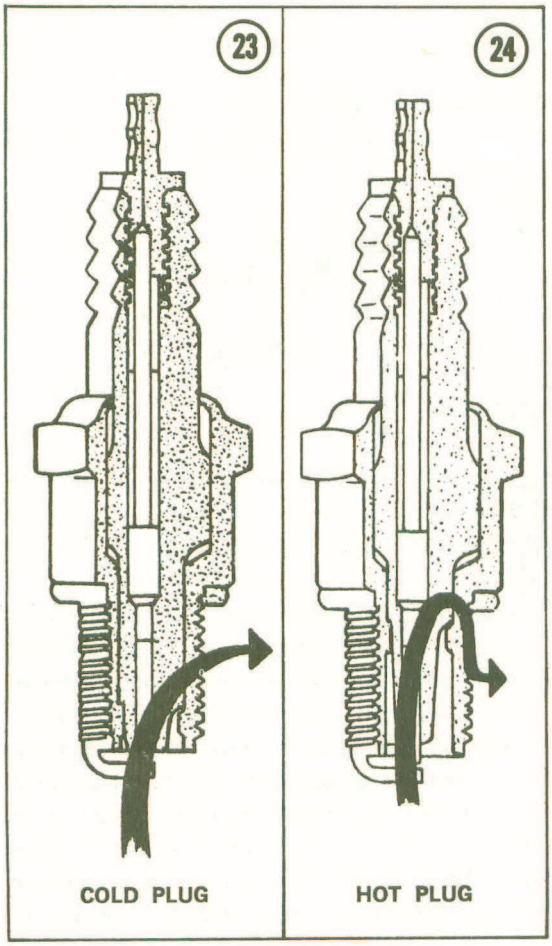


With the cylinder head off, torque each spark plug in place with a new washer. If the end projects no more than approximately 0.050 in. (1.27mm), grind the threaded end of the plug down so that it is flush with the combustion chamber wall. If the plug extends farther than 0.050 in. (1.27mm), shim it up with spacers from Champion.

CAUTION

Do not stack normal plug washers as shims or compression leaks will surely result.

Selection

To select a proper plug, conduct a plug check as follows:

1. On level ground, accelerate to top speed in third gear, pull in the clutch, and shut off the engine at the same time.
2. Stop the motorcycle with the brakes; do not let it stop under engine compression.
3. Remove the spark plug and compare its condition to the spark plug conditions illustration (page 10). This way, you will learn the accuracy of the jetting as well as the spark plug heat range.

Check the color of the deposits in the exhaust pipe. Spark plug and exhaust pipe deposits are an indication of carburetor adjustment. Be sure the carburetor is properly adjusted and that the deposits are light tan, not gray or black.

Spark Plug Wiring

Special ignition wires with silicone jackets and solid steel wire centers are available to replace the stock wire. If the stock wire is in good condition, keep it even if it is of the resistance type. If the wire shows obvious deterioration, install a new one. Old ignition wire is often a source of mysterious misfire problems.

ELECTRONIC IGNITION SYSTEMS

There are a number of special electronic ignition systems available as aftermarket equipment. The best types are transistorized or capacitive-discharge (CDI) such as the Cycle See-Dee unit.

Transistorized ignition systems use a transistor to switch the large primary current to the coil. The original breaker points switch a small transistor control current rather than the larger primary current to increase point life.

Capacitive-discharge ignition systems use transistors in a different way. Closing the breaker points activates a transistorized oscillator, which charges a capacitor to high voltage. Opening the breaker points discharges the capacitor through the ignition coil primary and an even higher secondary voltage develops to fire the plug. When the points open again, the capacitor charges for the next spark pulse.

Electronic ignition systems can increase horsepower, acceleration, and gas mileage. They can also make cold/damp weather starting easier, increase point life, and extend spark plug life.

Plug life on a modified 2-stroke engine can be very short. For this reason, a capacitive discharge ignition (CDI) used to increase plug life can be a valuable asset.

Yamaha has special competition magnetos and CDI units to fit most models. The special part number for this item is No. 314-81300-10-00 for the 125; 175 models can use the magneto and CDI from an IT 175.

FUEL SYSTEM

The stock fuel system is designed to give reasonable fuel economy, good low end torque, and fair performance over a very wide range. A number of things can be done to vastly improve performance, but fuel economy and engine flexibility may suffer.

It is impossible to evaluate any fuel system changes until the stock system is working right. The first place to start is a good engine tune-up as described in Chapter Two. Do not touch the fuel system until the ignition system works perfectly.

CARBURETOR

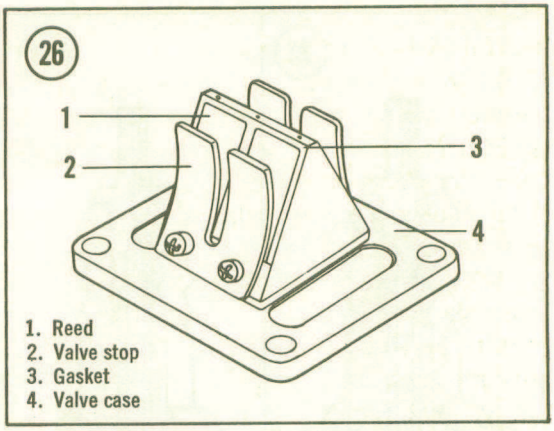
A change in carburetion can add considerable horsepower, particularly if you also install a tuned exhaust system and change port timing.

Little can be done to improve upon the performance of the stock carburetor. The flow characteristics are well-suited to the engine.

Mid-range and top-end performance can be increased slightly by switching to a larger (2-4mm) Mikuni carburetor. Modification to use a G.E.M. or Yamaha reed valve will help, too, on early models without "torque induction." A reed valve engine can accept a large carburetor with no fear of "drowning" the engine because it only admits needed fuel. See **Figure 26**.

Reed Valves

During the down stroke there is both vacuum and pressure in the intake tract at various moments, and nothing to control either. With the throttle wide open, a lot of fuel is forced back out of the carburetor. Go-Kart engines and outboard 2-strokes have used reed valves very successfully to better control vacuum and pressure in the intake tract. With the introduction of its 1972 models, Yamaha used reed valves exclusively in its Enduro line.



1. Reed
2. Valve stop
3. Gasket
4. Valve case

Kendick Engineering has a kit for converting piston port engines over to reed valve. The reed valve assembly keeps the reeds closed during the pressure moment in the big end to prevent "spitting." The only time the reeds open and act as a valve is when vacuum is produced in the big end and fuel needs to be sucked in. Wasted fuel and operational inefficiency is minimized to make the engine run much cleaner. Easier starting and more power through the entire range is the result.

The best bet is to send the cylinder along with a new piston (preferably one size over the bore diameter) to Kendick and have the experts perform the job for you. The complete conversion kit (manifold, heat shield, 33mm diaphragm carburetor, air cleaner adapter, linkage, and reed valve assembly) costs less than approximately $70 from Kendick. If you send the parts to Kendick for machining and welding, the labor cost is approximately $35 additional.

Jetting

Altitude and humidity have a marked effect on engine performance and must be compensated for with suitable jet sizes and needle position. Changes in port shape, the exhaust system, and displacement will also necessitate changes in jetting because they alter the engine's ability to breathe. Correct jetting and adjustment is

largely a matter of experience gained through careful trial-and-error tuning.

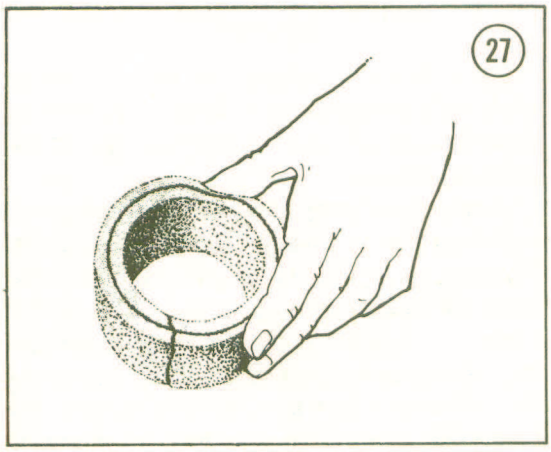
Before making any alterations in jetting or needle position, conduct a plug check as described under *Spark Plugs,* this chapter. This way, you can learn not only the condition of the jetting but also the suitability of the spark plug heat range.

Always begin jetting with a slightly larger jet than you feel you need; a too-lean mixture often results in a damaging piston seizure. Make changes in one-step increments. Do not make a change of 2 sizes. Allow sufficient time to do a thorough job; time spent finding optimum jetting and adjustment is every bit as important as other engine modifications.

As a rough guideline, add one jet size if a modified exhaust system is used. Add one jet size if port timing is changed. It is better to start rich on the jetting and adjust to suit the engine.

AIR CLEANER

The stock paper air cleaner is effective but restrictive. There are many special air cleaners made to fit the stock carburetor. One good brand is the Filtron foam type. See **Figure 27**.

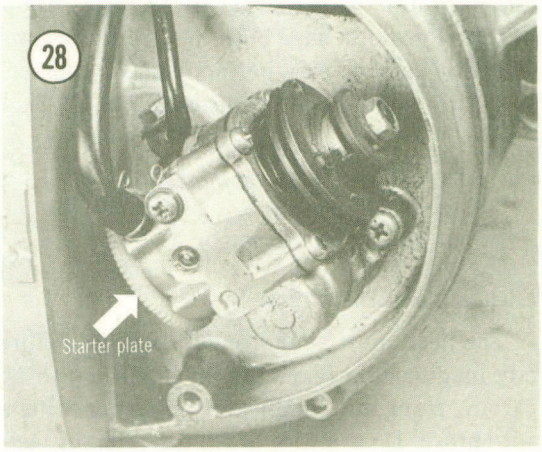


You should never operate your engine without an air filter. A clean air filter does not rob your engine of enough power to offset its advantages.

The incoming fuel/air charge also supplies lubrication for the lower-end bearings, so clean air is a "must" or the engine will be damaged in less than a couple of hours. A Ken Maeley air cleaner housing with a Filtron element is a good combination. The Maeley housing has a side-mounted element that can be reached by removing a wing-nutted cover for quick replacement of the element.

ENGINE LUBRICATION

On models equipped with Autolube oil injection, remove the oil injection unit, pump, and tank for off-road use and pre-mix the gas and oil. See **Figure 28**.



When you put oil in the gasoline, you know it is getting into the engine if the gasoline is. You will never run out of oil while there is still gas, and you will drop 3 lb. (1.4 kg) in the process.

CAUTION

Plug up the oiler hole in the barrel or an air leak and a blown engine will develop.

Remove the nylon driving gear found on the inside of the outer right-hand case. An alloy casting and gasket will cover the hole left by the oil pump. Two O-rings from the discarded tachometer drive and speedometer drive cables will slip over the special plugs supplied by Yamaha to fill the holes in their respective castings. A good oil must be used if the pump is eliminated, such as Torco T2R, mixed at 40:1.

Stay away from oil additives in the crankcase or the fuel system. There is a chance they may

not be compatible with the additives already in the oil.

CYLINDER HEAD

To eliminate a frequent source of detonation and preignition, make sure there are no sharp edges or burrs in the combustion chamber. In addition, check that the spark plug does not protrude too far into the chamber.

Extensive modifications are possible and should be considered for maximum power. If you want to go "all-out" on modification, take the head to an experienced performance shop. If piston or ports have been modified, the combustion chamber may be modified to compensate for a compression ratio increase.

CAUTION

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

Cleaning and Inspection

The head must be thoroughly cleaned before any modification or measurement. Remove all carbon from the combustion chamber with a wire brush. Do not wire brush the cylinder seating surfaces. Particularly stubborn deposits can be removed by blasting with glass beads or walnut hulls. Scrape out all dirt from between the fins and wash in solvent.

CAUTION

Do not sandblast the head; sandblasting is too abrasive and can damage the sealing surfaces.

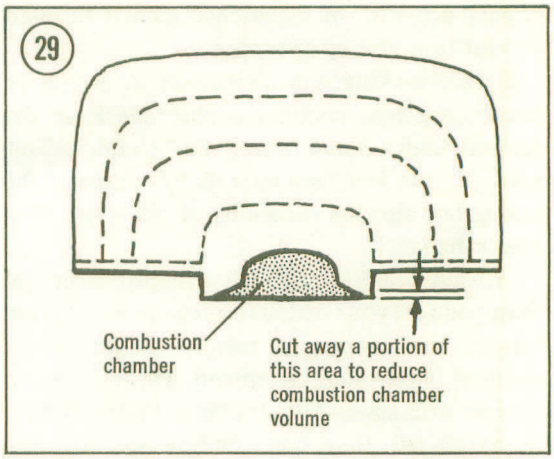
Changing Compression Ratio

Three ways to change the compression ratio are:

a. Bore
b. Stroke
c. Flycut head

Flycutting is equivalent to milling the head on a water-cooled engine. It decreases the volume of the combustion chamber. See **Figure 29**.

Installing a big bore kit or "stroker" crankshaft will also increase the compression ratio. If you also flycut the head, you may raise the compression ratio far beyond a desirable or safe limit.



CONNECTING ROD

The oil groove in the rod should be flared (**Figure 30**) to ensure more complete lubrication of the connecting rod big-end bearing. When assembling the crankshaft, refer to Chapter Three and check the alignment of the counterbalance wheels and make any corrections that are necessary.

PISTON

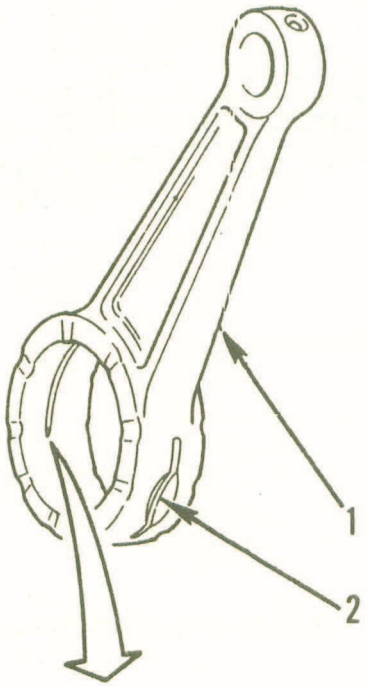
Stock Yamaha pistons can be modified to work well enough so that there is no need to change to an aftermarket type (except for all-out competition).

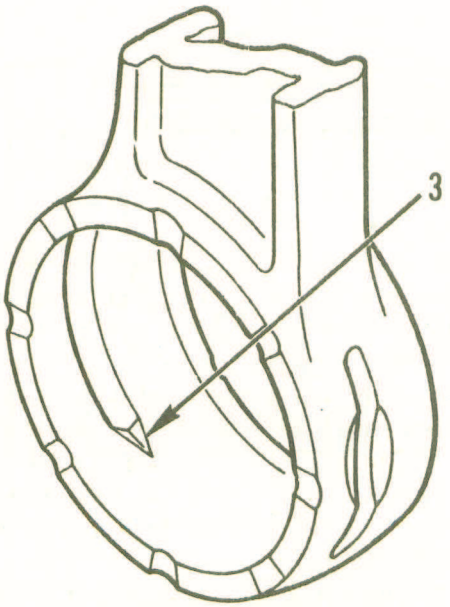
A convenient way to make slight changes to port timing is to modify the top of the piston. The area on top of the piston next to the exhaust port, or transfer ports, may be cut so that exhaust or transfer ports will open earlier and stay open longer. Do not cut the piston closer than 0.08 in. (2mm) to the ring groove. See **Figure 31**. The piston skirt may be shortened so that the intake port will open earlier and stay open longer.

When shortening the piston skirt, take care not to remove too much. This will cause the piston to rock in the cylinder, causing damage to the piston and cylinder.

Use the piston diagrams (**Figures 32 through 36**) for piston modification dimensions.

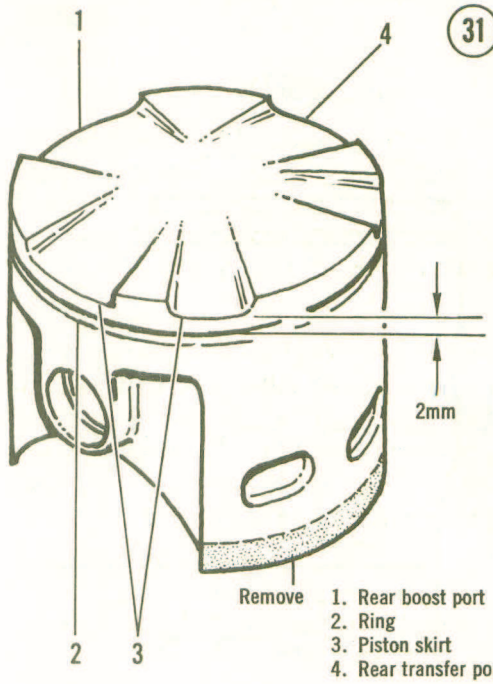
30





1. Connecting rod
2. Oil slot
3. Oil groove

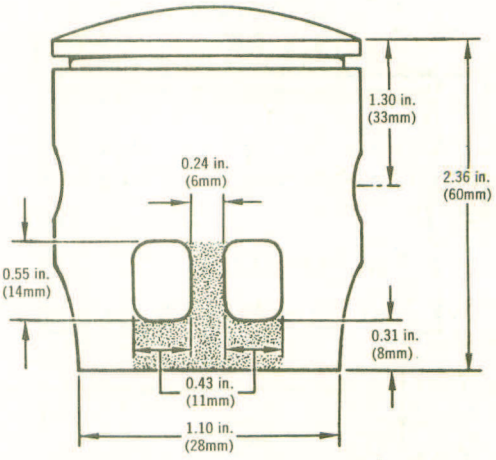
31



1. Rear boost port
2. Ring
3. Piston skirt
4. Rear transfer port

32

100cc MOTOCROSS SPECIAL

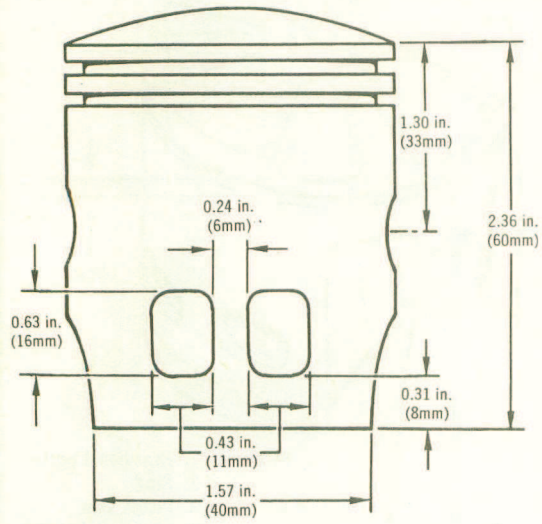


NOTE: When modifying the piston skirt, be sure to modify the intake side only. This will change port timing

8

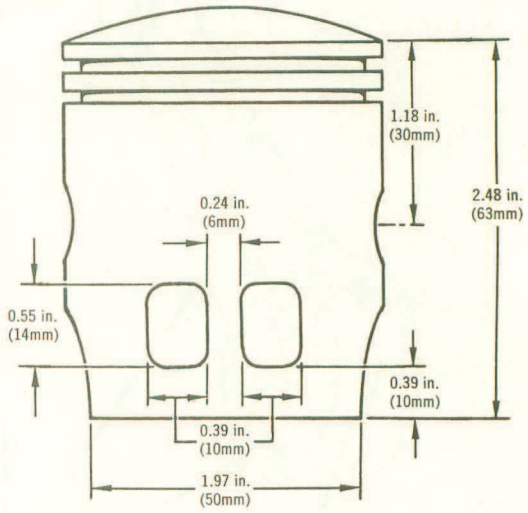
PISTON DIMENSIONS

(33)



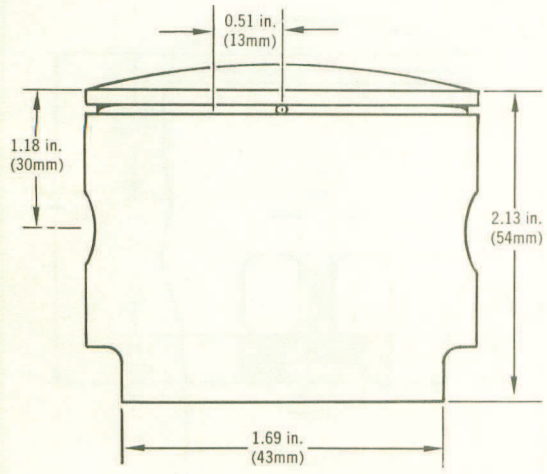
100cc ENDURO/MOTOCROSS

(34)



125cc ENDURO/MOTOCROSS

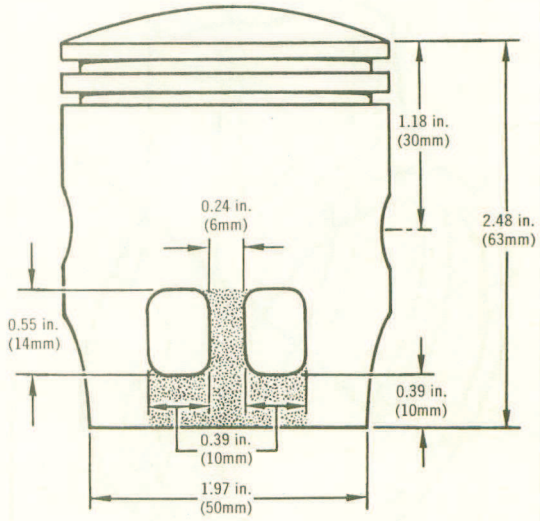
(35)



125cc MOTOCROSS SPECIAL

NOTE: If a TD 2 piston is used with AT 2 cylinder, the ring gap must be relocated.

(36)



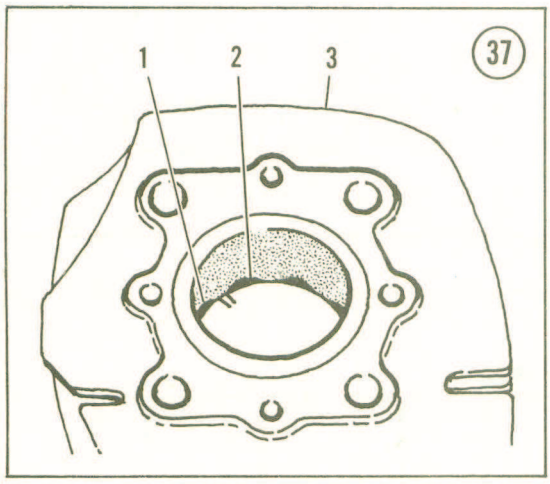
175cc ENDURO/MOTOCROSS & MOTOCROSS SPECIAL

NOTE: Remove shaded area for Motocross Special

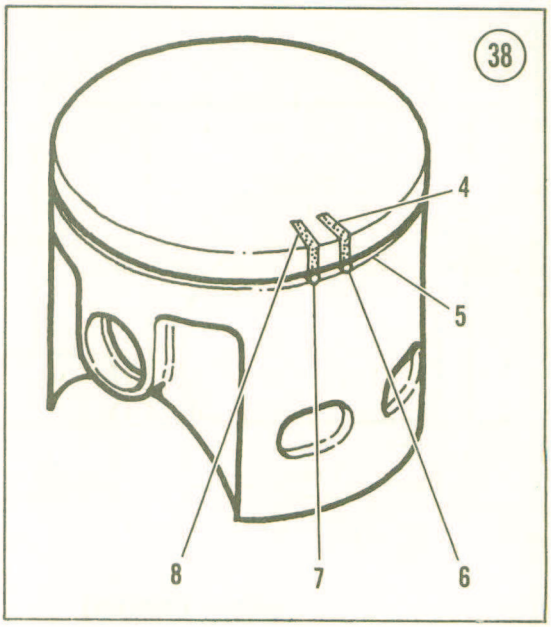
PISTON RINGS

Replace the standard piston rings with Poppy Super Rings. These rings are virtually unbreakable and will outlast the standard rings by several times. These rings are hard-chrome plated to reduce running friction over stock rings and consequently reduce heat. Also, they have inherently better heat transfer properties than standard rings and dissipate more heat to the cylinder and away from the piston.

Piston ring gap must be located between rear and transfer port (2) and rear boost port (1). Refer to **Figures 37 and 38**. If the rear boost port has been widened, the piston ring gap may need to be relocated as follows:



1. Use a felt pen to mark top of piston (4) in line with the pin (6).
2. Temporarily place the piston, without rings, on the rod. Temporarily place the cylinder (3) in position on the crankcase.
3. Check that the mark (4) is located between the rear transfer port (2) and rear boost port (1). If the mark is correct, the ring gap need not be relocated (omit Steps 4 through 9).
4. Make another mark (8) on top of the piston.
5. Remove cylinder and piston.
6. Mark upper edge of ring groove (5) in line with the new mark (8).
7. Fill the ring groove with soft material (aluminum, brass, etc.) to aid in drilling a new pin hole. Be sure that the pin (7) is installed tightly



to prevent the ring gap from moving around in the cylinder bore and damaging the cylinder and piston.

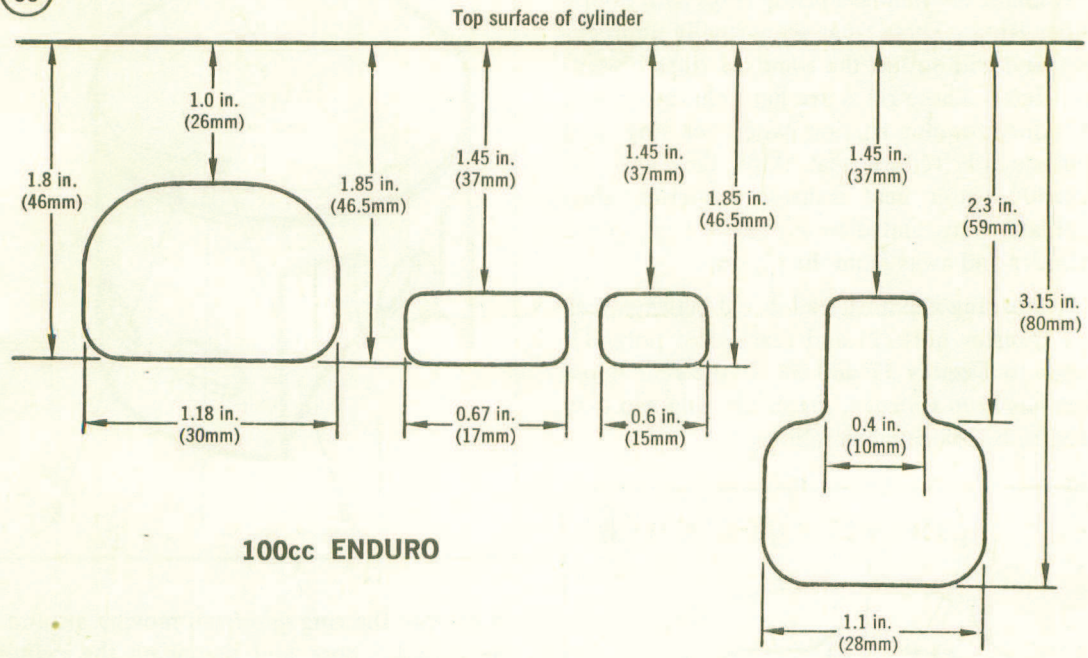
8. Drill a hole for a press-fit for a new pin at the new mark on the edge of the ring land. Press in a new pin (7).
9. Press in an old pin (6) until it is flush with the bottom of the ring land.

CYLINDER

A great deal of power can be created by altering port height, size, and shape, but take care unless you have considerable experience with 2-stroke tuning. **Figures 39 through 47** give maximum port dimensions for optimum power. Somewhere between this extreme and the stock dimensions is a good compromise to suit your needs. Modify the cylinder a little at a time but make sure that each port is modified in proportion to the others. It does not do any good to modify the intake, for example, without also modifying the exhaust.

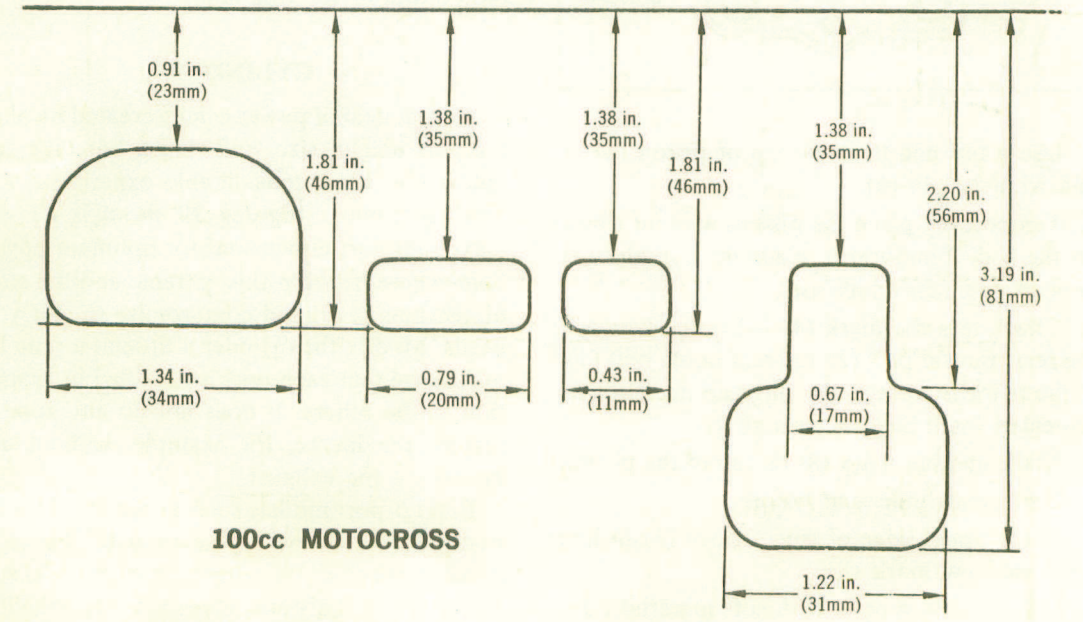
Early 5-port models such as the DT-1 can be vastly improved by replacing with the entire 7-port top-end of the corresponding model such as the DT-2. This also gives you the benefit of the reed valve. An alternative would be to add a Yamaha reed valve kit.

39



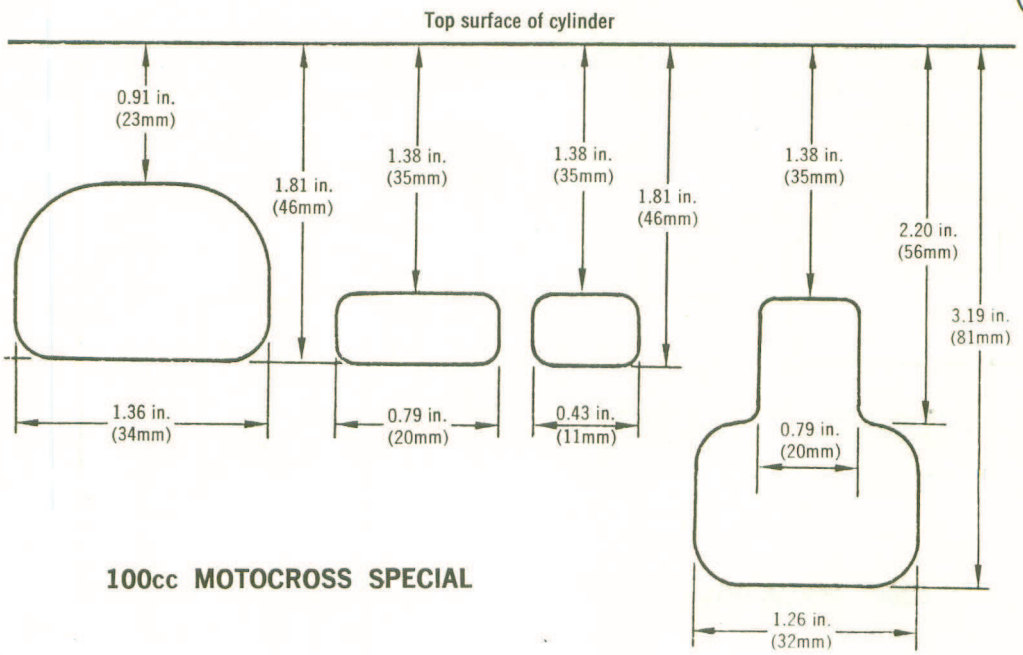
100cc ENDURO

40



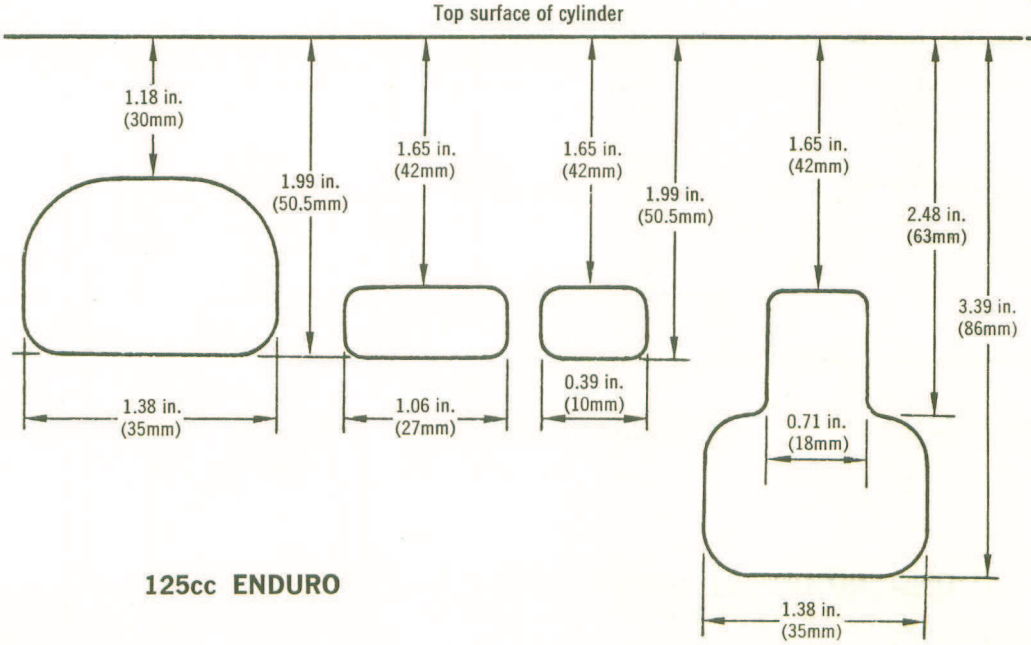
100cc MOTOCROSS

41



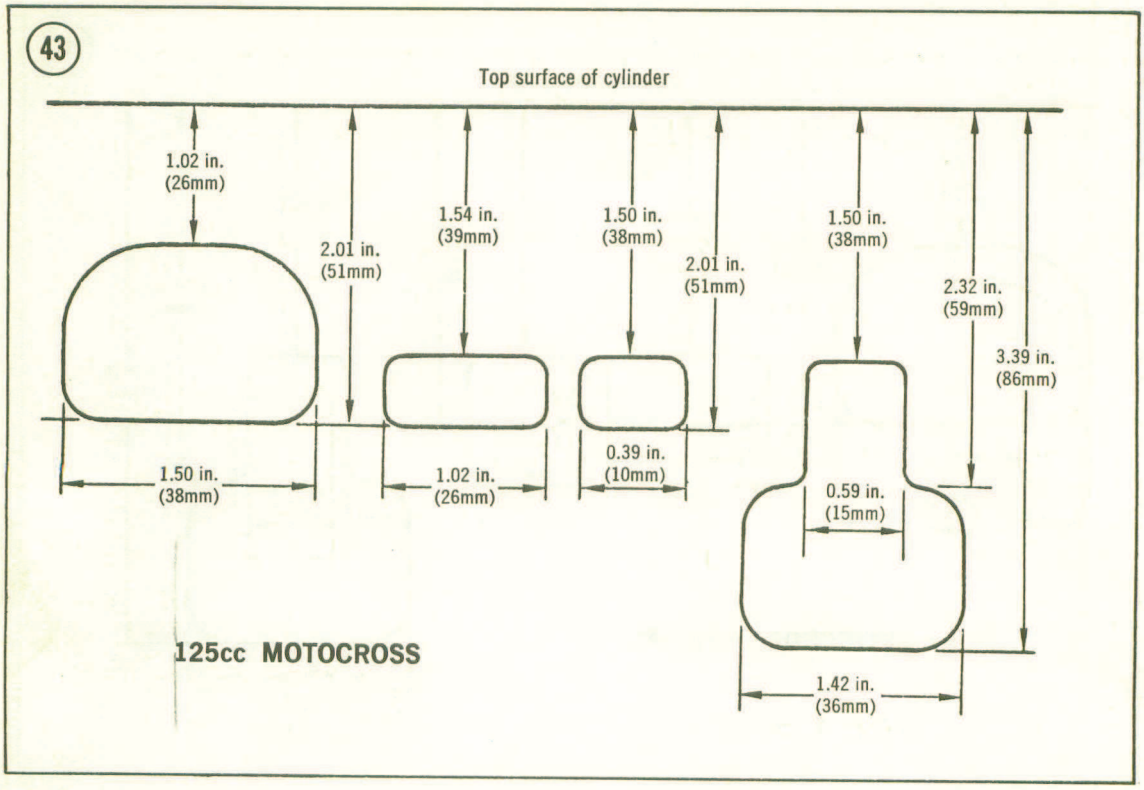
100cc MOTOCROSS SPECIAL

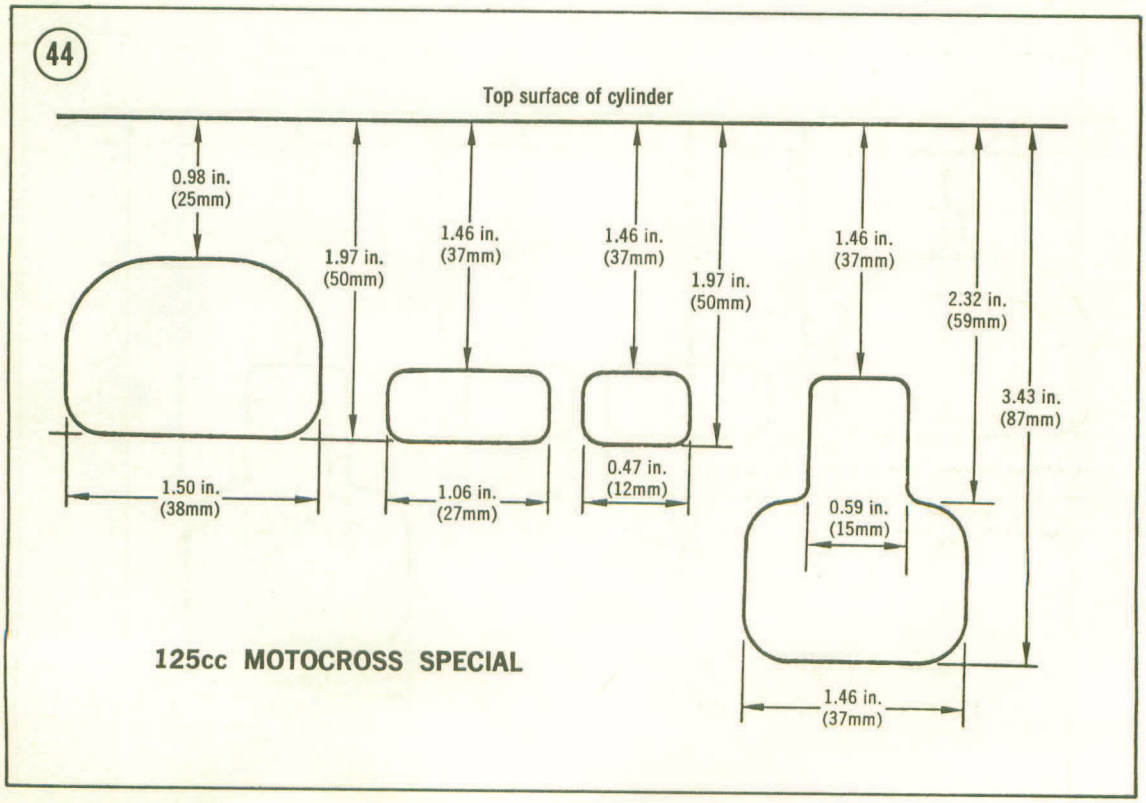
42

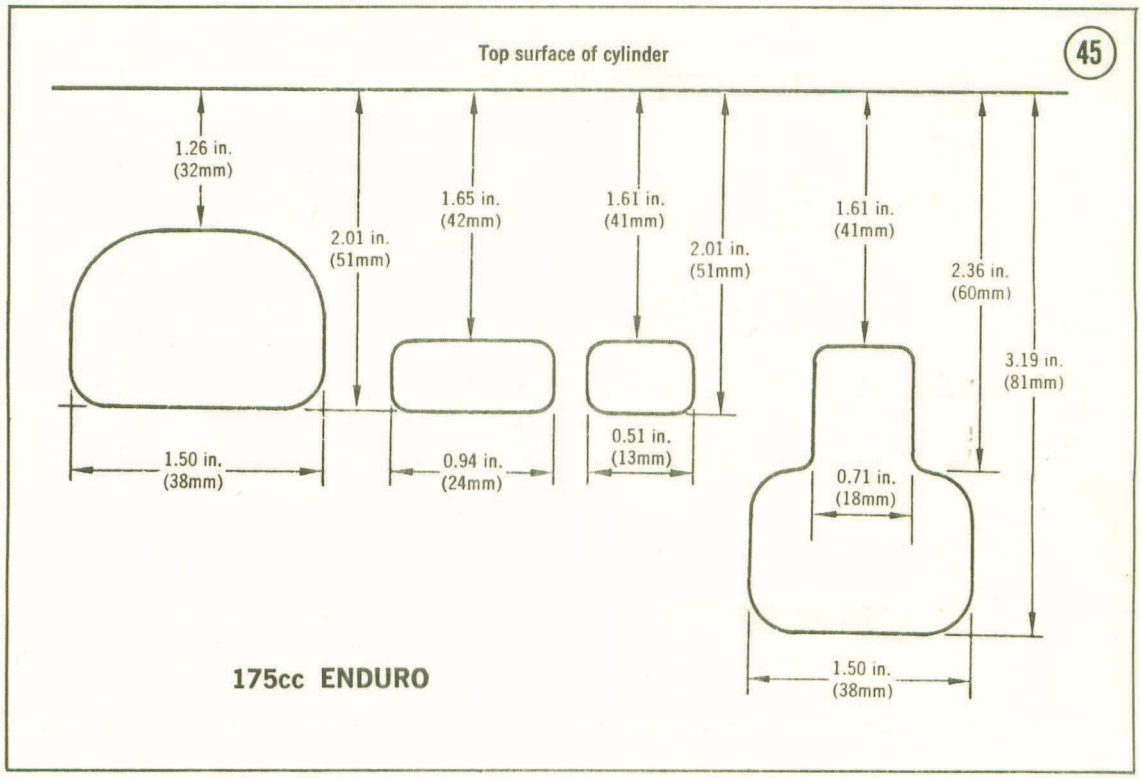


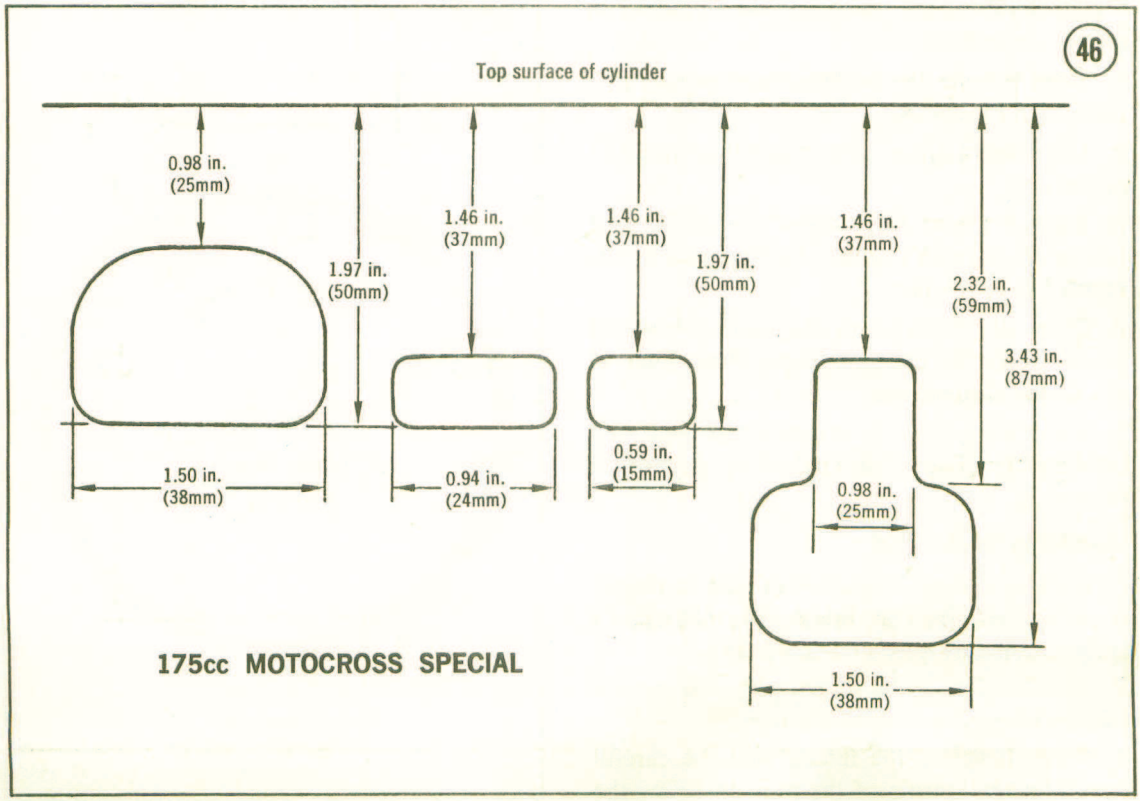
125cc ENDURO

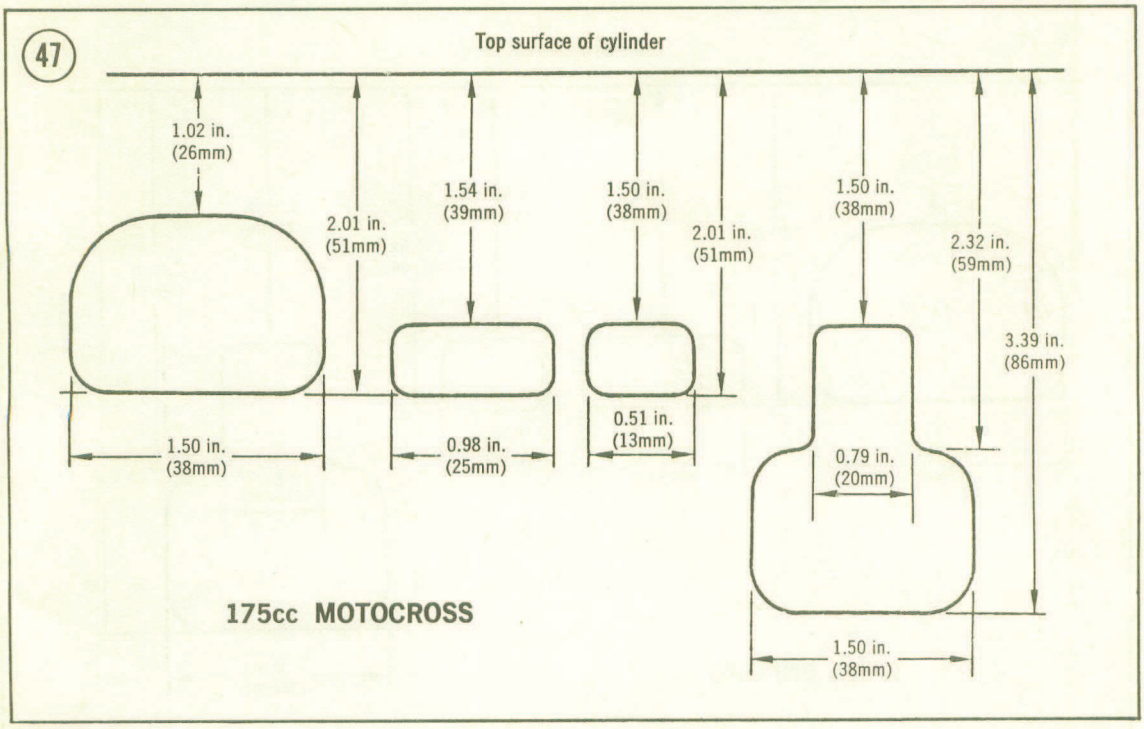
8


43
Top surface of cylinder
1.02 in.
(26mm)
2.01 in.
(51mm)
1.54 in.
(39mm)
1.50 in.
(38mm)
2.01 in.
(51mm)
1.50 in.
(38mm)
2.32 in.
(59mm)
3.39 in.
(86mm)
1.50 in.
(38mm)
1.02 in.
(26mm)
0.39 in.
(10mm)
0.59 in.
(15mm)
1.42 in.
(36mm)
125cc MOTOCROSS


44
Top surface of cylinder
0.98 in.
(25mm)
1.97 in.
(50mm)
1.46 in.
(37mm)
1.46 in.
(37mm)
1.97 in.
(50mm)
1.46 in.
(37mm)
2.32 in.
(59mm)
3.43 in.
(87mm)
1.50 in.
(38mm)
1.06 in.
(27mm)
0.47 in.
(12mm)
0.59 in.
(15mm)
1.46 in.
(37mm)
125cc MOTOCROSS SPECIAL


45
Top surface of cylinder
1.26 in.
(32mm)
2.01 in.
(51mm)
1.65 in.
(42mm)
1.61 in.
(41mm)
2.01 in.
(51mm)
1.61 in.
(41mm)
2.36 in.
(60mm)
3.19 in.
(81mm)
1.50 in.
(38mm)
0.94 in.
(24mm)
0.51 in.
(13mm)
0.71 in.
(18mm)
1.50 in.
(38mm)
175cc ENDURO

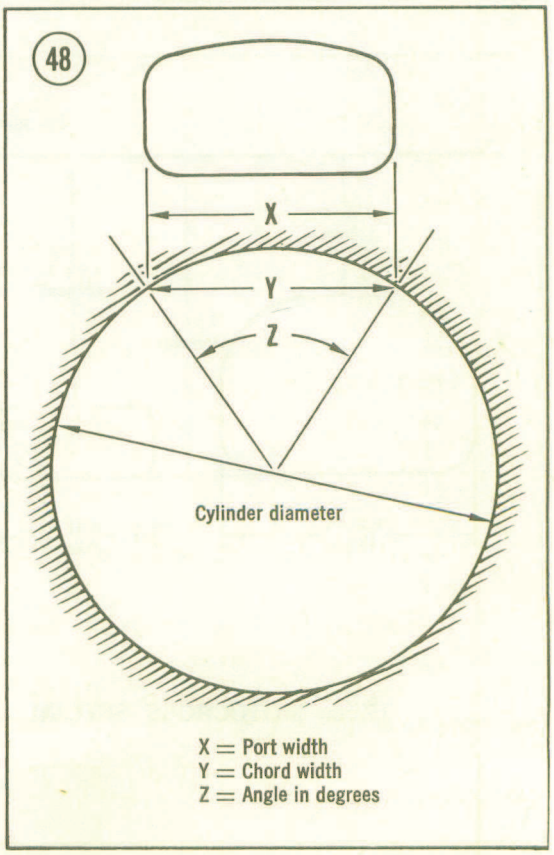

46
Top surface of cylinder
0.98 in.
(25mm)
1.97 in.
(50mm)
1.46 in.
(37mm)
1.46 in.
(37mm)
1.97 in.
(50mm)
1.46 in.
(37mm)
2.32 in.
(59mm)
3.43 in.
(87mm)
1.50 in.
(38mm)
0.94 in.
(24mm)
0.59 in.
(15mm)
0.98 in.
(25mm)
1.50 in.
(38mm)
175cc MOTOCROSS SPECIAL



Porting

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

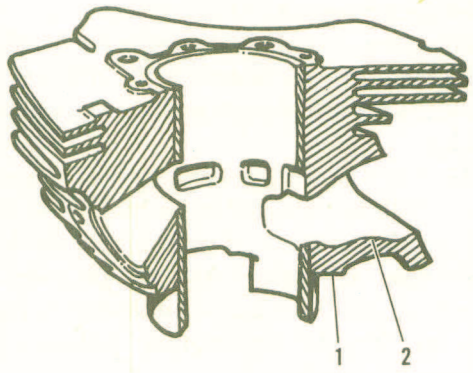
1. Draw a circle the same diameter as your cylinder. See **Figure 48**.
2. Use inside calipers to measure the width (X) of the port.
3. Mark a chord (Y) across the circle. The length of chord (Y) should be the same as the width (X) of the port.
4. From the 2 points on the circle where the chord meets the circumference, draw lines to the center of the circle.
5. Use a protractor to measure the angle (Z) between the 2 lines. This angle is the port width in degrees.



Modifying Intake Port

1. Remove casting irregularities such as ridges, steps, lips, etc., from the intake port to provide a smooth, uninterrupted flow of intake gases.
2. Modification of the intake port will require widening and lowering of the port.
3. When lowering the intake port, be careful not to let the bottom of the port go below the

cylinder-to-case mating surface (1). See **Figure 49.**



1. Cylinder-to-case mounting surface
2. Intake port

4. When modifying intake, a port width of more than 75° will have a detrimental effect on piston, ring, and port. A width of 70-75° works best.

Modifying Exhaust Port

1. Width of the exhaust port should be close to the width of the intake port (i.e., 70-75°). See **Figure 50.**

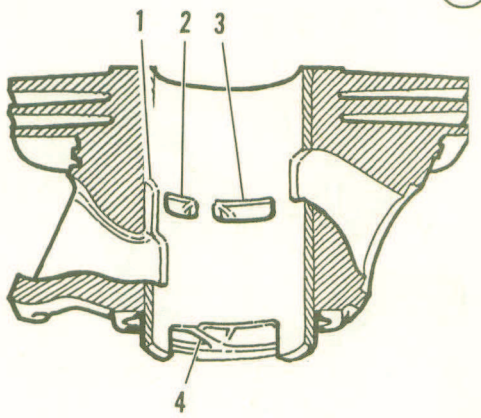
2. Bottom of the port should be even with top of the piston when it is at BDC.

3. For low speed running, an exhaust port timing of 105° gives good results.

4. Remove casting irregularities such as ridges, steps, lips, etc., from the exhaust port passage (2) to provide a smooth, uninterruped flow of exhaust gases.

5. Remove irregularities from the exhaust pipe mating surface so that the gas flow from the exhaust passage to the exhaust pipe is smooth and uninterrupted.

6. Polish the exhaust passage to help keep carbon buildup at a minimum.



TRANSFER AND BOOST PORTS

1. Rear boost port
2. Rear transfer port
3. Main transfer port
4. Transfer port divider

Modifying Transfer and Boost Ports

Refer to **Figure 51** when modifying the main transfer (3) and rear transfer (2) ports as follows:

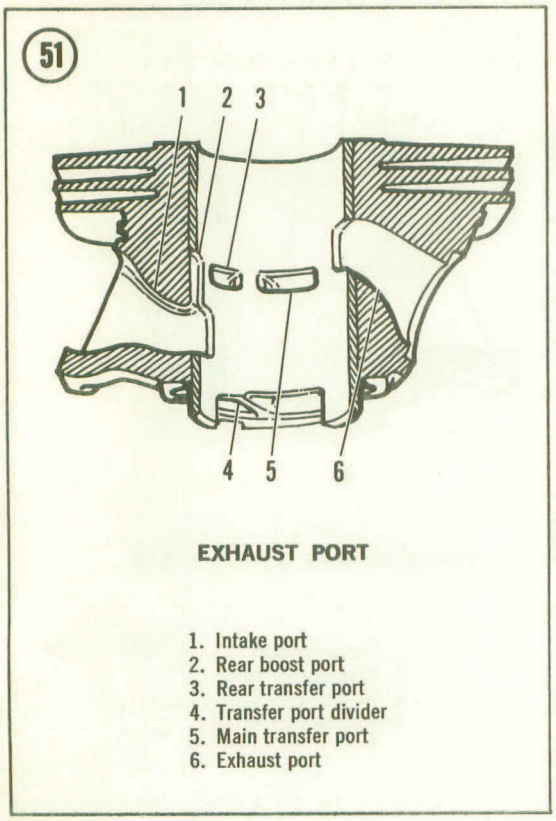
1. Remove casting irregularities such as ridges, steps, lips, etc., from transfer passages (2, 3) to provide a smooth, uninterrupted flow of gases.

2. 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. The main transfer port (3) should be raised slightly and, in some cases, widened a little.

3. The rear transfer port (2) should be raised, widened, and, in some cases, lowered a little.

4. The transfer port divider (4) should be narrowed, but must not be removed. The flat area of the divider (4) that faces the incoming fuel/air flow offers poor shape for good flow of gases.

5. Remove casting irregularities such as ridges, steps, lips, etc., from the boost port (1). The boost port (1) can be raised to the height of the rear transfer ports (2). When widening, be sure



EXHAUST PORT

1. Intake port
2. Rear boost port
3. Rear transfer port
4. Transfer port divider
5. Main transfer port
6. Exhaust port

to leave at least 0.31 in. (8mm) between the boost port and the transfer port (2) next to it. If the boost port is widened too much, it will be necessary to alter the piston to relocate the ring gap.

SUMMARY

The modifications described offer enough options so it is possible to alter the Yamaha slightly with just a few dollars and little time to make it a generally better performer, or to construct a competitive novice racer.

Remember, begin by improving the handling and braking performance of the motorcycle. These are the first steps to making a motorcycle quicker.

Be critical of the parts and services you purchase. Talk to your dealer; let him know what you are after in terms of performance and how much time and money you are prepared to spend. Dealers have a good information pipeline that includes performance bulletins and sources for components.

PART SUPPLIERS

Table 2 is a list of parts suppliers compiled to assist readers in obtaining the best hop-up components. Contact your local parts house for items specifically mentioned in this chapter or write directly to the manufacturers.

We have tried to list only reputable companies which produce items of proven effectiveness and value. However, we urge you to be thorough in checking the parts and reputation of the manufacturer prior to using any of these parts.