

1984

SNOWMOBILE MECHANIC'S GUIDE
Supplement-Vmax Performance

**1984 Snowmobile Mechanic's Guide
Supplement: Vmax Performance**

Yamaha Motor Corporation, U.S.A.
Cypress, California

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Supplement: Vmax Performance**

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INTRODUCTION

The Vmax is a much faster sled than many realize. Because of excessive track spin during acceleration, the Vmax cannot achieve its full potential for excellent low-speed and midrange performance. Increasing traction is therefore the single most effective means of gaining performance in these areas.

The means for increasing traction are presented in two stages. The stage used is dependent on the type of use intended for the machine and the amount of time and money to be spent. Stage 1 is less expensive and applies to the broadest range of uses. Stage 2 is considerably more involved and is to be used for lake-racing situations such as radar runs or drag racing, but not oval racing.

Bear in mind when considering these modifications that an increase in traction demands a comparable increase in steering control. Carbide runners must be added to compensate for traction products, which tend to drive the machine straight ahead.

Stage 3 of these procedures is concerned with engine modifications to increase power output. The modifications include cylinder porting and head milling, as well as changes to carburetion, oiling, and clutching.

Stage 4 is the type of work done by factory racing teams. It consists of "chassis blueprinting," or making sure that everything is aligned and true in the drivetrain. This is the most labor-intensive stage as related to gain.

STAGE 1

Yamaha has made it quite easy to add Stage 1 traction products to the 1984 Vmax. The VMX540H has tunnel protectors installed from the factory. The tunnel protectors, plastic strips positioned in front of and behind the heat exchangers, protect the tunnel from damage caused by adding traction products. In addition, the heat exchangers on the '84 Vmax have been modified to allow installation of traction products on the outside track belts without contacting the exchangers.

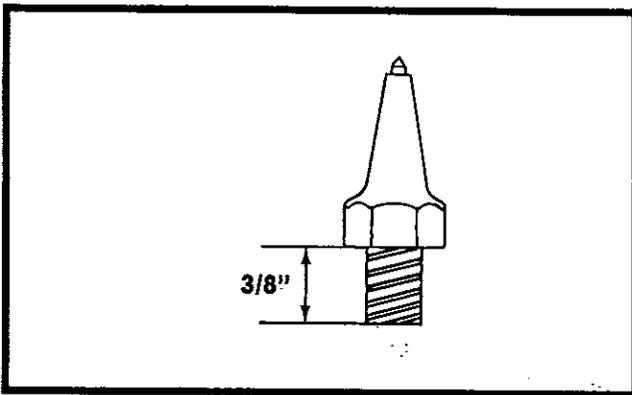
The addition of track studs will provide a dramatic increase in acceleration on ice, depending on the type, quantity, and condition of the stud. In addition, studs will improve the machine's braking ability on ice. Only a slight increase, however, can be expected in deep, soft snow.

Remember, when studs are installed, the machine will become more difficult to steer; carbide runners will be required.

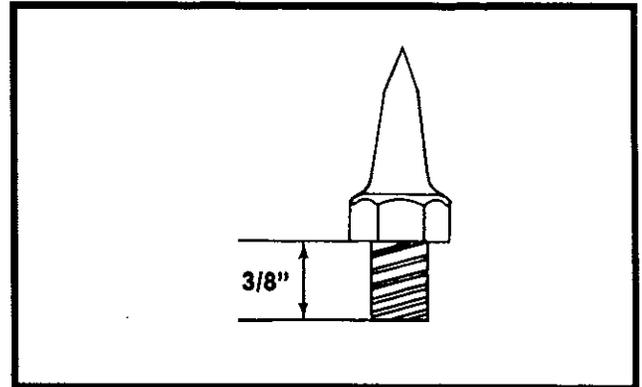
TYPES OF TRACTION PRODUCTS FOR USE ON THE VMAX

Following are the most common traction products available:

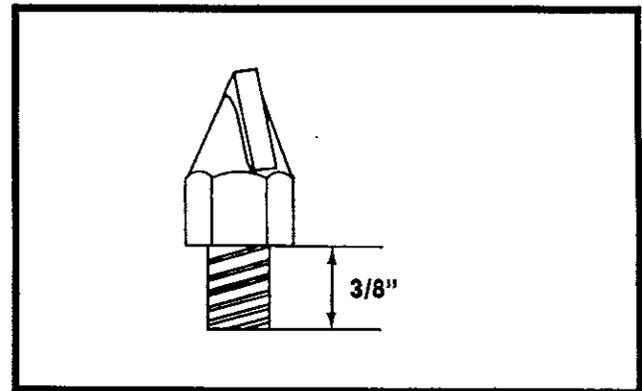
1. Consumer-type pick: This is an unsharpened, carbide-tipped stud. It is very durable and offers consistent performance. It is also the least expensive of the carbide-tipped studs.



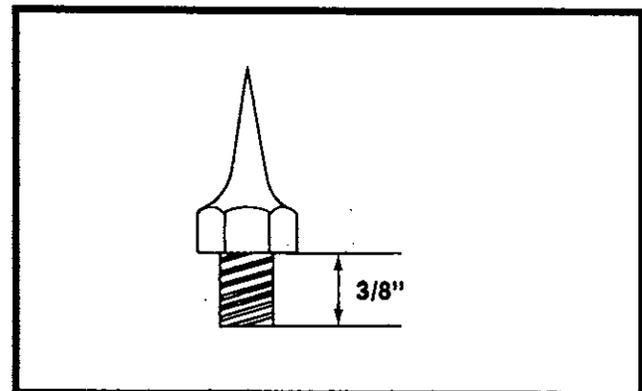
2. Racing-type pick: This is a sharpened consumer pick. Such picks are often used in racing because of their good performance. Because of the sharp point, however, they are not as durable and the performance level will fall as they become dull.



3. Wedge-type pick: This is a carbide, inverted-V-tipped stud that offers the maximum in traction and durability. It is also the most expensive type of stud.



4. Steel-type pick: This is an all-steel stud. It offers excellent performance on ice and is often used in racing, but it requires frequent sharpening and replacement. It is the least expensive of all the studs available.

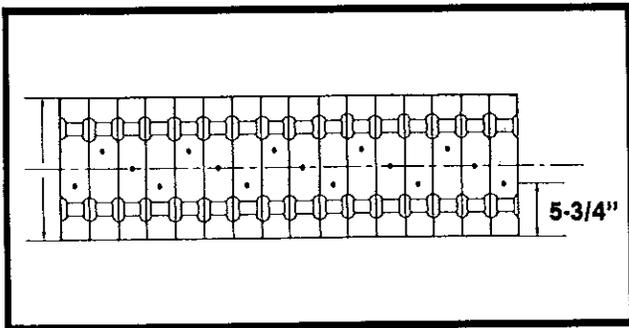


INSTALLATION OF TRACTION PRODUCTS

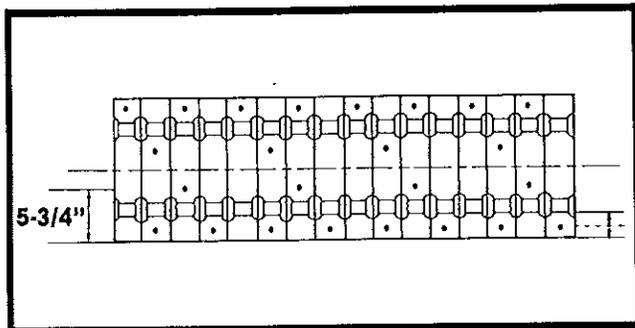
As mentioned before, Yamaha has already installed tunnel protectors on the '84 Vmax. After deciding on the type of studs to use, only the following steps need be followed: 1) Decide on the type of stud pattern to be used and prepare the track, 2) drill the track, 3) install the studs, and 4) adjust the track tension and alignment.

1. Stud patterns: The Vmax track has 48 pitches, so the patterns shown will come out even.

Pattern #1 (requires 48 studs, backing plates, and T-nuts)



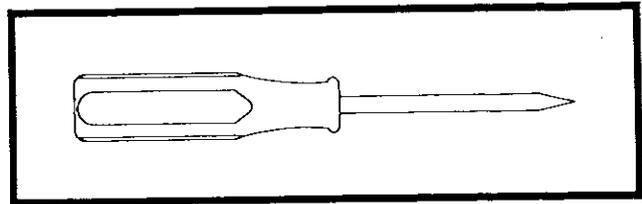
Pattern #2 (requires 72 studs, backing plates, and T-nuts)



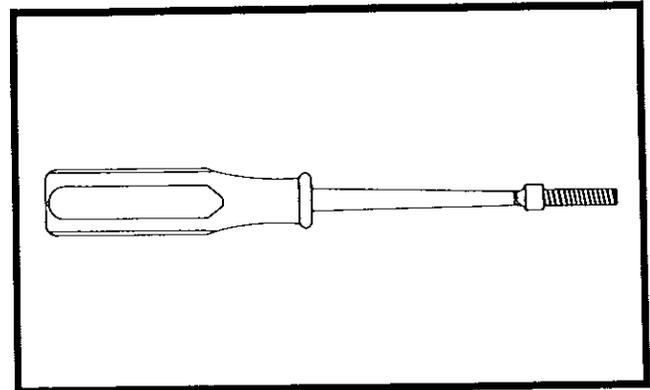
Whenever holes are drilled into the track, cords will be severed; this weakens the track to some degree. Drilling the outside belt causes the most damage, do bear this in mind when selecting a stud pattern.

2. Track drilling: Mark the selected stud pattern on the track with chalk.

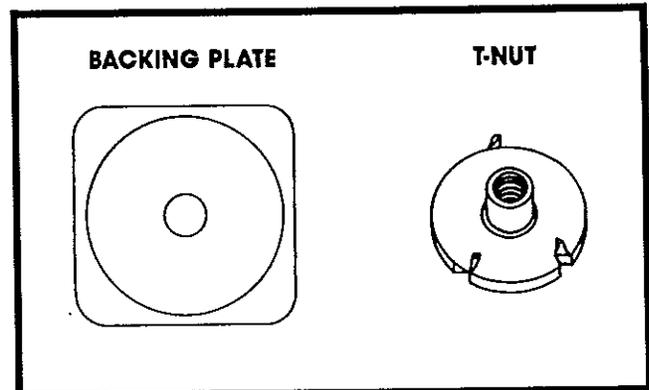
Then, find an awl or screwdriver with a 1/4-inch-diameter shank. Heat the shank until it's red hot, and poke it through the track. This will seal the hole and prevent further damage from water entering the track and freezing. In addition, the T-nut will be easier to install.



3. Stud Installation: First pull the T-nut into the track; a 1/4-20 bolt welded to an old screwdriver works well for this.



Insert the stud through a new lock washer and the backing plate, apply blue Loctite to the threads, and screw the stud into the T-nut. Finish the entire track in this manner.



4. Adjust track tension and alignment: When traction products are used, these adjustments become extremely important. Proper alignment is necessary to prevent the studs from coming in contact with the tunnel or heat exchanger.

CAUTION

The track *must* be kept tight to prevent track derailment; machines using track studs exert higher side loads when cornering.

ADDITIONAL INFORMATION AND TIPS

1. Use studs no longer than 11/16-inch.

2. Secure the mud flap to the frame.
3. Traction products placed close to the slide rails are more effective than those in the center of the belt.
4. Traction products placed in the outside track belts are most effective in cornering.
5. When using traction products, it is wise to install carbide ski runners. Installing 48 studs may require 3 to 4 inches of carbide to regain a balance in steering control; using 144 studs may need 6 to 8 inches of carbide. Remember, there must be a proper balance between traction and steering.

STAGE 2

The Hooker Traction System is a method of attaching traction products directly to the track clips. The Hooker system involves the welding of special plates to the track clips; these plates have three threaded holes in which studs may be installed. This system offers several advantages over conventional track studding: 1) More traction is gained with fewer studs; the studs penetrate more deeply because they're placed directly under the slide rails and because they don't roll under during acceleration. 2) The studs are easy to remove or install as conditions or needs change. 3) There is no damage to the track caused by drilling holes which cut track cords, thereby weakening the track.

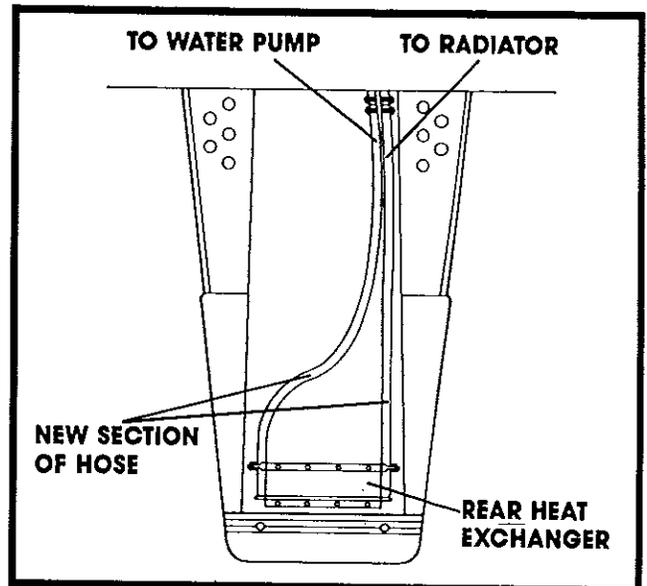
Disadvantages to using the Hooker system include the expense of removing the track, having the plates welded on the track clips, and modifying the cooling system and frame protectors. In addition, because one or two heat exchangers must be removed, caution and common sense must be used when riding a Vmax so equipped: high speeds on ice or light snow are no problem, but riding slow or in heavy, deep snow may cause the engine to overheat. In most situations, however, increasing the speed or spinning the track will reduce engine temperature quickly.

INSTALLATION OF THE HOOKER TRACTION SYSTEM

The instructions given here are for Yamaha dealers with properly equipped shops, not for consumers.

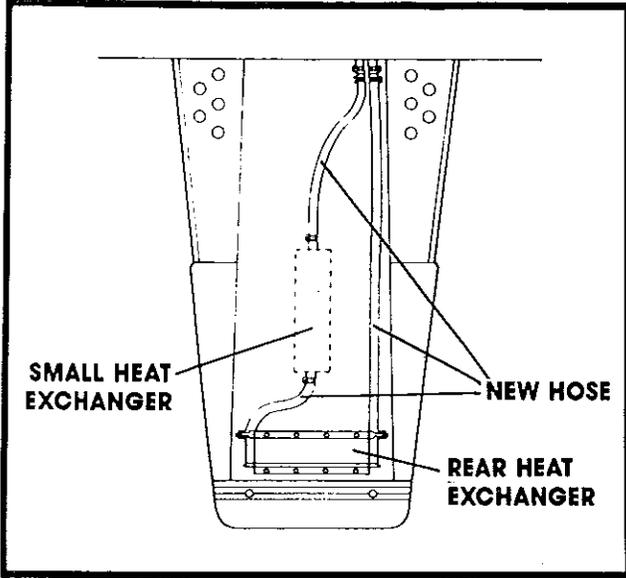
Additional instructions are included only where different from normal repair procedures.

1. Remove the track: The track must be sent to an authorized dealer of Hooker products to have the special plates installed. Every clip or every other clip may be modified according to the intended use. Contact: Woody's International Engineering, 6054 North M-30, Hope, MI, 48628.
2. Remove the seat and fuel tank.
3. Drain the cooling system.
4. Remove the two parallel heat exchangers: Drill out the pop rivets holding the exchangers to the frame; make sure the rivet holes are not enlarged when drilled.
5. Remove the tunnel protectors: Drill out the rivets, again making sure not to enlarge the holes.
6. Connect the rear heat exchanger: Use 1-inch I.D. radiator hose to connect the rear heat exchanger to the two hoses coming from the radiator and water pump. An additional 1-inch O.D. pipe nipple is needed to join the hoses. About seven feet of hose is required.

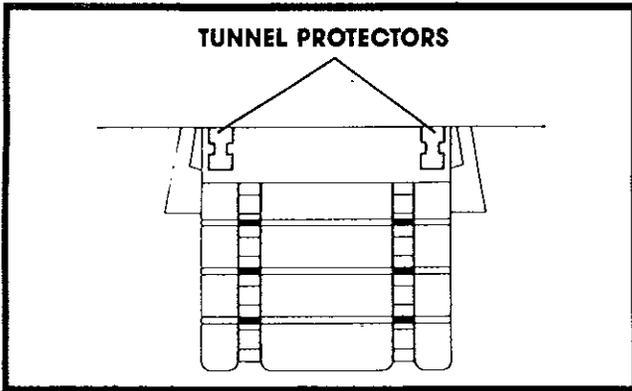


7. Install a second heat exchanger (optional): The short heat exchanger may be installed in the center of the tunnel as shown in the illustration; it

will provide additional cooling.



8. Install new tunnel protectors: New, full-length tunnel protectors at least 5/8- to 1-inch thick must be installed to prevent the traction products from damaging the tunnel. The method shown here is only one way of doing this. Using Yamaha tunnel protectors (888-21978-00-00), modify them as necessary to fit. Install the modified tunnel protectors as shown in the following illustration.



Bolt each end of the tunnel protector with a 6mm screw and a lock nut. Use 3/16- and 9/16-inch aluminum rivets in the middle nine holes.

NOTE: The tunnel protectors are located above the outside track belts to leave the center belt available for additional studs if needed. Yamaha recommends using studs in the outside belts only when oval racing or for high-speed cornering.

9. Rivet aluminum plates over the holes left by the removal of the heat exchangers.

10. Fill in all empty rivet holes with short 3/16-inch pop rivets.

11. Install the track and suspension.

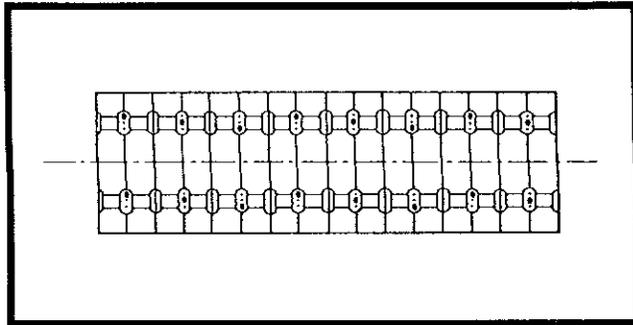
12. Install the fuel tank.

13. Modify the seat base: The seat base must be modified to accommodate the hoses coming from the heat exchanger(s). Remove the plywood base from the seat, and cut away the plastic and foam to allow the hoses to pass through. Replace the plywood base and route the hoses through. Make the hose connections and secure the seat.

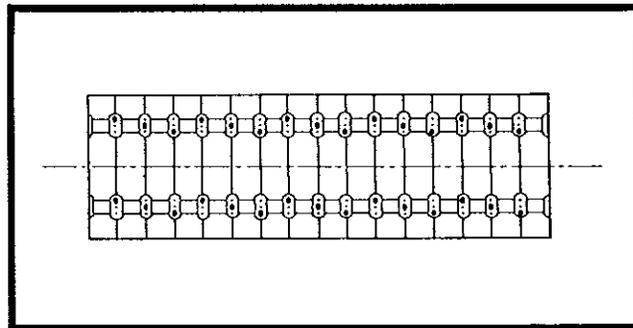
SUGGESTED STUD PATTERNS

The following are suggested patterns for installation of the special plates and for additional studs in the center of the track.

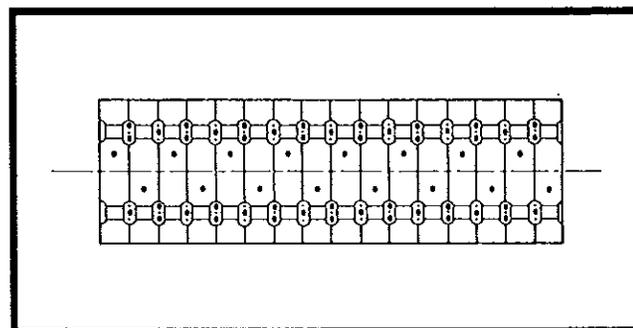
Half Hooker track; every other clip has a Hooker plate.



Full Hooker track; every clip has a Hooker plate.



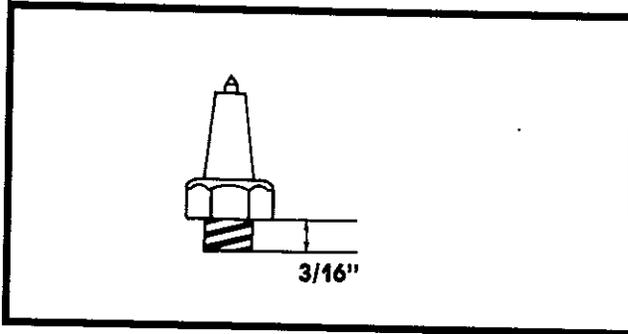
Full Hooker track with additional studs in the center belt.



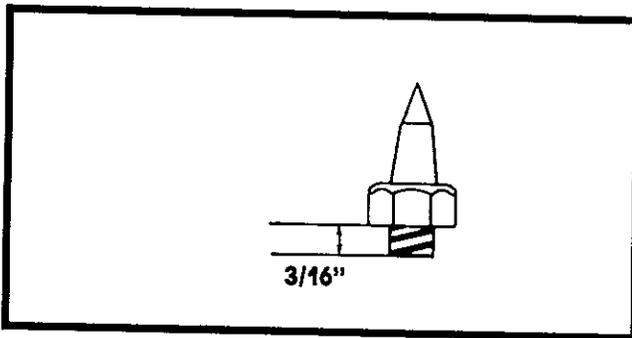
TYPES OF TRACTION PRODUCTS FOR USE WITH THE HOOKER TRACTION SYSTEM

Hooker studs are shorter than the standard studs overall and the threaded portion has only three threads. These are the **only** studs that can be used with a Hooker track.

1. Consumer-type pick: This is an unsharpened, carbide-tipped stud. It is very durable and offers consistent performance. It is also the least expensive of the carbide-tipped studs.

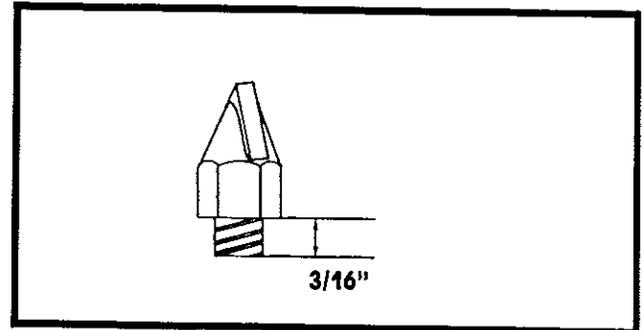


2. Racing-type pick: This is a sharpened consumer pick. Such picks are often used in racing because of their good performance. Because of the sharp point, however, they are not as durable and the performance level will fall as they become dull.



3. Wedge-type pick: This is a carbide, inverted-

V-tipped stud that offers the maximum in traction and durability. It is also the most expensive type of stud.



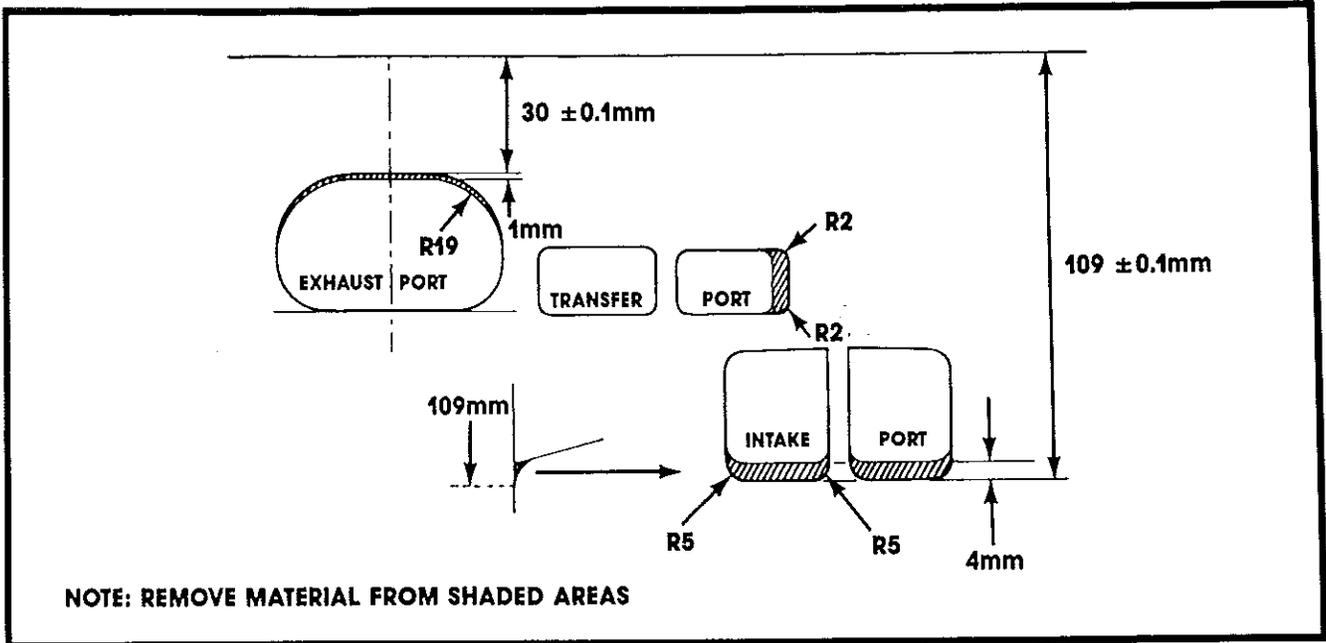
STAGE 3

Additional performance can be gained through engine and clutch modifications developed by Yamaha. These changes, when executed correctly, will provide an increase of about 8-1/2 horsepower while maintaining engine reliability. The procedures require no additional expenses for exotic equipment and do not increase the sound level of the machine, but can provide from five to eight miles per hour more top speed and quicker acceleration under good conditions.

To realize the full potential of these modifications on icy conditions, it is necessary to install either Stage 1 or 2 traction systems.

CYLINDERS

Using a hand grinder, grind away the port material shown in the shaded sections of the illustration, being sure to match the specifications given. Note that the figures in brackets represent approximately the amount of material to be removed. This is for initial layout only. The final dimensions of the ports should match exactly those specifications shown.



CAUTION:

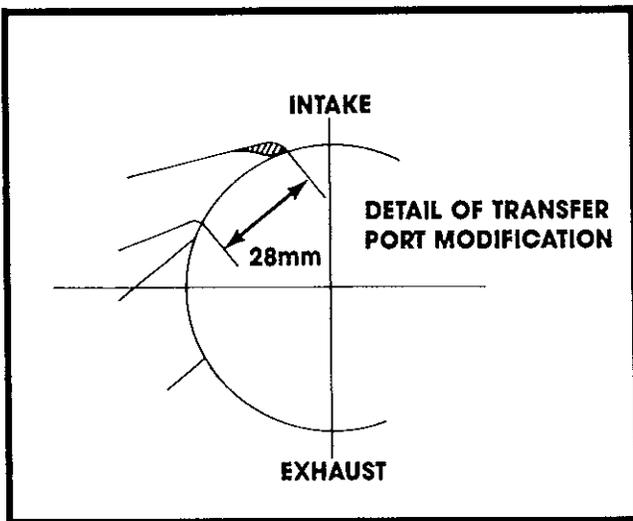
Be sure to chamfer all ports.

Grind material from the transfer port as shown in the illustration.

NOTE: This illustration refers to the transfer port windows leading into the cylinder; *this is not at the base of the cylinder.* This transfer port modification must be done correctly to obtain the indicated horsepower increase.

CYLINDER HEAD

Machine 0.3mm of material from the cylinder head gasket surface. For best results, check the total volume of each combustion chamber; the volume should be $26.3 \pm 0.2\text{cc}$. If either combustion chamber volume is outside of this range, modify accordingly.



CARBURETION

For 1984 Vmax models (VMX540H), **no changes to carburetion are necessary.**

For 1983 models (VMX540G), the following parts must be replaced.

NOTE: These specifications are for sea level operation. For higher altitudes, refer to the tuning data in Technical Bulletin S83-013.

ITEM	LEFT CARBURETOR	RIGHT CARBURETOR
Power Jet	Same	#130 (256-14944-26-00)
Power Air Jet	Same	1.8 (239-14172-18-00)
Pilot Jet	#40 (193-14142-40-A1)	#40 (193-14142-40-A1)
Throttle Valve	3.0 (8X6-14112-30-00)	3.0 (8X6-14112-30-00)
Jet Needle	6DH1-3 (275-14116-A0-00)	6DH1-3 (275-14116-A0-00)

The new-style throttle valves and jet needles have a new type of retainer. Order the following parts for use with the new-style throttle valves:

PART NUMBER	DESCRIPTION	QUANTITY
98502-04008-00	Screw, pan head 4 x 8mm	2
92902-04100-00	Washer, spring 4mm	2
2H0-14235-00-00	Washer, needle	2
3V3-14136-00-00	Seat, spring	2

OILING SYSTEM

The additional power output resulting from these engine modifications requires changes in the engine's oiling system. For 1984 Vmax models (VMX540H), you may either retain the standard oil pump **and use premix fuel at a ratio of 50:1** or change to the 1983 oil pump. For 1983 Vmax models, no change is required. Note that this additional lubrication is necessary to ensure connecting rod and crankshaft bearing operation, not to prevent piston seizure.

PRIMARY CLUTCH

Increases in power output naturally require changes in clutching specifications. Understand

that the following recommendations are initial settings and that optimum performance under local conditions can only be obtained by field-testing each machine.

Install primary spring 90501-55388-00 (blue-white, 40.7-2.43 rate). This spring has a larger outside diameter, so the spider of the primary clutch **must** be modified. Remove the clutch spider and modify the spring seat area as indicated in the illustration.

NOTE: No presently available Comet clutch spring has the correct spring preload and rate. Modification of the clutch spider therefore is absolutely necessary.

Identical diameters. Do not remove more than 1.5mm of material from any of the wheels. The benefit of these modifications is a considerable reduction of friction within the track as well as an increase in traction.

NOTE: On glare-ice surfaces it is recommended that slide-rail lubricators be incorporated to eliminate friction between the slide rails and track clips.

After completing the above modifications to the suspension, install the track and suspension in the frame. With the V-belt removed, check for free rotation of the track. (Some lubrication will be necessary on the track clips to simulate snow as in normal operating conditions.) Make sure there are no tight spots. If there are tight spots, locate their origin and eliminate them. For example, check for unequal track lug pitch; if found, remove rubber from the appropriate track lug.

ENGINE ALIGNMENT

Install the secondary clutch, and adjust the engine so that center-to-center distance and offset are correct. Now place the alignment gauge under the clutch sheaves and again check offset. If the offset matches, alignment is correct and the crankshaft and jackshaft are parallel. If offset is different when measuring from beneath the clutch sheaves, then the crankshaft is tilted with respect to the jackshaft. The remedy is to shim either the left side or the right side motor mounts, depending on the direction of the tilt. Doing this modification will reduce friction, improve belt life, improve shifting and increase performance.

SECONDARY CLUTCH

A significant source of friction on the secondary clutch is aerodynamic. The ribs cast on the outer faces of the clutch act like propellers and produce considerable drag at high speeds. This drag can be eliminated by installation of "windage" plates from the Phaser. Order the following parts:

PART NUMBER	DESCRIPTION	QUANTITY
8V9-17665-00-00	Plate #1	1
8V9-17675-00-00	Plate #2	1
98501-05010-00	Screw 5 x 10mm	6
92503-06012-00	Screw 6 x 12mm	3
98501-05008-00	Screw 5 x 8mm	6

Use the plates as a template, and drill and tap mounting threads. Notice that the Vmax clutch has mounting bosses already cast in place. Be sure not to mix screw lengths so that balance will not be affected.

CAUTION

Under some circumstances this modification will increase secondary sheave temperatures, thereby reducing V-belt life and clutch performance below the acceptable level.

FINAL STEPS

Again, final clutch calibration can only be done after all modifications have been made and the machine is tested under the conditions in which it will be operated. **All increases in performance can be lost here if clutch setting is improperly executed.**

