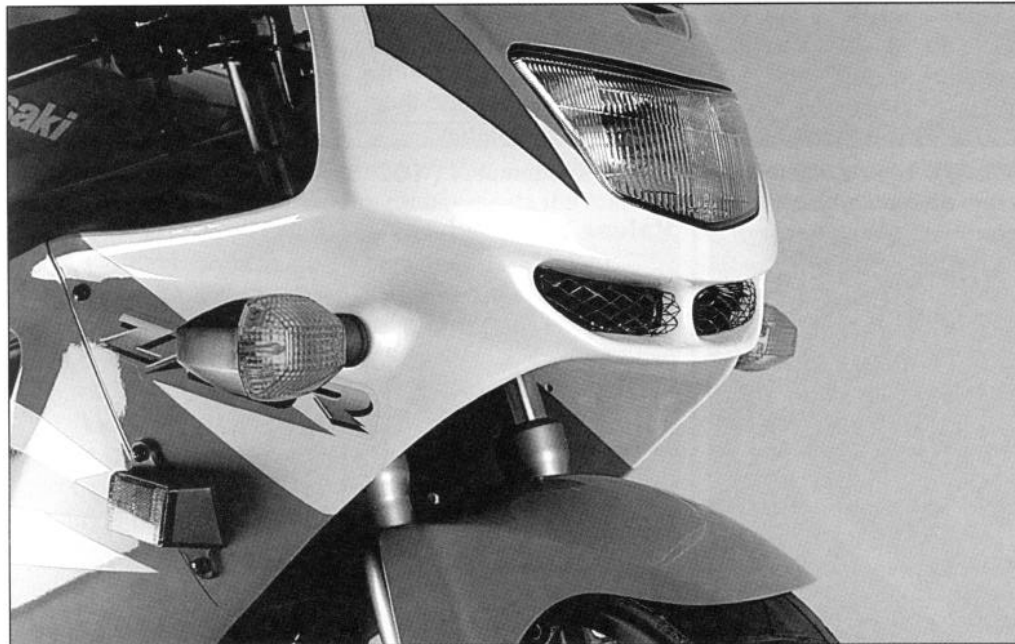




Volumetric Efficiency



by Patrick Kelly
*Instructional Designer/
Instructor*

Last issue we defined what horsepower is and examined the relationship between horsepower and torque. This issue, we will start exploring the different ways engineers are extracting more and more horsepower from today's engines.

The modern motorcycle engine has become increasingly efficient. For example, the original "superbike"—the Kawasaki Z-1—displaced 903cc and produced a then-awesome 83 hp at 8,000 rpm. Today's ZX-9R displaces 899cc and produces a *now*-awesome 139 hp at 11,500 rpm. That's 67 percent more power from virtually the same displacement.

Ten short years ago, the liquid-cooled, four-valve-per-cylinder "state of the art" ZX600-A1 produced 75 hp; the ZX600-F1 now produces 40 percent more.

And these are only a couple of examples where horsepower has gone up dramatically, without an accompanying increase in displacement. So what is the secret? How is this done?

Unfortunately, there is no secret, no magic and no single answer. Engineers have worked to improve the motorcycle's

CONTINUED ON PAGE 2

ROUTE LIST: SERVICE PARTS SALES
PLEASE RETURN TO SERVICE LIBRARY

Inside!

■ Service tips & more!

Efficiency

CONTINUED FROM PAGE 1

performance in virtually every area, from how the fuel/air mixture is packed into the combustion chamber and how well it is burned, to how efficiently the power is delivered to the rear wheel.

Let's discuss one area of engine efficiency, known as volumetric efficiency.

That's efficiency

Volumetric efficiency is a measure of the volume of air an engine inhales

compared with how much it would hold if 100 percent full. For example, if we had a 500cc single cylinder engine that took in 500cc of air on the intake stroke, then that would be 100 percent efficient.

Volumetric efficiency is simply a measure of how well an engine breathes.

Of course, this efficiency varies throughout the engine's rpm range. The rpm at which an engine reaches its peak torque output is the rpm of high-est volumetric efficiency.

Some engines are

tuned for low-rpm torque and thus have smaller port and valve sizes, and shorter-duration cams that are most efficient at low rpms. These low speed engines simply cannot breathe well at higher rpms.

On the other hand, high-speed, high-output engines have large port and valve sizes combined with long camshaft duration times. The large ports and long valve-duration times take advantage of the air's momentum at high rpm for maximum high rpm breathing efficiency.

Let's look at the engine in our latest "state of the art" two-wheeler, the ZX-6R, to see how its volumetric efficiency has been maximized.

First and most obvious is the design and layout of the intake system. The ZX-6R's twin ram air induction system starts at the front of the bike, feeding the engine cool, fresh air. Since cooler air is also denser air, it means more air in the cylinder and thus improved volumetric efficiency.

Valves included

Sometimes changes in engine design are indirectly related to improvements in other areas. For example, in the last few years modern high performance motorcycles have had their intake ports angled upwards, to straighten the port and improve breathing efficiency. But this change is directly related to another factor, the included valve angle (the angle between the valve stems).

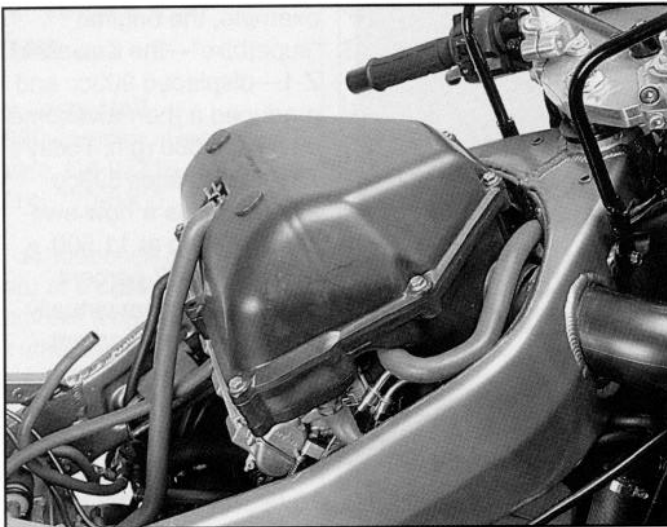
In recent years this angle has become narrower and narrower, bringing the angle of the valve stems closer to parallel with the centerline of the cylinder, all to make a compact combustion chamber for improved combustion efficiency.

To prevent putting a sharp bend in the intake port, the port is angled upward. So it is actually the angle between the port and the valve stem that is important for maximum breathing efficiency. As the valve stem has been brought closer to parallel with the cylinder center-line, so has the port.

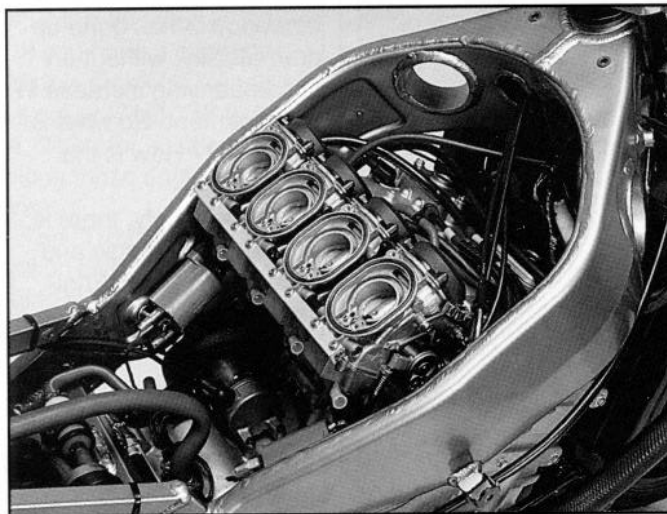
Let's compare the ZX-6R's intake port-to-valve angle with the ZX-6's: The included valve angle of the ZX-6 is 30°, 15° relative to the cylinder for both the intake and the exhaust valves. The ZX-6R's included valve angle is 25°, 12° relative to the cylinder for the intake and 13° for the exhaust.

The ZX-6's intake ports are at a 56° angle relative to the cylinder, while the ZX-6R's intake ports are 6° closer at 50°.

Let's try to make some sense of all this: The ZX-6R's intake valve was angled 3° closer to the centerline of the cylinder to make the combustion chamber more compact, and the port was angled 6° closer to keep the port close to parallel with the valve stem. What does all this add up to? The ZX-6R's intakes ports are 3° closer to being parallel to the valve stem than the



The list of improvements in the ZX-6R's engine efficiency begins with the bike's high-tech ram air induction system.



ZX-6's; and so the ZX-6R breathes better.

The positioning of the camchain on the right side of the engine instead of the middle also allows the ports to be straighter. And, again, this change is related to other improvements—in this case a stronger crankshaft and a more compact engine.

Small details

Inside the engine are contributors that are smaller and not as obvious, but equally important to effi-

cient breathing. For example, much attention was paid to the valves themselves. Valve stem diameters are a minuscule 4mm. These small diameter stems keep interference with the air flow in the ports to a minimum and increase the effective port area.

Also, the amount of material where the valve head meets the valve stem is kept to a minimum for maximum air flow. The bottom surface of the valve is flat for less sur-

face area. This allows the valve to stay cooler, which keeps the incoming charge cooler, increasing volumetric efficiency ever so slightly.

Taken by themselves, these seemingly small changes to improve volumetric efficiency would not have much benefit. But, the combined effect is

greater than the sum of each subtle individual change. Each year, the edges of engine development are pushed a little further.

As for the future, no one knows for sure, but it will surely be interesting. What is "state of the art" today will almost certainly be obsolete tomorrow. □

CATALOG

New special tool catalog

If your dealership has a Micro-K subscription and almost every dealership has at least one—then our new special tool catalog is already in your store. It was included with the December end mailing.

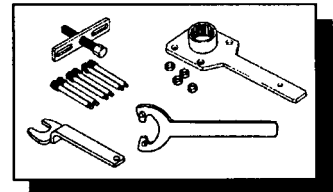
But, in the event you folks in service didn't see the new catalog, we have included one with this issue just for you.

One thing you will notice when you pick up the fiche are the "eye-readable" grids which show how the tools are categorized and help you get to them fast.

If you are doing a top end job, for example, you would look in the "Top End" chapter of the service manual, right? Well, the tool catalog is organized the same way: All the tools you need for a top end job are together.

Oftentimes, as you probably know already, some tools shown in the service manuals are not available in the U.S. market. Or, there are substitute tools available from KMC that are not shown in the service manuals. So, how do you find out? Refer to the master index at the begin-

ning of the fiche. It lists special tool part numbers—which ones are available from KMC and which ones substitute to another tool. available tool part numbers are in bold.



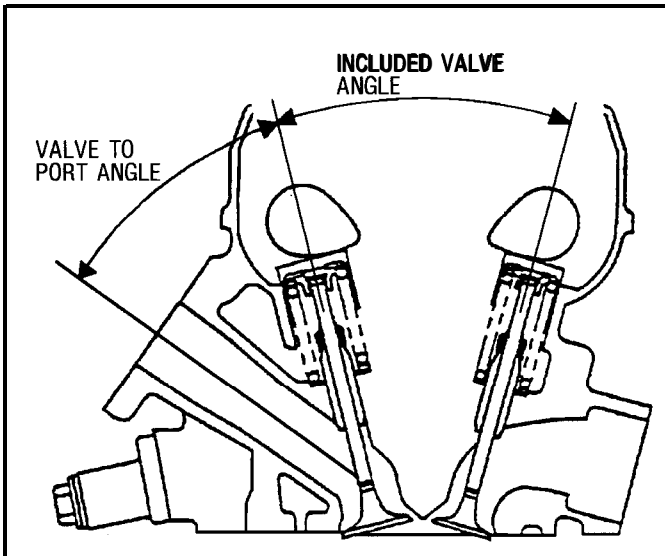
The tool catalog also has sections for product-specific tools for products like watercraft. It also has a section for kits and individual pieces that are available.

Take a few minutes now to familiarize yourself with the layout of the tool catalog and it will save you time later on.

If you have any comments or questions regarding the catalog, please give us a call. We are always looking for ways to improve our service to you.

And, for those of you who would prefer to have a printed copy of the tool catalog, you can order it from the Distribution Center using P/N 99960-0065-01.

The dealer cost is \$7.75
—Don Church



(ABOVE) A guide to angles; (BELOW) Volumetric efficiency improvements where the rubber meets the road!



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Motorcycle Mechanics Institute Advisory Committee

by **Don Church**
*Manager, Service Training
 and Communications Dept.*

Service Managers: I'm sure you all have certain expectations regarding the skills you feel an entry level technician should have. And then there are the "intangibles" possessed by your top performers.

How do you find people with the right combination? Not easy, is it.

The Motorcycle Mechanics Institute (MMI) understands that the key to their success is their skill at providing employers with graduates who are properly trained to meet expectations. So, what are they doing about it?

MMI has been working for three years to modify its curriculum so the skills of their graduates better meet the needs of prospective employers. But, trying to get a consensus from dealers about what those needs are has been difficult. So, MMI formed two Technical Training Advisory Committees--one for motorcycles and ATVs that met at the Phoenix campus in December; and another one for watercraft that met at the Orlando campus in March.

In the December TTAC meeting, 11 manufacturer and dealer representatives broke into smaller groups along with senior MMI instructors to answer some key questions concerning the abilities and performance characteristics desired in an entry level MMI graduate. The small

groups then came together to hammer out a consensus. As it turned out, achieving a consensus was not too difficult; but the relative importance of some ideal characteristics of a successful entry-level technician may come as a surprise.

Listed in the order of importance:

1. Professional Work Habits

- Attention to detail;
- Tools used correctly;
- Good communication skills with fellow employees and customers;
- Knowing own limits (get help when needed);
- Organized work area;
- Reference material used;
- Systematic approach used.

2. Good Work Ethics

- Initiative;
- Positive "can do" attitude;
- Listen to and follow directions;
- Respect authority/accept constructive criticism;
- Punctuality;
- Follow-up on jobs;
- Respect vehicles;
- Tolerate ambiguity;
- See from perspective of owner/customer.

3. Technical Ability/ Proficiency When Hired

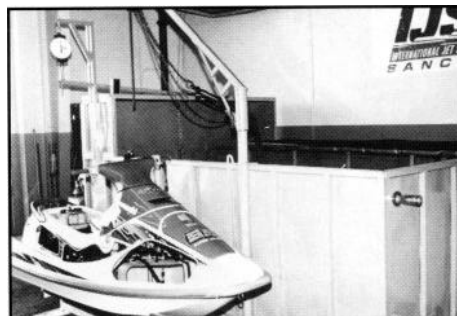
- Set up and service new units;
- 5000-mile service;
- Handling vehicles (loading, rigging, shipping);
- Replacement of hardware/accessories;
- Parts cleaning, gasket removal;

- Routine brake service;
- EGA familiarity;
- Two-stroke top end R&R;
- Tire changing and selection;
- Carb R&R and cleaning;
- Basic electrical diagnostic checks and repairs;
- Routine drivetrain repair;
- Service writing (writing R.O.'s);
- Minor trade-in reconditioning;
- Use reference materials;
- Systematic approach to diagnosing problems.

The general consensus was that dealers would prefer to hire an MMI grad with technical ability who had professional work habits and good work ethics, and then assist him or her in developing their service skills--this as opposed to trying to teach an "ace" good work habits and ethics.

MMI is ensuring that all students and instructors are aware of the Technical Training Advisory Committee's recommendations. The school will adjust its lesson plans where needed to ensure that all entry-level skills, as identified by the committee, are thoroughly covered.

And, finally, MMI will be expanding the emphasis on good work habits and ethics in all clinics through examples and follow-up lessons to the "Expectation Challenge." □



(LEFT) MMI's Orlando campus: Kawasaki 750SS cutaway sits next to an indoor test tank--both made by instructors and students in the PWC course.

SERVICE CONTEST

Congratulations, Service Contest No. 2 winners!

The results of Service Contest No. 2 are in! The names of those who scored 80 percent or better are listed on Page 6. Congratulations to all the winners!

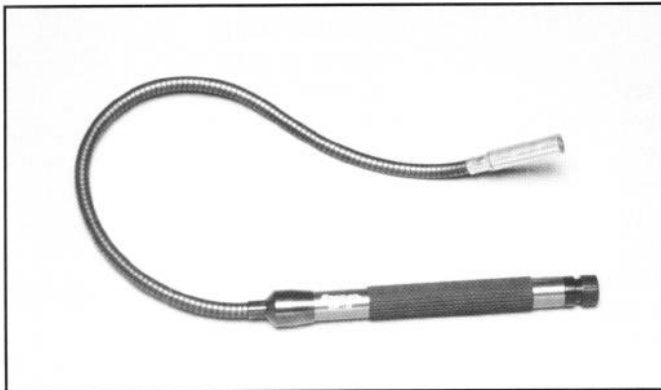
The top award for all the winners is an electromagnetic pick-up tool from Snap-On.

The third and final test in this series is included in this issue and covers Jet Ski® watercraft. Even if you did not win the first two contests, don't give up! You can still qualify for an award with a score of 80 percent or better on this one.

If you are a Jet Ski expert, now is the time to

put all of your knowledge to the test. Good luck!

- The deadline for this third and final part of the contest is May 12.
- The contest is open to any Kawasaki dealership personnel.
- Contestants may use any materials and information available to answer the test questions.
- Send completed tests to: Service Contest No. 3, Kawasaki Motors Corp., U.S.A., 9950 Jeronimo Rd., Irvine, CA 92718. □



(ABOVE) Service Contest No. 2 award: an electromagnetic pick-up tool! (BELOW) Two helpful service department forms

Visual Inspection Checklist		
<p>OWNER: _____ YEAR/MODEL: _____ ADDRESS: _____ FRAME #: _____ VIN: _____ LICENSE #: _____ DAYTIME PHONE: _____ REPAIR ORDER # _____</p> <p>The following information is being provided to our service department as a special service to you. We have taken the liberty to research repair procedures for you and we hope you will find them helpful. If you have any questions, please call our primary contact. Thank you for your business and we hope to see you again soon.</p>		
CHASSIS	NEEDS ATTENTION	COMMENTS
<p>Visual Check</p> <p>Exterior Damage</p> <p>Body and Color Condition</p> <p>Interior</p> <p>Turn Signal</p> <p>Hazard</p> <p>Headlight</p> <p>Headlight Lens</p> <p>Speedometer/Cluster</p> <p>Emergency Brake Switch</p> <p>Ignition Switch</p> <p>Seat/Center Stand</p> <p>Motor & Charging System</p> <p>Lubrication System</p>		
<p>ENGINE/OIL/VE TRAN</p> <p>Oil Level</p> <p>Oil Condition</p> <p>Water Pump</p> <p>Clutch/Fuel System</p> <p>Oil Filter</p> <p>Lubrication</p> <p>Other</p>		
<p>Thank you for letting us service your vehicle.</p> <p>Service Department</p> <p>PN 0886-769</p>		

HOTLINE WORK SHEET																		
HOTLINE CONTACT: _____		LOG # _____																
MODEL: _____		FRAME: _____																
RELEASE: _____		FAIL DATE: _____																
CUSTOMER: _____		DESCRIPTION OF TROUBLE _____																
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<p>CLASSIFY THE CHECKED ONE: 11 PRE-PAID 12 MONTHLY 13 RETAIL PRICE 14 BULK PARTS 15 NECESSARY 16 UNKNOWN 17 ESTIMATE</p>																		
AUTOMOBILE NEW INC.		AUTOMOBILE RETAIL																

Micro-K: MSDS ... by law

by Dave Pyle
Parts Publications Specialist

By now you should have received your copy of the Material Safety Data Sheets (MSDS) on microfiche. This information is required by law to be kept on hand and available at your dealership.

Take a few minutes to review the information contained on this microfiche. The introduction, table of contents and indexes are all included on the "A," or top, row.

Three separate indexes are included to help make finding information easy.

First is the "Product Index" that will help you find the MSDS by the type of product, such as paint or chain lube. The second index is the "Part Number" index. The third index is the "Manufacturer Index" which is helpful in finding products that are commonly known by their brand names ("LocTite" or "Bel-Ray").

Additional copies of the MSDS microfiche are available at no charge by ordering P/N 99961-5008.

Paper copies are also available by calling (714) 770-0400, ext. 2473. □

FORMS

Helpful service dept. forms

We would like to tell you about a couple of publications available from us that you might not know about. These are forms that can help you be more organized in your service department and present a more professional image to your customers.

One form is called the "Visual Inspection Checklist" (P/N 99995-769); the package quantity is 20. This is a duplicate-type form (one copy for you, and one for your customer). It has room for all the usual customer and vehicle info at the top, and then a list of visual or functional checks that you can quickly do on any vehicle.

Filling out one of these forms for a customer's vehicle can identify areas that might need attention. This, of course, could be nothing more than a

courtesy to the customer, but it can also bring you more service work if you identify some needed work.

You might offer this as a free service along with certain paid service work, or in connection with a promotion.

The other form is called the "Hot Line Work Sheet." This form is designed to help you keep an accurate and complete record when you are dealing with the Kawasaki Technical Hot Line concerning a particular problem. It will not only help you stay organized as you diagnose and repair a difficult problem, but it will also be a big help to the person who ends up calling for authorization if it is a warranty repair.

If you want some of these forms just call the Hot Line. We'll send you some.—Gregg Thompson

Service Contest No. 2 Winners

Craig Faith	Smith's Cycle	Russellville, Ark.
Daniel Harrington	Kawasaki of Ocala	Ocala, Fla.
John Dohnal	Illinois Kawasaki	Aurora, Ill.
Michael Bertino	Illinois Kawasaki	Aurora, Ill.
Pete Bullard	Garrett's Kawasaki	Streator, Ill.
Dixon Beeson	Dixon's Cycle Center	Scott City, Kan.
Ken Gay	Shawnee Cycle Plaza	Shawnee, Kan.
Curtis Hillman	Shawnee Cycle Plaza	Shawnee, Kan.
Sean Kent	Shawnee Cycle Plaza	Shawnee, Kan.
Andy Reeves	Shawnee Cycle Plaza	Shawnee, Kan.
Jack Scott	Shawnee Cycle Plaza	Shawnee, Kan.
Jim Stuhr	Shawnee Cycle Plaza	Shawnee, Kan.
David Moon	Leer's Cycle Center	Waterloo, Ia.
Joseph Stowell	Joe Brooks Kawasaki	Ionia, Mich.
Doug Engie	Northern Kawasaki	Cloquet, Minn.
Jason Clymer	Jackson Cycle	Jackson, Minn.
Larry Clymer	Jackson Cycle	Jackson, Minn.
Mike Gregory	Jackson Cycle	Jackson, Minn.
Chadd Preuss	Jackson Cycle	Jackson, Minn.
Anthony Bashain	Sports City Cyclery	Great Falls, Mt.
Sean Cox	Sports City Cyclery	Great Falls, Mt.
Scott Dailey	Sports City Cyclery	Great Falls, Mt.
Kevin Lake	Sports City Cyclery	Great Falls, Mt.
Dwight Landreth	Sports City Cyclery	Great Falls, Mt.
Rayburn Sumner	Forsyth Kawasaki	Winston-Salem, N.C.
Anthony Malusa	Campus Cycle & Marine Kawasaki	Centereach, N.Y.
Curtis Schmitt Sr.	Campus Cycle & Marine Kawasaki	Centereach, N.Y.
Panagiotis Vassilatos	Campus Cycle & Marine Kawasaki	Centereach, N.Y.
Greg Becker	Big 4 Kawasaki	Marietta, Ohio
James White	Rehmert Cycle Sales	Versailles, Ohio
David Bjork	Capitol Kawasaki	Columbia, S.C.
Steve Mason	Bare Brothers Inc	Bristol, Va.
Christopher Rowe	Bare Brothers Inc.	Bristol, Va.
Jim Tribou	Wayne Cycle Kawasaki	Waynesboro, Va.

ZXi jet pump bracket removal

by **Kenny Osberg/GT**
Kawasaki Product Support

On the new 750 and 900 ZXi models, the jet pump inlet scoop (referred to as "bracket" on the microfiche) is a separate cast aluminum piece. It's not part of the hull or pump housing as in past models. It's called a bracket because it bolts to the hull and the pump housing bolts to it.

If you ever have the privilege of removing one of these, you will want to remember that it has two 6mm studs in the upper corners that go through the hull into the engine compartment. These studs come through the hull directly behind the electrical box. Each stud has a large washer and a nut on it.

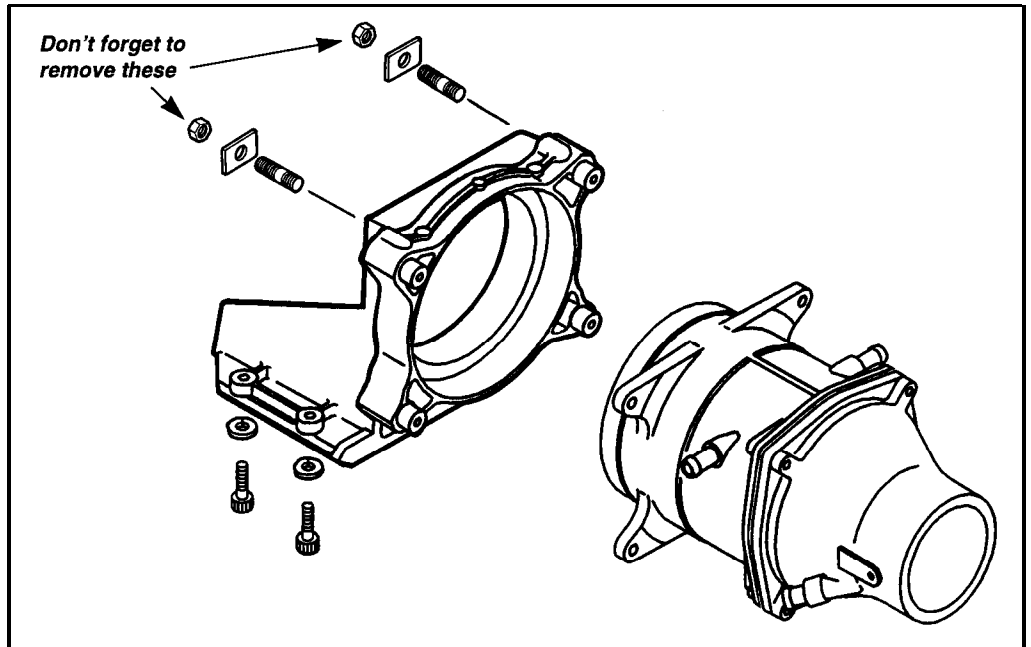
There are also four 6mm Allen bolts that fasten this

inlet scoop to the hull from the bottom, plus there is lots of silicone sealing it to the pump cavity.

The first time you remove one of these, you will be inclined to remove the four

bolts from the bottom and then attempt to pry it loose from the silicone. Without removing the 6mm nuts from the studs inside the engine compartment, you won't get very far.

Even with the nuts removed from the studs, it's not easy to remove this part because of all the silicone sealant. □



SPECIAL TOOLS

JH900-A1 flywheel puller

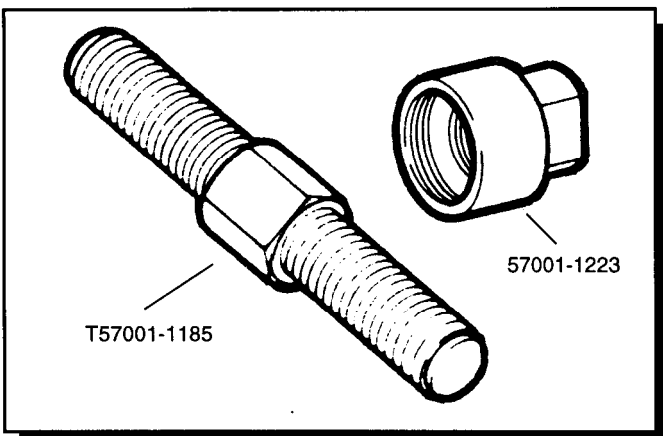
Would anyone out there like to know the part number of the flywheel puller for the new 900 ZXi watercraft?

Actually it is a two-piece tool and there is a separate part number for each piece.

Neither of these is a new part, so you might already have both of them in your tool box.

The numbers are shown on this illustration.

—Gregg Thompson



WARNING!

JH900-A1 cooling line caution

On the new 900 ZXi, the cooling water **inlet** hose and the **bypass** (or outlet) hose are virtually identical in looks and length at the ends where they connect to the exhaust system.

In addition, they connect to the exhaust pipe right across from each other, only inches apart.

Because of their close proximity and identical appearance, it will be very easy to get them switched. Switching these two lines, of course, means no cooling water to the engine. All the cooling water will go into the end of the exhaust pipe and right out through the muffler.

The **inlet** hose comes from a fitting just below the muffler on the front of the jet pump cavity and connects to the exhaust manifold next to the cylinder.

The **bypass** hose comes from a fitting next to the muffler on the top of the jet pump cavity, and connects to the end of the expansion chamber, just before it goes into the muffler.

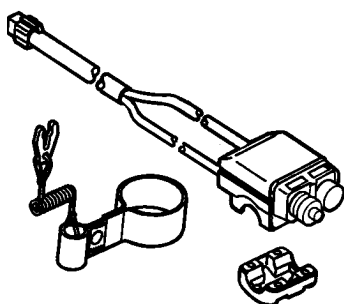
During the initial service and whenever you're connecting or reconnecting these hoses, make sure you trace each one to identify it and then connect it to the proper fitting on the exhaust.

—Kenny Osberg/GT

PARTS

Optional lanyard switches for stand-ups

This year, anyone racing a stand-up type personal watercraft in IJSBA-sanctioned events will be required to equip his/her boat with a lanyard style ("dead man") engine stop switch.



Of course, this type of switch shuts the ignition off if the rider is separated from the watercraft, and has always been required on sit-down models.

Because of this new rule, Kawasaki will make aftermarket lanyard stop switches available for Kawasaki 550cc and 750cc stand-up models as well as the 650 X-2s. These switches will be available as optional parts, and are "bolt-on" replacements for the standard stop switches on the left handlebar.

The part numbers for these optional Kawasaki items are:

- JS550-C2/C527045-3707
- JF650-A9,A10 . . .27045-3708
- JS750-A/B27045-3706

—David Pyle

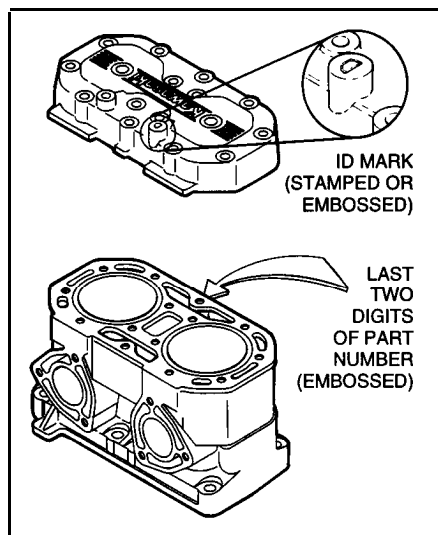
Identifying 750 cylinders and heads

There are now five different cylinder heads and three different cylinders for different models of 750-series watercraft engines. This makes it very easy to get the wrong cylinder head on the wrong cylinder on the wrong engine. And certain mismatches could lead to disastrous results.

To make matters worse, most of these parts look the same on the outside.

The cylinder heads vary in combustion chamber finish and size. They are identifiable either by an embossed "A," "B" or "C," or by a stamped "D" mark on the top of the head.

The cylinders, meanwhile, vary in exhaust port height and are a little easier to identify. The last



two digits of the part number are embossed on the intake side of the cylinder. The exception to this is cylinder P/N 11005-3720, which has no mark.

Below is a chart which will help in identifying Jet Ski watercraft cylinders and heads.—

Kazuhiro Tanaka

Model	Cylinder Head P/N	ID Mrk.	Comb. Volume	Chbr. Finish	Cylinder P/N	Ex. Port Timing*	Comp. Ratio
JS750A	11001-3717	A	31.9±0.4cc	Cast	11005-3720	89°	7.0:1
JS750B	11001-3720	C	28.3±0.2cc	Machined	11005-3724	96°	7.0:1
JH750A	11001-3719	B	29.8±0.2cc	Machined	11005-3722	93°	7.0:1
JH750B	11001-3718**	B	29.8±0.2cc	Machined	11005-3722	93°	7.0:1
JH750C	11001-3722	D	27.8±0.2cc	Machined	11005-3724	96°	7.2:1
JH750D	11001-3718**	B	29.8±0.2cc	Machined	11005-3722	93°	7.0:1
JT750A	11001-3719	B	29.8±0.2cc	Machined	11005-3722	93°	7.0:1
JT750B	11001-3722	D	27.8±0.2cc	Machined	11005-3724	96°	7.2:1

*BBDC/ABDC
** Identical to P/N 11001-3719 except external color is Lime Green.

PARTS

750SX handlepole bushings now replaceable

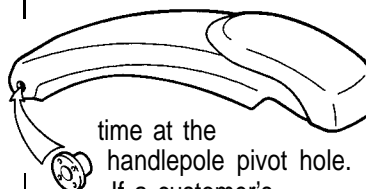
For 1995, the stand-up 750cc Jet Ski® watercraft—the SX and SXi—come with replaceable bushings in the handlepole pivot. Prior to '95, they did not.

However, all the old handlepole part numbers substitute up to the new one that takes the bushings. Since the bushings have a separate part number and don't come with the handlepole, you must order the bushings any time you order a replacement handlepole for any unit that doesn't already have them.

You will need the bushings because, regardless of which handlepole you order,

you will receive the kind that takes the bushings.

Earlier 750SX watercraft (those that don't have the bushings) typically experience wear after a period of



time at the handlepole pivot hole.

If a customer's handlepole is worn excessively at the pivot, but in good shape otherwise, you might want to consider repairing it with the bushings rather than replacing the entire handlepole.

To install the bushings,

you will have to drill out the pivot hole large enough to receive the bushings.

Prepare some epoxy and smear it inside the pivot hole and on the bushings before installing them. Kawasaki Hull Repair Kit will work for this, but there are epoxies available that cure much faster.

While the epoxy is curing, set the handlepole in the bracket and put the pivot shaft through the hole to ensure perfect alignment. If you use a sea-going epoxy putty like our Hull Repair Kit, let it cure overnight before using the watercraft.

—Kenny Osberg/GT

KAF450-B1 transmission

by David Pyle
Parts Publications Specialist

In early MULE™ 1000's (up to engine no. 003435), the shift fork fingers are 5mm wide at the point where they ride in the groove of the shifter (or slider). The groove in the shifter is just slightly wider, allowing for oil clearance.

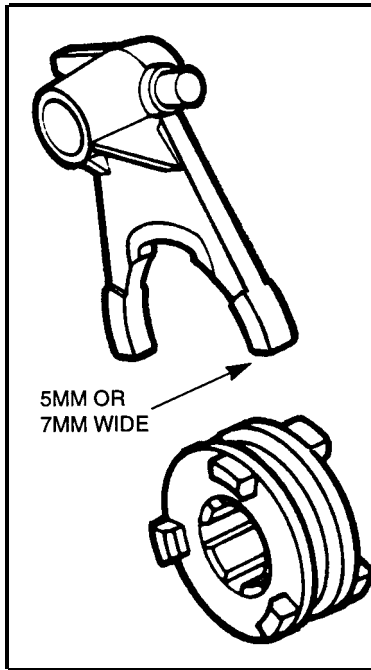
From engine number 003436, the shift fork is 7mm wide. Of course, the shifter is changed, too.

For obvious reasons, these parts are not interchangeable except as a set. The wider shift fork and slider are available in a kit which also includes other updated parts.

If you are replacing either of the older (5mm wide) parts, you should just order the kit (P/N 99995-1193). Replacing the older-style parts with the kit will result in a more durable transmission.

For your reference, the kit P/N is listed on the part microfiche. And each of the parts contained in the kit is identified with an asterisk (*) on the exploded view drawing.

There are kit parts listed on the Transmission grid and on the Gear Change Drum/Shift Forks grid. □



TECHNICALITIES

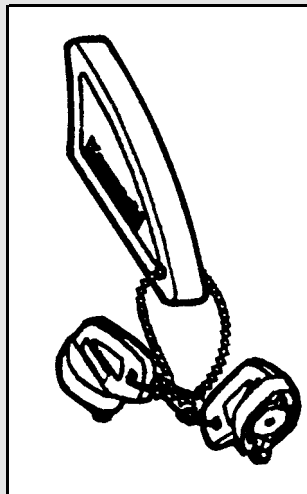
750 and 900 ZXi keys

You may be surprised by the price the first time you order one of those magnetic ignition keys for the new ZXi's. The retail is over \$27!

What isn't obvious from the microfiche is that by ordering the part number for a key you will get a set of two keys and the little flotation key ring.

You might consider stocking some of these keys if you plan on selling lots of these new ZXi's.

—Gregg Thompson



TIP

Sticking reverse lock shafts

We've had some reports of KLF220s with reverse lock levers that stick in the reversed position (i.e. the transmission will shift into reverse without turning the reverse knob). Typically when the dealer inspects one of these units, there doesn't seem to be any obvious cause of the problem. The parts all look OK.

We think the binding in the shaft is caused by a slight misalignment of the holes in the engine cases and the bevel gear case when assembled. Often, disassembly and reassembly with a new return spring on the lever solves the problem (at least temporarily).

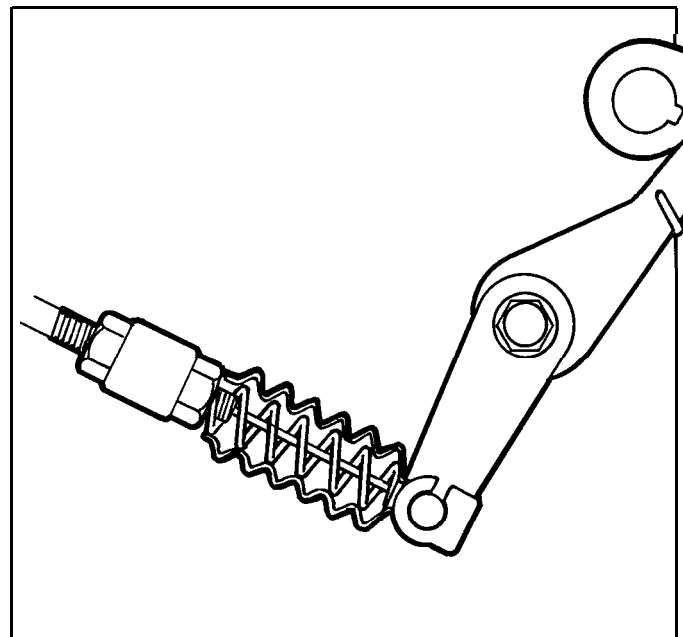
If you run into one of these, there is a way to solve the problem without taking the bevel gear case off. It does, however,

require sacrificing a KE100 front brake cable.

The spring (cut in half) and boot from one of these brake cables will fit over the end of the KLF220 reverse lock release cable, replacing the boot that comes on that cable. The pressure provided by this spring should be enough to ensure that the lock lever shaft will return to the locked position when the reverse knob is released.

If you use this fix, be sure to cut the KE100 brake cable spring in half or shorter. If the portion you use is too long, the control knob will be difficult to operate. Also, the boot will have to be shortened some in order to fit.

—Randy Davis/GT



READERS NOTE: Service Contest
No. 3 answer sheets are due
May 12! (See Page 5.)

KAF620 torque converter removal

by John Pomo/GT
Kawasaki Product Support

The KAF620-A1/B1 (MULE™ 2510/2520) Service Manual text begins describing the torque converter removal, like this:

“Remove: Cargo Bed, Air Ducts, Torque Converter [Outer] Cover”

... and then it goes on to the removal of the torque converters themselves. If you have ever done this job, you probably know you don't just “remove the torque converter cover”! There isn't enough room between the drive converter and the frame to get the cover out without moving something else. Cutting the frame is a tempting idea, but not recommended. Instead, we recommend you pull the drive converter off the crankshaft and then remove the cover and the converter at the same time.

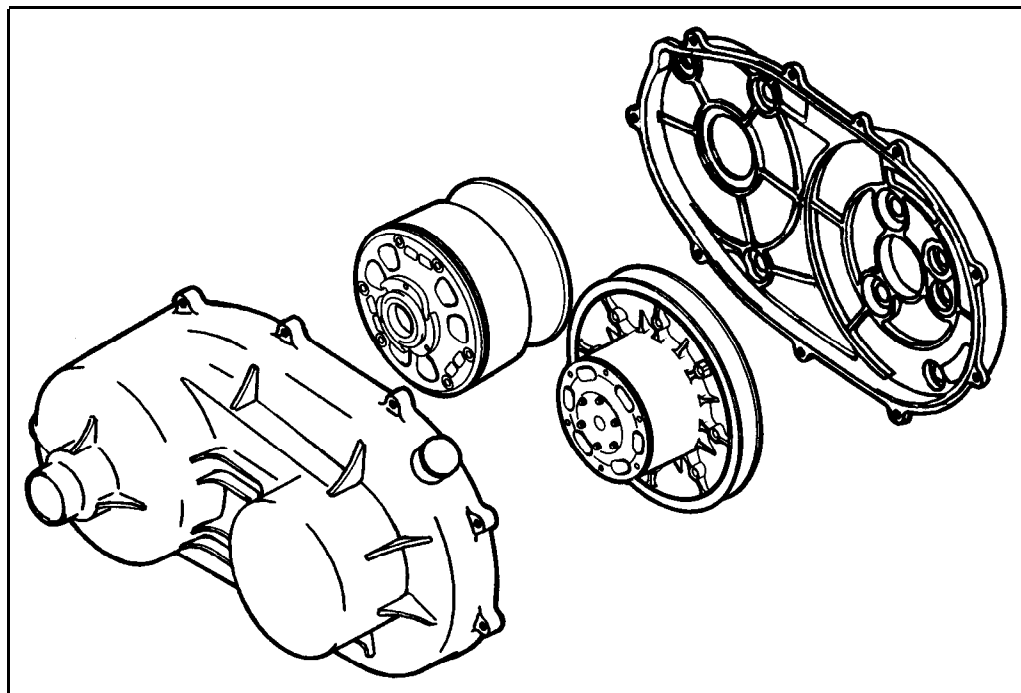
To do this, remove the air inlet duct and go in through the hole in the cover with an impact wrench and

an extension to loosen the drive converter bolt. Remove the outer cover mounting bolts and pull it away from the inner cover. Reach in and wind up the driven converter's movable sheeve and pull enough slack into the belt so it will come off the drive converter. Slide the drive converter off the shaft into the cover and

remove the two together.

If the job you are doing requires engine removal, you must align the engine and transmission when reinstalling the engine. Kawasaki sells a special tool for this, but actually the inner torque converter cover does the job just fine. Just tighten the torque converter inner cover to

both the transmission and the engine before tightening the engine mounting bolts. (Make sure the positive and negative battery cables are routed properly before doing this). The cover will hold the engine in proper alignment while you torque the engine mounting bolts. □



TECHNICALITIES

Tips from the field: KLF400-B final drive pinion

We recently received a note from Donnie Margraves, service manager of Good Time Cycle Co in Tyler, Texas. In it he gave us the Kawasaki part number for the rear final drive pinion shaft bearing on the KLF400 Bayou.

It seems that on the 400 Bayou parts fiche, that bearing is only listed as pan of the Ring and Pinion Gear Set. It is not listed separately. Donnie didn't like selling the customer a

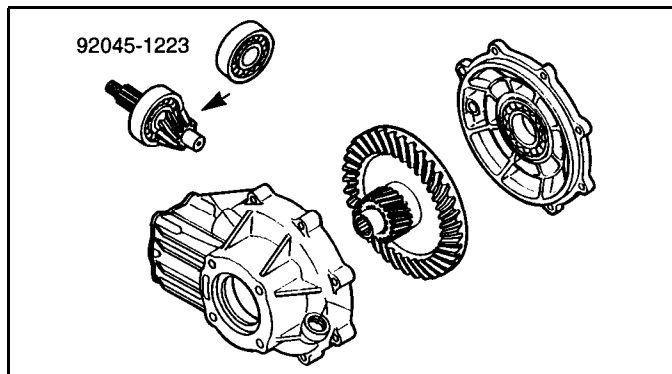
whole ring and pinion set when the bearing was the only bad part. So, he hunted around and found the same exact bearing listed separately on the KLF300 Bayou parts microfiche.

If you ever need to replace just the rear pinion shaft bearing on a KLF400-B, the part number is 92045-1223. It is listed as 92045-1276 on the KLF300 C1/C2/C3/C4 Bayou microfiche. The 1276 number

subs to the 1223 number.

Thanks for the info, Donnie. As always, if your

tip gets printed, you get \$100. The check is in the mail.—Ed.



Darkroom secrets: How to photograph a white hull

by **Gregg Thompson**
Product Support Supervisor

Kawasaki will repair cracks in watercraft hulls under warranty as long as we believe the damage occurred as the result of normal use. When a customer asks for such warranty coverage, the dealer must call the Hot Line, discuss the matter with a technician and obtain a log number before having the repair done. In most cases, we will want the dealer to get an estimate (or write his own) and take some pictures of the damage.

To help us decide if the damage should be covered and whether or not a repair estimate is reasonable, we need photographs that clearly show the damage. This presents a problem that many dealers have not been able to overcome.

Most of the pictures we receive are either over-exposed or out of focus. Either way, the cracks are usually not visible at all.

Taking pictures of a crack in a white hull is not real easy! But if you follow a few basic rules, you can take pictures that show even hairline cracks.

Rule number 1 is **don't use a Polaroid** unless you're shooting a very large crack. Even then, it's not a good idea to use a Polaroid because any small cracking around the large one will not show in the photo.

If you don't have a 35mm SLR camera available, buy an inexpensive "point-and-shoot" or a disposable (single use) 35mm. If you buy a disposable camera, get the cheapest one you

can (with no flash); it will work fine. We will reimburse you the cost of the disposable camera and developing.

Make sure the cracks you wish to photograph are **easily visible**. If they're small, enhance them with some penetrating dye. You can buy these dyes (like Magnaflux Spotcheck), or

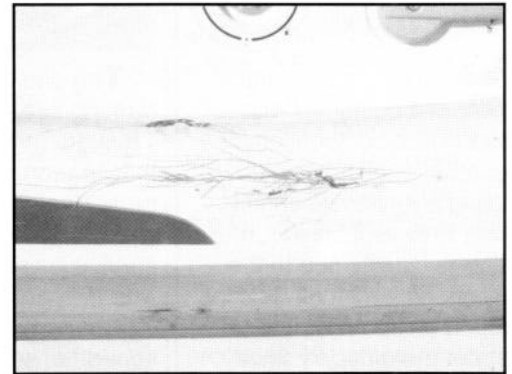
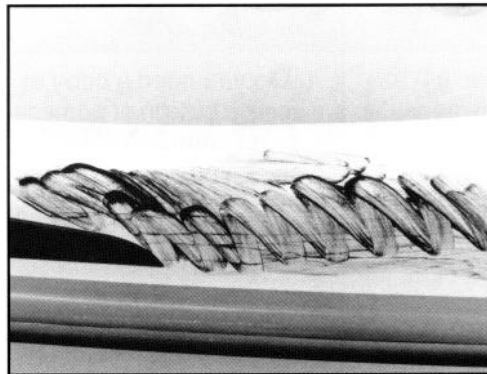
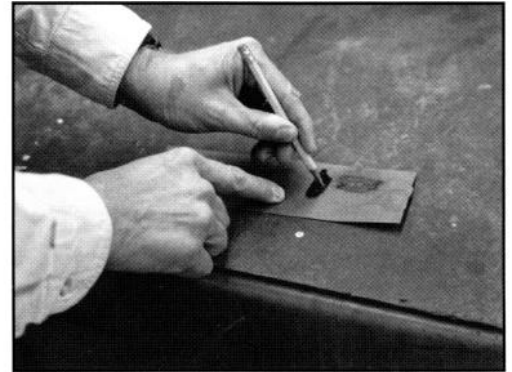
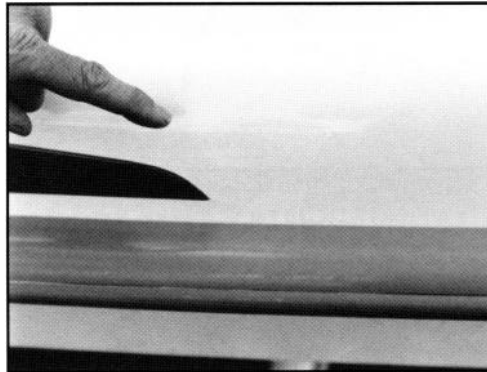
will be much more visible.

Take your pictures in **soft available light**. Avoid any source of bright light shining directly on the surface; this includes direct sunlight, camera flash and bright shop lights.

The best conditions will be found early or late in the day, outdoors in the shade.

you're using and take your pictures accordingly. If everything else is done right, 4 feet is plenty close enough to show any hull damage.

And while you're taking pictures, step back and take a picture of the whole boat showing the damaged area. If there are several areas on the vehicle that



(TOP LEFT) Cracks on a white hull are all but invisible in bright light. **But a homemade dye, brewed from a mixture of graphite (TOP RIGHT) and a light oil, and then (ABOVE, LEFT) rubbed on, works wonders: (ABOVE, RIGHT) The final photo should look like this.**

you can use a penetrating oil with graphite (such as Dri-Slide or Lock-Ease).

Or you can make your own: Rub a pencil lead on some medium sand paper until you have a small pile of graphite. Then, mix that with some light oil (Jet Ski Lube or WD-40) in a small cup or oil bottle cap. Dab this mixture onto the damaged area of the hull, rub it into the cracks and then wipe off. The cracks

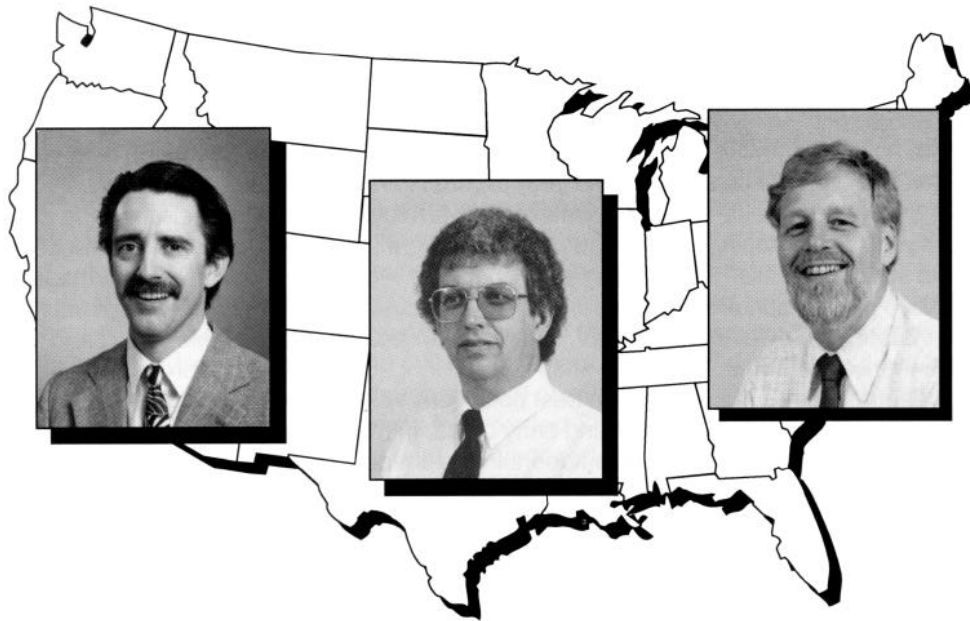
Point your camera from a position where you can see little or no reflected glare in the cracked area.

Make sure your picture is **in focus!** Most 35mm SLR (non-telephoto) lenses can focus on the subject from as close as 2 feet, or even closer. Most disposable cameras need to be at least 4 feet away for the picture to be in focus.

Make sure you know the capabilities of the camera

need repairs, send at least one photo of each area.

To wrap it all up, one more rule: If the pictures don't show the damage, don't send them to us. Read this article again and then try the pictures again. We don't care about perfect exposure or whether the picture is framed properly or composed artistically. We just want to see the damage for which we're being asked to pay. □



Training Schedule

East Region

March
21-23 ... JET SKI® Watercraft

April
4Engines
11-13 ...JET SKI® Watercraft
18-20 ...Troubleshooting Electrical Systems

North Region

March
27-28 ...MULE Service
29-30 ...Team Green Race Preparation
31..... Service Department Operations

April
24-26 ...JET SKI® Watercraft
27-26 ...Fuel Systems

Central Region

March
27..... Modern Engine Theory
28-30 ...Engines

South Region

April
3 ATV Service
4Precision Measurement and Diagnostic Tool Usage
5-6MULE Service
10Tune and Service
11-13 ...Engines
17-19 ...JET SKI® Watercraft
20Generator
24Service Department Operations
25-26 ...Troubleshooting Electrical Systems
27 ATV Service

West Region

March
22-23 ...Engines
24Modern Engine Theory
28-30 ...JET SKI® Watercraft

April
4-6 Troubleshooting Electrical Systems

WEST

It won't run ...

by Jerry Heil
9950 Jeronimo Road
Irvine, CA 92718
(714) 770-0400

About once a month I hear of a customer who has built a competition bike or other special project using a Kawasaki engine, only to have it fail to run. This is usually due to the electronic anti-theft device found on some Kawasaki street motorcycles since 1991. Another cause may be the ignition lockout circuit first installed in '83.

If you have a customer with this problem, please call me at (714) 770-0400, ext. 2464, for solutions to getting those engines running.

The "Troubleshooting Ignition Systems Video Guide" also provides information about these cures. Of course, this information is only available to authorized Kawasaki dealers.

I look forward to talking with you soon! ☐

SOUTH & CENTRAL

Summer is near

by Walter Rainwater
6110 Boat Rock Blvd. S.W.
Atlanta, GA 30378
(404) 349-2000

The end of the '94-'95 training season is near. Training attendance is up this season as more and more dealers are taking advantage of Kawasaki's service training classes. There are only a few more classes on the spring schedule, so you should sign up now.

The third and final installment (for this season) of the *K-Tech Service Contest* is included in this edition. Take the time to answer the questions, and win a worthwhile award for your efforts. Remember, you are only competing against yourself.

This summer I will be busy helping the Hot Line with their dealer calls and attending some rider rallies with Team Tour. I am looking forward to talking with you, either in person or on the phone. ☐

NORTH & EAST

Just the fax, just the facts

by Fred DeHart
201 Circle Drive N. #107
Piscataway, NJ 08854
(201) 469-1221

Do you need a copy of a service bulletin or perhaps a spare copy of *K-Tech News*? You can get these and many other important service documents from Kawasaki's newest information service, K-FAX.

K-FAX is a totally automated information system available to your dealership service department 24 hours a day, every day!

All you need is a fax machine, your dealer number and a touch tone phone. Call the K-FAX number—(714) 458-5663 -and follow the easy instructions.

An index of material available can be faxed to you at any time. And information, of course, is one of the keys to good customer service. Be sure to inform your personnel.

Try it. It's a great service tool. ☐