, until desired results are obtained.

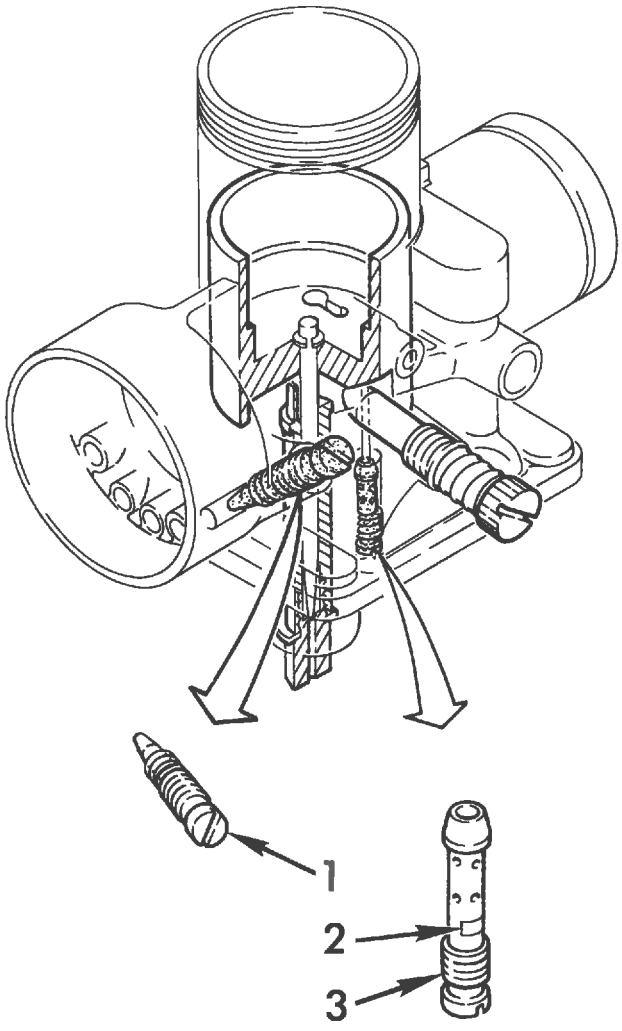
If desired results cannot be obtained by adjusting the air mixture screw, or if engine is hard to start, the pilot jet [3] should be changed.

The pilot jet [3] is stamped with a two-digit number [2]. The two-digit number will be either a whole or a half number (engine in 0.0 or 0.5).

Replace pilot jet with the next size:

- Smaller number to make mixture leaner
- Larger number to make mixture richer

Change pilot jet size one step at a time. After replacing pilot jet, make final adjustment using air mixture screw.



CARBURETOR ADJUSTMENTS

The idle speed screw [3] does not control mixture at any throttle operating range. The idle speed screw limits the closed position of the throttle and thus controls idle rpm.

Do not use the idle speed screw to correct any mixture problems in the 0 to 1/8 throttle range. Use the pilot jet [2] and air screw [1] to make mixture adjustments. Use idle speed screw to make rpm adjustments.

Adjust idle rpm by turning idle speed screw:

- In – to increase rpm
- Out – to decrease rpm

In many racing applications, idle speed is not of major concern, and the idle speed screw may be omitted. If idle speed screw is omitted, be sure to plug the screw hole.