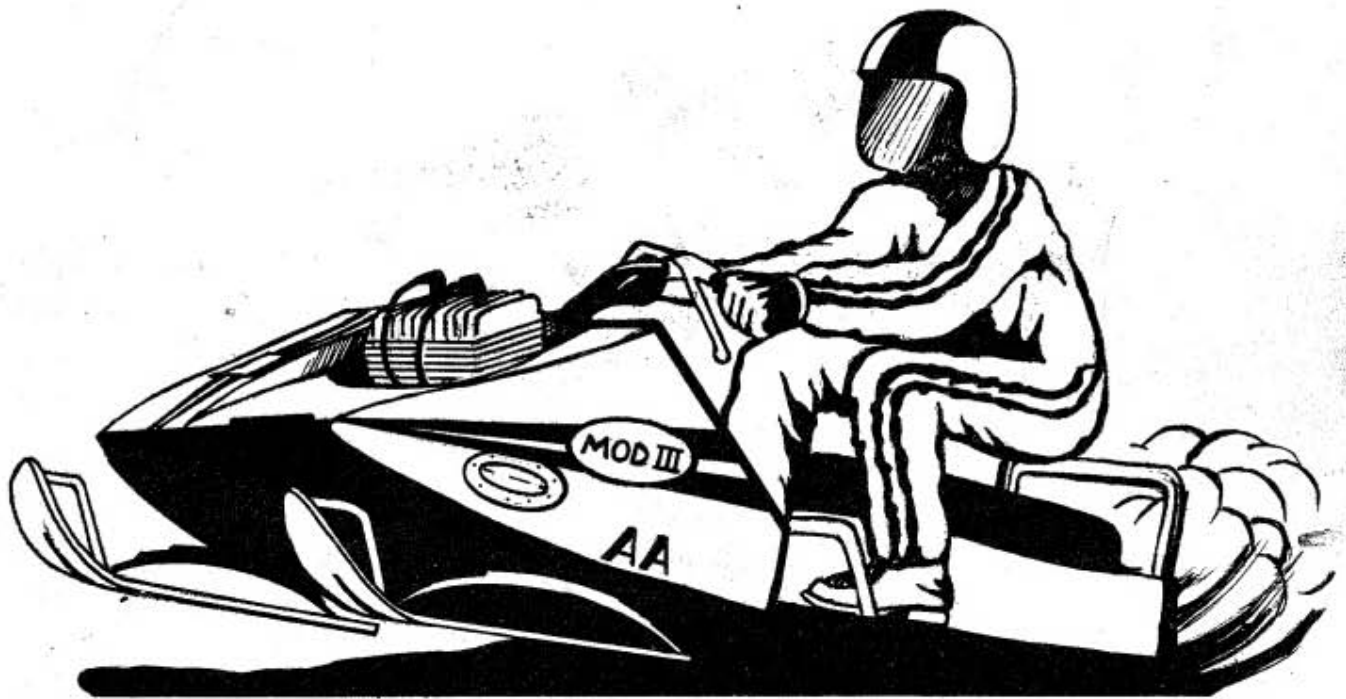




# YAMAHA



# GRASSRACING SUMMER '73

## WARNING

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

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

Machines 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 machine.

A machine that fails may cause extensive damage and may be expensive to rebuild. Some machine failures may cause temporary loss of control, resulting in injury to the rider.

When considering a machine modification, remember that the performance will be affected. The whole power curve will be changed if the engine is modified.

WHERE PERMITTED BY LAW, YAMAHA SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING INJURY TO PERSON OR PROPERTY.

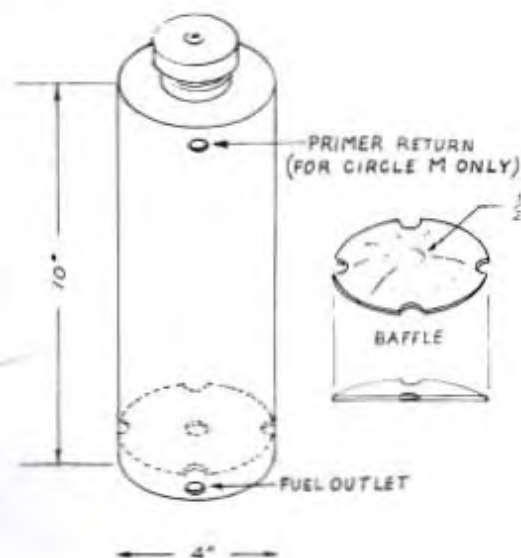
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## WEIGHT REMOVAL

**Skis:** Remove the first and third spring leaves and shock absorber assembly. Remove the standard wear bars. Install wear bars from the GP643B (Part Number 838-23731-01-00). Kalamazoo Engineering drag skis save about 6 lbs. over lightened Yamaha skis.

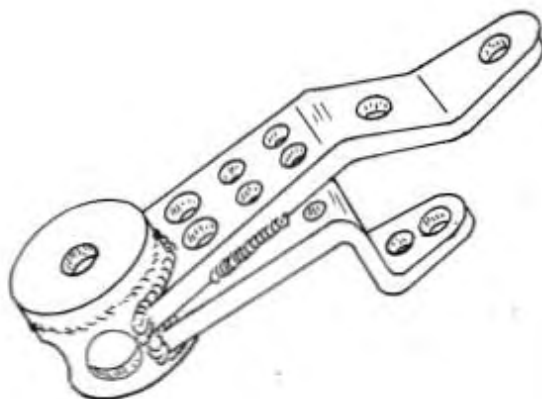
**Seat:** The stock seat should be removed, and some form of light weight pad should be attached to the chassis. Suggestion: Use a 2" thick foam rubber pad held in place by a naughahyde cover secured with upholstery snaps.

**Gas Tank:** The stock tank is not heavy by itself, but it requires a minimum gas level that adds extra weight. Suggestion: Build a tubular tank that mounts in a vertical position. To prevent fuel frothing with low fuel levels, a slightly conical baffle plate should be installed about 2" from the bottom. Be sure to include a fuel filter in the fuel line. The fuel outlet should be at the back of the tank. This type of tank is especially important for use with Circle M Carburetors.



**Motor Mount:** Cut off any part of the motor mount that isn't necessary to hold the motor in place or support the secondary shaft. The remaining portion can be further lightened by cutting out sections or drilling holes.

**Ski Spindles and Arms:** The ski spindles can be drilled from the bottom up to lighten them. The spindle arms can be lightened by moderate drilling. The splined boss which fits over the spindle splines can be drilled extensively.



Blizzard aluminum spindles and spindle arms save about 2½ lbs. and will fit the standard SR spindle boss. It will be necessary to modify the right spindle arm by welding on an extra arm to hook up the tie rod. A spacer under the spindle arm will be necessary, as they are longer than the SR spindles.

**Shrouds:** The upper and lower shrouds can be removed if it is legal in your racing association, or replaced with a lightweight substitute if it is not legal in your association. Camber Company, 947 W. 18th St., Costa Mesa, Calif. 92627, (714) 642-5856, plans to manufacture a lightweight one piece shroud. The price is \$75.00 each plus shipping.

**Mud Flap:** The original component can be exchanged for one made of lighter material.

**Chain and Sprockets:** On the 292 a double row chain is sufficient, and on the 433, a triple row chain is sufficient. Don't forget to cut off the extra sprocket rows and insert a spacer in place of them.

## DRIVE

**Track:** An inner drive track made of an extremely flexible material should be used. Gates Rubber Company and Goodyear Rubber Company manufacture tracks of this type. Care should be taken that the drive sprockets are matched to the type of track used. Gates inner drive tracks and drive components can be obtained from Kalamazoo Engineering, P.O. Box 8154, Grand Rapids, Michigan 49508, (616) 534-3661. *616-532-3661*

**Suspension:** There are three choices of suspension type available.

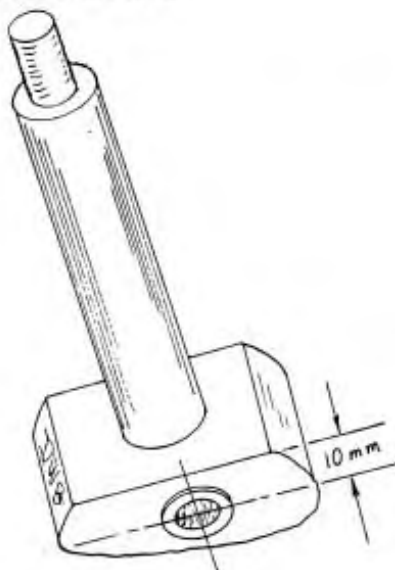
1. Install bogie wheels and link plates, either directly in the chassis, or in a sub-frame which is bolted to the chassis.

2. Install a "bogie rail" type suspension. Kalamazoo Engineering manufactures a suspension of this type called the Sandblaster, which is available separately or in a complete grass racing kit.

3. Bell Industries - Griswold (1081 Highway 36 E. at Junction 61, St. Paul, Minnesota 55109) manufactures a new type of suspension suitable for drag racing use, called the Flex-O-Bar. This is also available as a complete kit. *612*

**Spindles:** If the skis drag on the ground during acceleration, use the shortest available spindles (Part Number 856-23853-10-00). These spindles measure 10mm from

the center of the ski pivot bolt hole to the flat area above the hole.



## ENGINE

**Compression:** Higher compression can be used for drag racing only, due to the short length of the race. This increased compression is in addition to the engine specifications shown in the individual engine specifications, and should not be used for any race longer than a drag race.

To raise the compression, cut 1mm (0.040") from the cylinder head gasket surface.

For operation at altitudes above 2,000', an increase in compression will help to regain part of the power loss. Cut an additional 0.25mm (0.010") for each thousand feet above 2,000 feet altitude.

Cut no more from the head(s) than corresponds to the lowest altitude that you will race at. If you race at widely differing altitudes, you may desire to have different heads for each altitude. Do not exceed 200 p.s.i. cranking pressure.

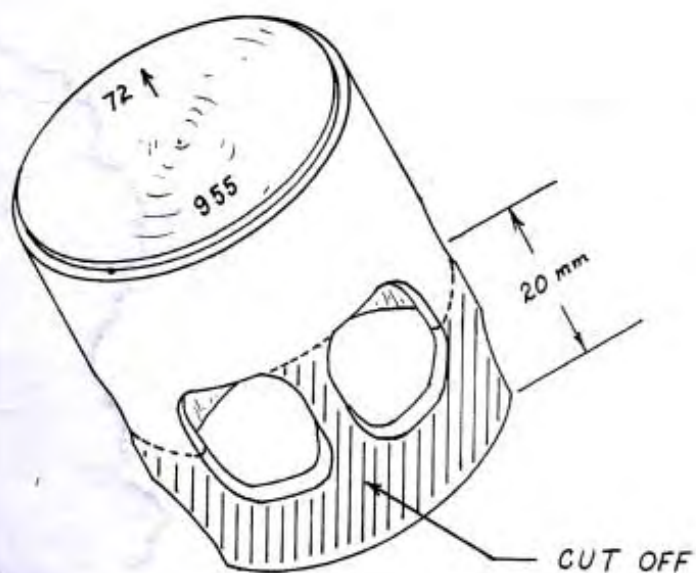
Refer to Cylinder Head Modification, pg. 6, for machining instructions.

Care must be taken to avoid heat problems. Start rich on carburetion, cold on spark plugs, and work towards the proper settings from the safe side.

### SR 292

Note: Many of these modifications were released during the winter season in Bulletin No. 15. Carefully check to see which, if any, of these modifications have already been made on your machine before proceeding.

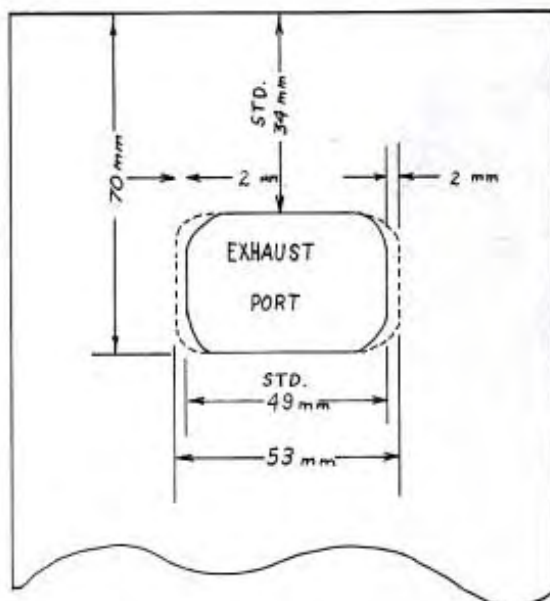
Piston: Cut as indicated:



Carburetor: Use a 50mm carburetor main body with the bottom (fuel pump and metering assembly) and external fuel pump from the original SR 292 carburetor. The

SR 433C carburetor is recommended, but experience shows that other carburetors of the same size are usually acceptable. Use the intake funnel from the SR 433C (Part Number 823-14479-71-00) or 1971-72 SR 292 kit (Part Number 823-14479-70-00).

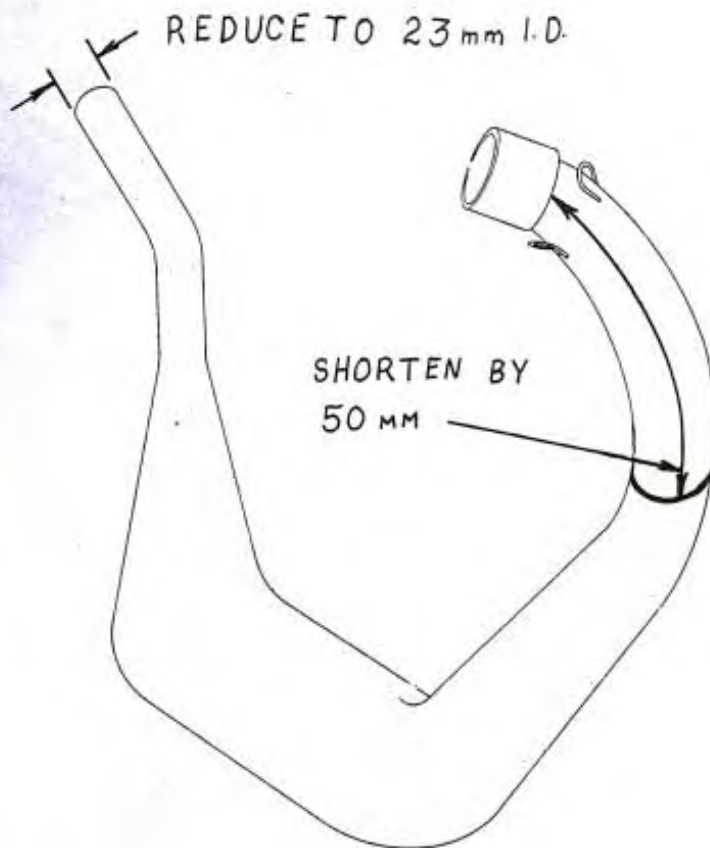
Cylinder: Increase the width of the exhaust port to 53mm by cutting 2.0mm (0.080") from each side of the port. Refer to Chrome Plated Cylinder Modification, pg. 7.



Reed Valves: Be sure that the reeds seat completely on the rubber covered plate. If they don't, turn the reeds over. The reeds should be replaced when they begin to stand open after being turned over once. Be sure to use loctite on the screws.

File the flat edge inside the peak of the pyramid to a V-shape. Using a fine file, remove the ridges along the sides of the individual reed holes. DO NOT remove any material from the reed seating area. Trim off the screw ends that protrude into the inside of the pyramid.

Expansion Chamber: Remove 50mm (2.0") from the head pipe (between the cylinder and first cone). Relocate the spring hooks if necessary. Reduce the inside diameter of the tail pipe (stinger) to 23mm (0.92" - 59/64"). The finished pipe will be different from the original equipment (unmodified) pipe as shown below.



Belt: On the SR 292 only, a standard (806) belt may be used for drag racing. The standard belt, being thinner and more flexible, is more efficient than the SR (820) belt.

When you chose to use the 806 belt instead of the 820 belt on the SR 292, check the 806 belt to be sure it complies with the tolerances for the racing (820) belt. The lengths and tolerances are:

820: 1101  $\begin{matrix} + 0.0 \\ - 8.0\text{mm} \end{matrix}$  43.35  $\begin{matrix} + 0.0 \text{ in.} \\ - 0.32 \end{matrix}$

806: 1097  $\begin{matrix} + 0.0 \\ - 16.0\text{mm} \end{matrix}$  43.19  $\begin{matrix} + 0.0 \text{ in.} \\ - 0.63 \end{matrix}$

Note: These measurements are taken on the outside circumference of the belt. The different measurements DO NOT indicate a different functional length. They simply reflect the difference in thickness between the 806 and 820 belts.

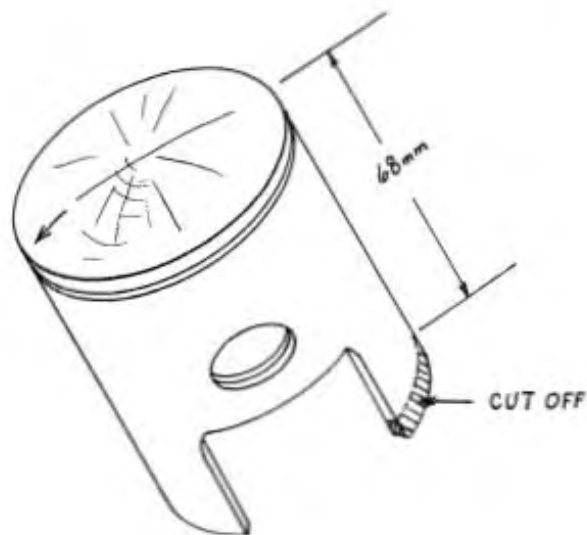
Maximum horsepower rpm - 8500

SR 433C

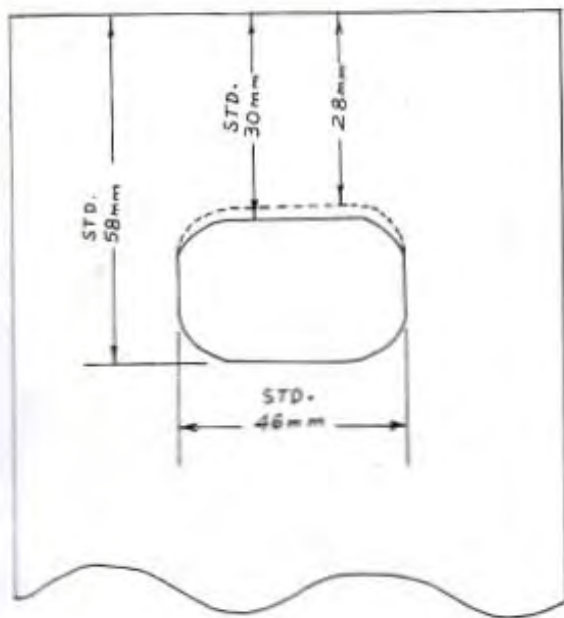
Ignition Timing: With the modified engine, the ignition timing should be 2.0mm BTDC.

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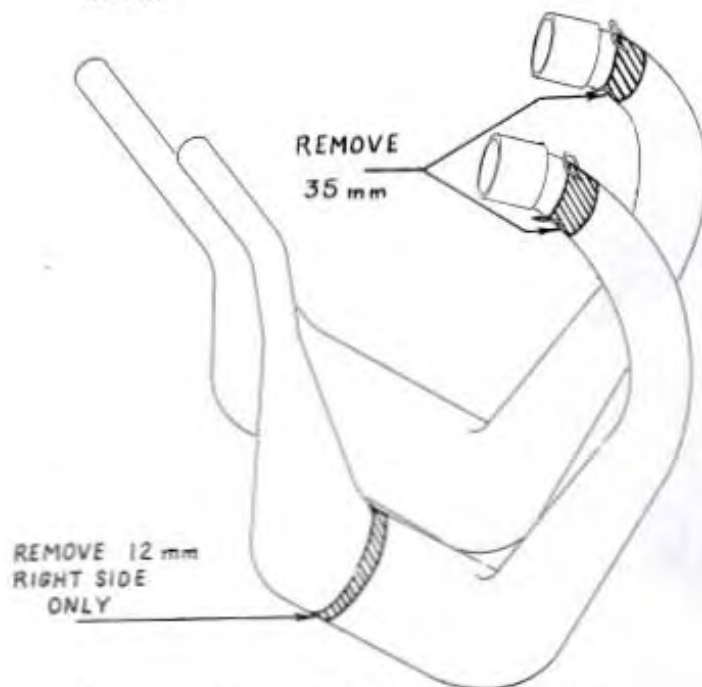
**Piston:** Reduce the intake skirt (only) length to 68mm, measured from the edge of the crown to the bottom of the skirt. Put a 0.5mm (0.020") radius on the freshly cut edge.



**Cylinder:** Raise the exhaust port to 28mm from the top of the cylinder. Refer to Chrome Plated Cylinder Modification, pg. 7.



**Expansion Chamber:** If you have already modified your expansion chambers according to SR Bulletin No. 17, you need only remove an additional 10mm (0.4" - 13/32") from the head pipe. The material should be removed from the first 80mm of the pipe, which has no taper. Relocate the spring hooks if necessary. The finished pipe will be different from the original equipment (unmodified) pipe as shown below.



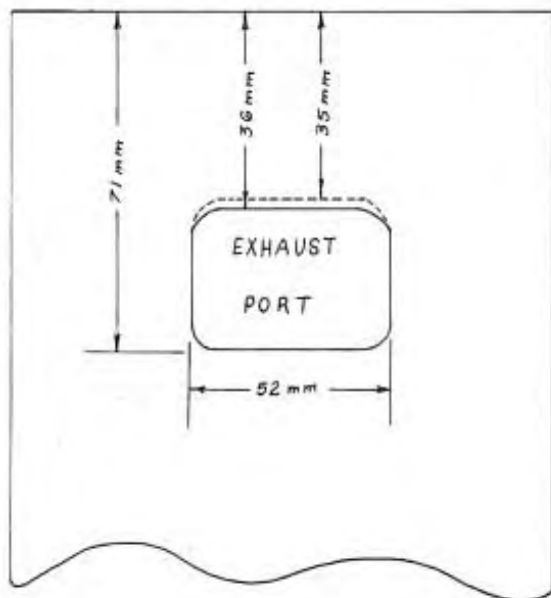
**Cylinder Head:** Cut 0.25mm (0.010") from the gasket surface. Refer to Cylinder Head Modification, pg. 6.

Maximum horsepower rpm - 8500

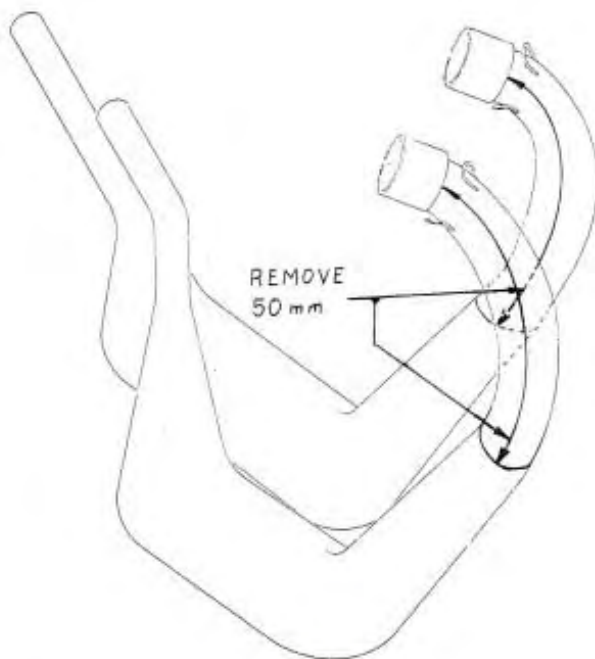
#### SR 643B

Because of various problems encountered during the winter season, it is not recommended to modify the SR 643B engine. However, if you have had no serious engine problems yet, and if and only if you feel that a little more performance will significantly improve your results, you can try the following suggestions.

Cylinder: Raise the exhaust port to 35mm from the top of the cylinder. Refer to Chrome Plated Cylinder Modification, pg. 7.



Expansion Chamber: Remove 50mm (2.0") from the head pipe (between the cylinder and the first cone) on each expansion chamber.



Cylinder Head: Cut 0.5mm (0.020") from the gasket surface. Refer to Cylinder Head Modification, pg. 6.

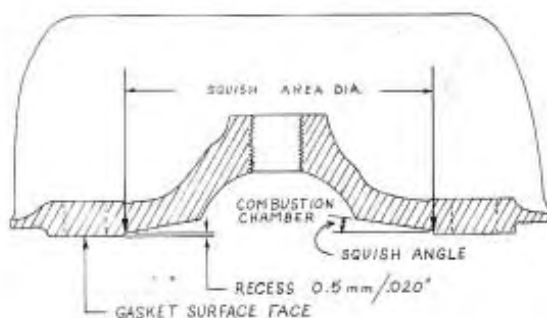
Maximum horsepower rpm - 8000

Cylinder Head Modification: To increase compression, material must be removed from the gasket surface face of the cylinder head.

After the material has been removed, the diameter of the squish area must be checked. It should be 1mm (0.040") larger than the bore diameter.

The clearance between the piston crown and cylinder head should be checked. The proper clearance is between 0.8 - 1.2mm (0.032 - 0.048"), depending on bore size. The minimum clearance is 0.8mm (0.032").

Usually the best procedure is to recess the squish area by 0.5mm (0.020"). The squish angle is usually 14°, but the best procedure is to copy the original angle. Do not radius the edge where the squish angle meets the main combustion chamber. Round the corner just enough to remove the sharp edge (sanding with a medium grit sandpaper is usually enough).





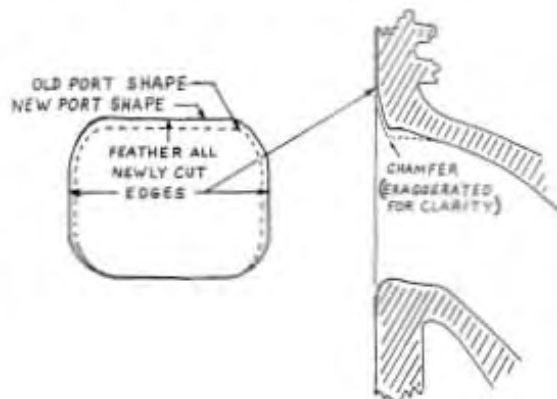
**Ports:** Be sure that all port joints are matched to eliminate "steps" that reduce flow. Don't overlook gaskets (cylinder base gaskets, carb gaskets, etc.) that may extend into flow passages. Trim off any edges that extend inside the port.

**Chrome Plated Cylinder Modification:** The modification of chrome plated cylinders must be done very carefully to prevent damage to the chrome plating, either during the modification process, or during engine operation afterwards.

If you use a file to remove the metal, be sure that all cutting strokes are away from the bore. Never make a cutting stroke toward the bore, as this will chip the chrome plating.

The finished port shape and the radius on the edges should be the same as the original shape and radius. The only change should be in the basic dimensions of the port.

When the port has been enlarged and shaped properly, the edges of the chrome should be feathered with an oilstone or sandpaper to reduce the possibility of being snagged by the corner of the ring, damaging both the ring and plating.



## DRAG RACE TUNING TIPS

**Clutches:** Clutch engagement speed for grass drag racing will usually be higher than for snow racing. Engagement speed needed will vary according to engine power, rider weight, type of track, and gearing.

**Primary Spring:** The primary spring free length should be checked frequently to be sure that it is within 6-8mm of its proper length.

**Sheave Cap Weights:** The tips of weights and the cam ring should be checked frequently for excessive wear.

**Clutch Alignment, Center Distance, and Offset:** These adjustments are extremely important in drag racing, because they affect the transfer of engine power to the track. Adjustment should be checked before each race day.

For information on clutch components, (weights, springs, etc.) or adjustments, refer to V-Belt Torque Converter Operation and Adjustment, which will be available after August 1st.

**Gearing:** Gearing should be selected so that the following conditions are met.

1. Acceleration from a standing start is strong.
2. The drive belt comes completely to the top of the primary clutch at or very near the finish line. This can be checked by marking the primary sheave with a marking pen (from the center to the outside edge), and checking to see if all of the mark was removed after a run of the same length as the race. If the mark is not wiped from the top of the sheave by the belt, the gearing is too high. If the mark is removed

and the engine rpm doesn't rise drastically near the end of the race, the gearing is correct. If the mark is removed, but the engine rpm rises drastically near the end of the race, the gearing is too low.

**Track Tension:** Track tension adjustment should be slightly on the loose side. A tight track is harder to turn than one which is slightly loose.

**Track Alignment:** Track alignment has an effect on how straight the machine runs, and can cause excessive friction if it rubs on the tunnel. It should be checked before each race day. If you have a problem with "pulling" to either side, during acceleration off the starting line, you may be able to counteract the pull to some degree by slightly biasing the alignment to one side.

**Drive Line Drag:** Excessive drag in the drive line reduces power available at the track. Points to check are:

Brake adjustment, drive chain adjustment, bad bearings on axles or wheels, etc.

**Fuel Tank:** It is best to keep the fuel level in the tank at least half full, even though it contains enough fuel for several runs. This helps to avoid aeration of the fuel.

**Carburetor Fuel Level:** If throttle response is poor, and can't be improved by adjustment of low or high speed screws, raising the fuel level may improve it.

**Adjustment for Specific Race Tracks:** If you race at more than one track, and they differ enough to require different gearing, carburetor adjustments, or other different tuning settings, it is usually best to write the changed settings in a notebook. When you return to one of the tracks you have

raced at previously, or go to a similar track, you can save time and improve performance by referring to these notes.

**Check List:** Memorize or copy the following check list, and go over it before each race day.

## CHECK LIST

### ENGINE —

Ignition Timing	_____
Compression	_____
Spark plugs (condition and gap)	_____
Exhaust pipes (springs, cracks, dents, etc.)	_____
Carburetor settings and fuel level (refer to notes taken at previous race)	_____
Starter rope condition	_____

### CLUTCHES AND DRIVE —

Center to center distance	_____
Clutch offset and alignment	_____
Primary spring free length	_____
Sheave cap weight tip condition	_____
Belt condition and length	_____
Drive chain adjustment	_____
Brake adjustment	_____
Track adjustment (alignment and tension)	_____
Drive sprocket condition	_____
Wheel and bearing condition	_____
Track condition	_____
Gearing (refer to notes taken at previous race)	_____

### CASSIS —

Ski alignment and condition	_____
Nut and bolts ( <b>tighten</b> )	_____
Chassis bends, dents, and cracks	_____

### OTHER —

Start engine, make short test run (if possible)	_____
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