

# Slip-Slidin' Away

What type of motor oil  
should you use in your bike?

by Bill Stermer

**Dan commutes** 40 miles each way to his job in New York. He goes primarily by car, as weather and traffic are uncertain, and he worries that someone might rip off his sport-tourer. So he rides the bike mostly on weekends.

Friday night Dan drives home, his car idling in stop-and-go city traffic the first 20 miles, running at 33 to 45 mph in heavy traffic for 10 miles, then traveling at 60 to 65 the final few miles, turning about 2,500 rpm. His car's engine rarely exceeds 3,000 rpm, and when traffic clears it spends most of its time at steady-state cruising speeds. Not exciting.

Back home, Dan warms up his bike's engine so he can change its oil and filter. He has to make an important decision: Does he use the \$1.50 per quart car stuff from the discount store, or the \$3 to \$8 per quart motorcycle oil from his dealer? He figures, correctly, that bikes and cars have different oil needs, but wishes he knew more so he could justify spending \$15 rather than \$4.50 for a three-quart oil change.

At first light Saturday morning Dan is up and gone, his bike turning 3,800 rpm at 75 mph on the highway. A couple hours later he meets a friend for breakfast, then they ride up into the mountains where the real fun begins. They rev their bikes' engines to redline at 9,000 rpm, shift hard, brake hard. His bike is liquid-cooled, with four valves per cylinder, and makes about 80 horsepower. Life is good!

Sunday night he returns home, weary from the 600-mile weekend. He puts the bike away, too tired to even clean it. There it will sit till next weekend—or longer if it rains.



Life is still good.

This little scenario is meant to show part of the reason why a motorcycle's oil needs are different from, and more stringent than, a car's. Now consider that the engine in Dan's sedan displaces 2,500cc, has two valves per cylinder and generates 120 horsepower. A full cooling system carries away the BTUs. The crankcase holds five quarts of oil, and there's a separate reservoir for the transmission.

His bike generates 80 horsepower from its 1,000cc engine, eight horsepower per 100cc. His car generates fewer than five horsepower per 100cc. The cooling system on Dan's bike has much less capacity than his car's, yet it has to dissipate the heat from  $\frac{1}{2}$  as much horsepower. And like so many bikes (except Harleys, BMWs and a few others), the crankcase and transmission of Dan's sport runner share the same reservoir, and only three to four quarts of oil must handle the cooling and lubricating needs. You bet that motorcycles need different oil!

### Why Is There Oil?

The purpose of oil is to coat the hard parts of the engine and prevent them from rubbing together. It also carries heat away from hot spots.

In addition, cars and bikes usually have plain-bearing engines, but on motorcycles with integrated gearboxes the oil has to also adequately deal with roller bearings, clutch plates, the gunk the clutch sloughs off, gear teeth and much more power per cc. Handling these different duties and delivering optimal protection takes a superior type of oil.

### Additive Packages: What's in Oil?

Here's a quick compendium of what's added to high-grade, four-stroke motorcycle engine oil.

**Anti-Wear Agents:** To protect the camshafts from the lifters, motorcycle oils carry zinc (an anti-wear and anti-oxidant element) in greater concentrations. Plain-bearing engines need phosphorous, an important anti-wear ingredient.

**Anti-Foam Agents:** High revs, wet clutches and gear teeth can churn oil into a froth. Silicone-based anti-foam agents reduce surface tension so bubbles won't form.

**Anti-Acids:** Acids are formed when condensed moisture reacts with combustion contaminants. They'll eat your motorcycle's engine alive from the inside out.

**Detergents and Dispersants:** If allowed to circulate, the bits of metal that flake off bearings, piston rings, clutch surfaces, etc. would eventually interfere with moving parts and clog oil lines. Detergents and dispersants help dissolve sludge and keep particles in suspension so they can be trapped by the filter.

**Others:** Motorcycles tend to be used infrequently, to sit idle for weeks or months, then to be used very hard for short periods. Quality motorcycle oils have extreme-pressure (EP) additives, rust and corrosion inhibitors, sulfur, zinc di-thiophosphate and more. Some of these are also in quality automotive oils, but the concentrations of ingredients differ.

### The SJ Question

The MTBE additive in fuels, which was supposed to clean our air but

instead has poisoned our water, has also decreased fuel mileage. To compensate, the oil industry has added more friction modifiers. Engine oils that are listed as "energy efficient" are designed to decrease friction by about 2.7 percent. These also carry about half the zinc and phosphorous anti-wear agents of SJ oils (that protect car followers in motorcycles), as they supposedly clog catalytic converters. Energy-efficient SJ oils are fine for cars, but in a motorcycle with a common gearbox and wet clutch the friction modifiers can cause the wet clutch to slip and lead to valve-train problems. SJ oils formulated specifically for motorcycles do not present these problems. Coming soon is the JASO-MA (Japanese Automotive Standards Organization-Motorcycle/wet clutch) standard, which will clarify this immensely.

### Gearbox Crunchers—the Sniff Test

On BMW and Harley-Davidson motorcycles, the transmission is separate from the engine. Each component has a separate oil reservoir. Give their lubricants the sniff test. Engine oils tend to have a sweeter, vegetable aroma. Motorcycle hypoid gear oils have the nasty smell of sulfur, an extreme-pressure additive that lays down a barrier to prevent metal-to-metal contact during the pushing/dragging action of the gears. Motorcycle engine oils formulated for bikes with common engines and gearboxes include sulfur, but in much lower concentrations than in straight hypoid gear oils. Sulfur can get past piston rings and combine with condensation on cold engine walls to form metal-eating sulfuric acid. Automotive oils have less sulfur yet, which is why they offer less protection for motorcycle transmissions. If you've been running auto-

motive oil in your bike with an integral crankcase and tranny, and it shifts roughly, switching to a motorcycle-specific oil may improve shifting.

### Multi-Vis Oils

Many of today's quality oils have multiple viscosities. For example, in cold weather a 10W-40 (the "W" stands for "winter") flows like a 10-weight at zero degrees F, then thickens to a 40-weight at 212 degrees F. This viscosity shift is caused by chains of polymers that, like microscopic noodles, shrink when cold for easy starting, then thicken at operating temperature to cling better. Use lighter-weight oils for cool weather, and a higher weight for the heat.

A motorcycle's gear teeth can slice standard polymers, reducing the oil's viscosity. The 20W-50 you put in your motorcycle's engine may have sheared down to a 10W-30 in just several hundred miles. The oil has lost some of its ability to thicken at higher temperatures, which results in some loss of protection. For this reason, specialty motorcycle oils use tougher shear-stable polymers that retain their viscosity over longer periods of time, and leave a more consistent oil film on metal parts.

### Synthetic and Petroleum Oils

Synthetic oils are those that have been synthesized, or formed from other components. They're made from either Poly Alpha Olefins (PAO), which are petroleum-based, or from esters such as mineral oils, vegetable oils or other natural sources. Both types are formulated in laboratories, molecule by molecule, from base stocks, which allows synthetics to be more heat-stable. When an engine is used hard in hot weather, a low-quality oil can over-

heat and begin to turn to sludge.

Oils range from the low-end, inexpensive, pure petroleum products that are adequate for most uses, to the high end, expensive synthetics with full additive packages that can handle racing stresses. In between are many petroleum/synthetic blends that keep costs down while increasing the performance value of the oil.

### When to Change Oil

Oil wears out when it uses up a significant portion of its additive package and viscosity, and/or when it becomes contaminated. Oil-change intervals specified by manufacturers are recommendations, but specifically how a bike is used determines when its oil should be changed. A person who rides a liquid-cooled touring bike solo on the highway at legal speeds and runs a high-quality synthetic oil may actually be able to extend oil drain intervals beyond recommendations. At the other end is the rider who runs a high-powered, air-cooled bike two-up in hot weather at high speeds on petroleum automotive oils, pulls a trailer and commutes through stop-and-go traffic. The rider had better drain and replace the bike's oil more often than recommended. Throw in a clogged air or oil filter, stuck choke and out-of-tune engine, and engine life may be shortened.

One of your two most important oil changes is in the fall before you store your motorcycle for the winter. If you store the bike with old oil, acids and other contaminants can chemically eat away at the engine over time. Instead, before storing the bike run the engine long enough to warm the oil, then drain it completely. Replace the filter and put in fresh oil. Drain and replace that oil in the spring because it's been contaminated by condensation, but

the filter need not be replaced.

The other most important oil change is the initial one during break-in on a new machine. Most engines should be broken in with petroleum-based oils, which allow the slight metal-to-metal contact necessary for good seating of parts. Most manufacturers suggest that the initial oil and filter be changed at about 500 to 600 miles.

### Mix It Up

If you need to add oil on the road but can't find the particular kind you're running, it's OK to mix virtually any synthetic oil with petroleum-based oil, so long as they're the same viscosity. The two oils should be fully compatible in a chemical sense, but you're downgrading the overall quality of the synthetic by mixing it.

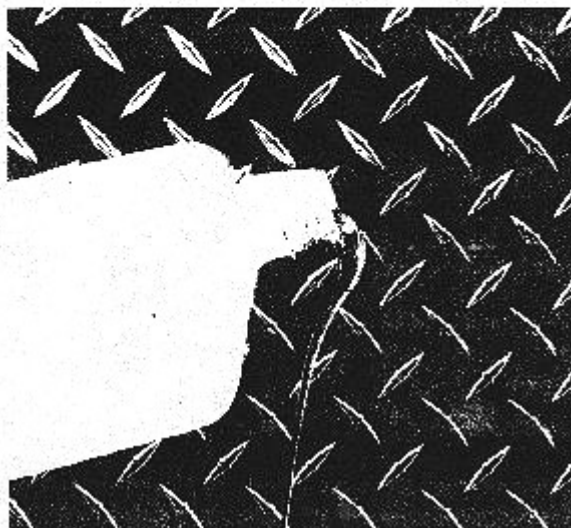
### The Bottom Line

What if you don't heed our advice, and run your bike with an integral transmission on inexpensive automotive oil? If you ride in a low-stress, steady-state manner, keep your bike tuned and change oil frequently, probably not much bad will happen to it. But if you run the bike hard, generating a lot of power and heat, the transmission is likely to suffer, which you may notice as a gradual increase in shifting effort. Also, accelerated valve-train wear may cause more mechanical noise short-term, and in extreme cases eventual breakdown.

If you ride hard, travel two-up or haul a trailer, ride in hot, dusty or stop-and-go conditions and intend to keep the bike for a number of years and many thousands of miles, it's likely to survive in much better shape if you use specialty motorcycle lubricants.

# 20 Questions: Oil

Practical information about your engine's lifeblood



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**MOTOR  
CYCLIST**  
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**M**otorcyclists' concern about their oil varies. Some just buy the cheapest stuff on sale at the discount auto-parts store and pour it in. Others treat it as a form of witchcraft, seeking out a special oil with all sorts of weird additives that promise better life and performance and perhaps greater success with the opposite sex on nights with a full moon. It isn't possible to condense every sliver of information about oil into one magazine, but we can address most of the practical information with 20 questions.

We picked the brains of several oil companies in and out of the motorcycle business for our answers and also asked a couple of engineers at motorcycle companies for their input.

## **1** What exactly does an oil do for the engine?

Obviously, it lubricates. This means it reduces friction and wear between adjoining parts. Additives like zinc dialkyl dithiophosphates (ZDD), copper, TCP and others cushion and prevent wear of

moving parts, especially the valve train and upper cylinder area. These antiwear agents are usually sacrificial, meaning they are consumed as they work. Zinc, for example, coats metal and prevents microscopic welding under high heat and pressure, which wears away metal.

As Suzuki has reminded us with its GSXR series, oil also cools the engine, especially the top end and rings, which have the heat of combustion as well as friction-generated heat to deal with. Oil transports this heat to areas like coolers and sumps where it can be passed to the atmosphere.

Oil is also used to clean the engine. Detergents and dispersant additives keep things like varnish and carbon from sticking to the engine and moving parts. They prevent ring sticking. The oil also carries wear debris, contaminants like dust and combustion by-products like acids, water and soot away to the filter or holds them in suspension.

Oil is also used to prevent corrosion. There are hundreds of different kinds of rust, corrosion and oxidation in an engine, and your oil is charged with reining

in all of them.

To do all these tasks, many additives are needed, which is why each brand and variation within a brand of oil is unique. In addition, oils start with different base materials and different stocks from within the materials.

**2** Is there any reason to pay the difference for oil made for four-stroke motorcycles when car oil is significantly cheaper? In other words, what are the differences in motorcycle oils (besides packaging) and are there any advantages to using motorcycle oil in motorcycles and if so, why isn't such oil used in cars?

Motorcycles make unique demands of their oils. Most lubricate their gearboxes with the same oil that handles the engine, for one thing. It is also possible to make a better oil for motorcycles than for cars.

We will elaborate on that second point first. Automobile oils have to be designed to work with catalytic converters. However, the catalyst doesn't survive

well when confronted with phosphorus, which is an essential element in the best antiwear agents, like ZDD (zinc dialkyl dithiophosphate). As a result, phosphorus is limited by law in oils marketed for cars. However, since motorcycles do not have catalytic converters, they are permitted to use lubricants with more of these useful elements and therefore obtain better protection. Motorcycle oils can also use more of other useful agents like TCP, which reduces wear and spark-plug fouling.

Because many motorcycles also run their engine oil through their gearboxes, they require more from their oil. A gearbox subjects its lubricant to enormous pressure and in the process shears the oil's polymer molecules. Polymers are one of the most critical oil components. When they are cold, they are small. But they get larger with heat, thickening the oil. They lubricate and cushion moving parts. The quality and quantity of polymers in an oil helps determine its characteristics. Motorcycle oils need plenty of good-quality, shear-resistant polymers. Robert Wehman of Spectra likes them to spaghetti: it starts out in long large pieces but gets cut into smaller fragments. In the case of polymers, the moving parts of the engine, particularly the gearbox, do the shearing. As the polymers in an oil get sheared, the oil becomes thinner. When the polymers are gone, the oil is worn out.

Some polymers are more shear-resistant and tend to squash rather than break, so these are more suitable for motorcycles and last longer. However, oils with high levels of antiwear additives and plenty of high-quality polymers cost more. Polymers may cost 8 to 12 times as much as the mineral-based oil used in auto oils. Motorcycle oils may use 50 percent more of them. Likewise, a motorcycle oil may have much more of other additives, which also cost more. The oil you put in your car is perhaps 10 to 20 percent additives. A specially blended motorcycle oil is 50 percent additives. Add in the fact that motorcycle oil is consumed in smaller quantities, and you can see why it is more expensive.

In some cases the benefits of a motorcycle oil will be apparent. You may feel your bike shift better or sense that its drivetrain is slightly quieter. In other instances, the benefits may simply be longer oil life and reduced engine wear. One of the key spots where a good oil stands up to wear is in the cylinder. Oil is like the water under a water skier. At high speeds, he has no trouble staying on the surface, but when he slows down, he drops through it. The same is true for the rings moving up and down in the cylinder. They have plenty of speed in mid-cylinder and skim along the surface of the oil. However, at the top and bottom—particularly at the top where there is also all the heat of combustion—they may drop through as they come to a stop and reverse direction. Some of the additives, called reserve chemical lubricants, ad-

dress this problem by sticking to the metals. Again, it is possible to put more of these in a motorcycle oil.

Although an oil formulated for motorcycles gives better protection, longer life and better service, the expense of a motorcycle oil may not be necessary for every rider. If you are happy with the shifting of your bike and don't plan to keep it more than a couple of years and several thousand miles, less expensive automotive oil is probably adequate if you don't plan to run the bike hard or hot too often.

### 3 Should a motorcycle use a straight-weight like a 40-weight or multiweight oil like a 10w40?

A multiweight is usually better. Multiweight oils contain tenacious additives that keep them from draining off during storage better than straight-weights. They provide quicker lubrication on start-up, so there is less damage on start-up and starting may be easier. Contrary to popular belief, they offer superior film strength at high temperatures because of their high polymer content. They also provide more and better protection against rust and corrosion. Most four-stroke manufacturers now recommend multiweights for these reasons.

### 4 Should you use different oil weights in winter and summer?

If you are using a multiweight oil, you probably can use it all year around. The numbers in a multiweight oil indicate its weight at 0 degrees Fahrenheit and 210 degrees Fahrenheit. A 10w40, for example, is a 10-weight at 0 degrees and a 40-weight at 210 degrees. Pour depressors are blended into multiweight oils to ensure that they flow at low temperatures. It is important that an engine not be started if the oil is below its pour point because it will sit in the engine like a gelatin and not flow. An SF or SG-rated 10w40 pours at minus-25 degrees Fahrenheit. A 5w30 pours at minus-35 degrees Fahrenheit; these are not temperatures at which people do much motorcycle riding. Several years ago one auto-oil manufacturer accidentally left out the pour depressors from a batch of oils. The company's insurance reportedly bought over 20,000 new engines that winter.

### 5 Should a motorcycle use a mineral oil or a synthetic?

If you are using a multiviscosity oil, it is at least partially synthetic. However, there are advantages to the mineral portion of the oil, too. For one thing, you can add oil purchased at a gas station without fear of it turning to cottage cheese when it meets the oil in your crankcase. A petroleum-synthetic blend is the best answer in our opinion, and it is what most oil makers supply.

There are seven kinds of materials

used to make synthetic lubricants, most of them with difficult-to-pronounce names. Each have certain strengths and weaknesses, and discussing all of them would make a long article in itself.

### 6 Other than weight, are there any categories or ratings to look for in an oil?

Look for the American Petroleum Insti-



tute (API) ring on the oil container. You want an oil that is rated SF or the new SG rating. The S means the oil is designed for a spark-ignition engine. The F was the highest rating until this year, providing greater oxidation and wear protection than previous service ratings (SA through SE). The new SG rating originally had some questionable requirements when viewed from a motorcyclist's viewpoint, but oil manufacturers now feel it is superior for us, too. The SG oil is apparently better able to deal with engines that run hot (and the SG rating will be needed to meet warranty requirements for most 1989 auto warranties).

The API also classifies oils as Energy Efficient if they offer a 1 percent reduction in fuel consumption through friction reduction. There is also an Energy Efficient Category 2 rating for oils that offer a 1.5 percent fuel savings. This rating is listed in the lower half of the circle, and it means that the oil is slightly more slippery, whether or not you ever notice it.

### 7 Is oil labeled "Racing Oil" better oil, and if so will it help protect a motorcycle engine?

Racing oils are for racing. They are designed for intense low-time use. Racers change oil after every race. Some manufacturers even say that racing oil may not last long enough for a 24-hour race.

### 8 How about aircraft oil? After all, it is designed for air-cooled engines.

Aircraft also have unique requirements. They run at constant throttle and rpm settings for hours at a time. This is a condition that is very conducive to spark-plug fouling, so these oils are low in metals, like zinc and copper, which constitute some of the best antiwear protec-

ton. Aircraft typically change oils every 25 or 50 hours of use. It is also very expensive.

## 9 How about castor oil (bean oil)?

Except for burning with a unique aroma that many people associate with racing, bean oil has little to recommend it, particularly on the street. It is expensive, hard to find, doesn't mix with additives or any other oil, has a narrow temperature range, doesn't protect well against corrosion, tends to oxidize and doesn't offer protection that is superior to an oil created from more common materials.

## 10 Are there any worthwhile additives (STP, Teflon, Marvel Mystery Oil, moly, seal saver) that could benefit a motorcycle?

None of these are miracle products, but most have ingredients that are useful in at least some situations. In fact most use ingredients that are already in oil. STP is polymers and a heavy-base oil. Teflon can act as a reserve lubricant. Marvel Mystery Oil is a light, naphthenic oil and may help remove some deposits and free sticking lifters or valves. Molybdenum disulphide is a useful lubricant, especially in gearboxes. The seal swellers are mostly kerosene.

When you start using additives, you are basically blending your own oil, and you are an amateur. While adding one of the polymer-rich additives like STP can restore that portion of your oil if it's getting depleted, it doesn't restore the entire additive package or remove the dirt and contaminants that your oil has been storing. Some of the friction reducers can also cause clutch slip in wet-clutch machines. It is best to use a preblended oil that is formulated for your application and change it when it is tired.

## 11 Should you worry if the model of motorcycle you ride uses some oil?

Not necessarily, especially if all of them do it. It may actually be good for the engine. The oil people say that adding oil allows you to replenish the additives, which are used up over time and miles.

## 12 What is a good oil temperature, and when is oil too hot?

The ideal temperature is about 212 degrees Fahrenheit, which boils off the water in the engine without damaging the oil. Above about 230 degrees, each 10-degree increase cuts oil life in half. Over 320 degrees you have serious problems. Any oil subjected to that kind of temperature should be changed promptly. A temperature gauge can be a worthwhile investment if you have hot-rodded your engine or use it under extremely hot or arduous conditions. Just be sure you in-

stall the probe where it samples the temperature of the hottest oil (usually the oil returning to the sump). An oil cooler can help if you do have a problem.

## 13 How often should oil be changed?

If you use a top-grade oil, the motorcycle manufacturer's intervals are effective ones, although you should probably change it once a year even if you don't travel the mileage suggested for an oil change. Of course, if you have overheated the oil or otherwise done something to damage it, you should change it immediately. Oil that's used in an engine that is run regularly, heated thoroughly but not overheated and was a good oil to begin with should go those 4,000- to 10,000-mile intervals now being recommended by manufacturers.

If we had a Gold Wing that we rode on dusty dirt roads most of the time, we would probably change oil and filter (and clean the air filter) at least every 1000 miles, but we might also use a cheaper oil. If we pulled a trailer through Death Valley in August, we would change frequently but continue to use a better oil. If we had a good oil, rode 10 miles to work every day on uncongested country roads or toured every weekend without overworking the engine, we would go the recommended 8000 miles.

One aside here: Dispose of oil properly. Don't pour it in the sewer or down a drain or even in the dirt. Take it to your bike shop or somewhere that has a collection drum or tank for recycling. Oil is hard on the environment and isn't hard to get rid of properly. Be responsible.

## 14 What factors beside shear and temperature can damage an oil?

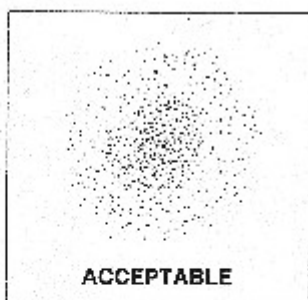
Gas dilution from a leaky carb or extensive riding with the choke on can dilute the oil. Running without air filters can get dirt and sand in the oil (and do a lot of damage in the process). If you suspect either of those situations, an oil change is good preventive medicine.

## 15 Other than temperature, is there a way to judge the condition of your oil?

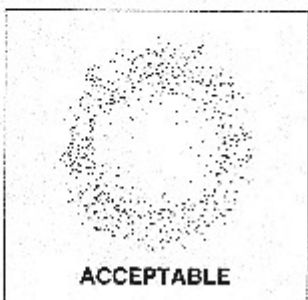
One way is wear. If you see camshaft scoring, for example, your oil may have already given its all. You should have changed it sooner if that's the case. Of course, the problem may be other factors as well.

In an engine with an oil filter, dirty-looking oil probably means it's time for a change.

Another method is the blotter or oil-spot test. This involves putting a drop of oil on a piece of 240M blotter paper. The pattern of the spot shows the level of dispersancy and contaminants. A light spot with darker center and indistinct pe-



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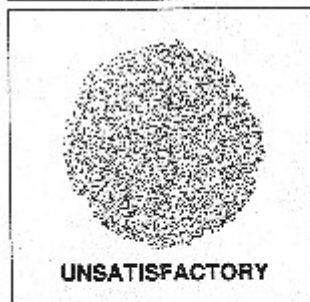
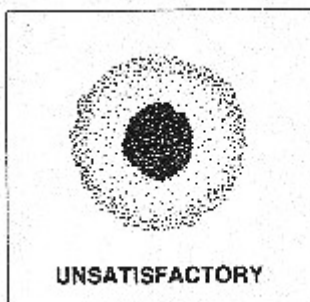
riphery shows that the oil retains a high dispersancy level and has few contaminants. It is still serviceable. As the amount of the insoluble contaminants increases, the periphery darkens. If water and antifreeze have contaminated the oil (and they will impair the oil's dispersancy), a uniformly dark center and a distinct outer edge on the spot is the result. A sharp outer edge with a uniformly dark area inside it indicates oil that is worn out and lost its dispersancy.

The blotter test can be used to track oil condition. It is cheap and quick. Performed every 500 or 1000 miles, it can give progressive information of your bike's oil condition.

## 16 How about oil analysis?

Spectrographic oil analysis is commonly used to monitor engine condition for early warning signs in situations where engines are expensive and/or critical, such as truck fleets or aircraft. It is not used to monitor oil life.

A sample of used oil is drawn from a hot engine and sent to a laboratory for spectrographic inspection. The materials found in this analysis can provide early warning of engine problems. For example, higher than normal levels of copper and lead indicate bearing problems. Silicone indicates that dirt is getting past the air filter somewhere. However, spectrographic oil analysis is most valuable when done on a regular basis to keep track of trends. At the least, you generally need a baseline from an engine that is



functioning properly before you can determine if the level of a certain material is abnormal.

Oil analysis kits run about \$8 to \$15 and include a simple little plastic bellows and tube to draw the oil out of your engine and store it for mailing. The price in-

cludes the analysis, but you have to pay for mailing the sample to the lab. You can get kits from aircraft or truck parts and service shops. For the fastidious owner, they might be useful and they might reassure the worrier. Most owners probably won't get enough out of them to justify the expense.

**17** When should the oil filter be changed and what kind should I use?

Change the filter whenever you change the oil.

Use a quality filter with a name you know and trust. When in doubt, stick with the original-equipment filter sold by your bike's manufacturer; those filters will always be good. (Be sure that is what you are getting when you pay for it, though.)

We are impressed by Fram filters, although we have not tried everything available. Experienced mechanics at your local shop can probably steer you to a trustworthy brand, and they can almost certainly tell you what brands to avoid in your bike. Some filters have been known to tear when you try to remove them. A good filter is worth a few extra bucks if you plan on using your engine for more than just a summer.

**18** What about winter storage? Should oil be changed at the beginning of the riding season after winter storage or at the end, when the bike is stored?

The best time to make that winter-storage oil change is before you store the

bike. This removes all the water, corrosives and sludge that may have accumulated in the oil. The recommended procedure is to change the oil and filter, ride the bike once long enough to get it fairly hot (a 20- to 30-minute ride) and then put it away. Do not run it again until you are ready to ride it the following season, since that will do more harm than good. (Of course, proper storage involves other tasks as well, such as draining fuel from the carbs and removing the battery.)

**19** What is the best way to clean an old sludge-ridden engine?

The best way is to take it apart and clean it properly. If you don't want to do that, you could run it briefly on a Dexron II automatic transmission fluid and then change to a high-quality detergent oil, performing blotter tests and changing it when it is unacceptable. The danger is that a lump of sludge could break loose and block an oil passage.

**20** Should you add an oil cooler?

You should add an oil cooler when you are overheating your engine either because you are working it hard (towing a trailer full of anvils in Death Valley in August) or have hopped it up. You will still be taxing your oil, however, and will have to change it more frequently, although probably not quite as frequently as if you didn't have the cooler. ■

# Oils & Lubricants

## For Wings

### A Thumbnail Sketch

By Nick Hopper

**T**o paraphrase Ecclesiastes III:1-8, "To every motorcycle, there is a season, and an oil or lubricant for every surface under heaven." To extend the analogy, if you put your faith in the wrong stuff or don't change it religiously, early wear-and-tear shall increase your troubles tenfold and leadeth thee into perdition.



Since most of us consumers are not petrochemical priests or charismatic chemists, most of us don't necessarily know what we're buying. And ignorance isn't necessarily bliss.

Apart from gasoline, what petrochemicals should a Gold Winger know about? *Wing World* recommends you develop an understanding (and perhaps have on hand) at least oil, coolant, brake fluid, shaft drive oil, and dielectric grease. It's also a good idea to have an acquaintance with several substances found in any service department—contract (brake) cleaner, fork oil and white lithium grease. Naturally, you can learn about and purchase all of these (and much more) at your Honda dealer's parts department.

Now, before you open your wallet at your local dealership, remind yourself that dealers (Honda and otherwise) tend to stock products (a) because they're the "house" brand, (b) because they are profitable, (c) because they believe the products perform well, or (d) some combination of all of these factors. As a consumer, be aware that high price alone does not necessarily equate to high value. Indeed, because of fierce competition among the many brands available, there's a lot of marketing hype, and we all know that effective advertising isn't cheap. While a little knowledge can be dangerous, total ignorance can be both costly and hazardous. Hence, our effort at a simplified guide to oils and lubricants for Wings.

#### Oil: Just The Basics

Fresh, adequately filtered oil is best. Whether you use 100 percent petroleum, 100 percent synthetic, a blend of petroleum distillates and man-made brews or whatever, if the oil and filter in your Wing are changed as often as Honda recommends, your engine and transmission will continue to purr. Problem is, this is such a simple answer, we want to believe in something more mystical. And, knowing ourselves as potentially or frequently lazy, we often seek behavioral solutions through better chemistry to prevent or repair the ravages caused by our own neglect.

Because the Gold Wing engine uses the same oil to lubricate the engine and the transmission, the oil used must withstand high temperatures, high shearing forces, suspended bits of metal and carbon-based crud, and do so for long periods of time. And while the likelihood of long exposures to unlubricated friction is less than in racing engines, it's still wise to keep your oil fresh and filtered.

Your owner's manual lists the oil grades it recommends for your machine. Most likely it says, "Use Honda or equivalent." And while the cynics can say that's just because they want the profit they get from their "house" label, it's also true that Big Red sets stringent guidelines for content and quality, so Hondaline products are dependably good.

The basic properties of oil are expressed in terms of viscosity, viscosity index, flash point, pour point, percentage of sulfured ash and percentage of zinc.





**Viscosity**, as described by the Society of Automotive Engineers' S.A.E. weights, indicates how an oil flows and resists shearing stresses. Thick oils have higher viscosity (SAE 50 weight), thinner oils have lower viscosity (SAE 10 weight). Too low a viscosity and oil can lose film strength at high temperatures and shear; too high a viscosity and oil may pump sluggishly at low temperatures and the oil film may tear at high rpm. The W in oil designators means the oil meets SAE specifications for viscosity at 0 F and is therefore suitable for winter use.

By adding high-molecular-weight polymers, multi-viscosity oils can be brewed. Add polymers to a light base oil (say, 5W, 10W, 20W), and you can prevent the oil from thinning as much when hot. Cold polymers stay tightly coiled, allowing oil to flow easily almost as though they weren't there. But as the oil heats, the polymers stretch into long chains preventing the oil from excessive thinning. Thus, at 100 degrees C, the oil behaves like the higher viscosity number. A 20W50 oil behaves like a 20 weight oil when cold, but like a 50 weight when hot. The wider the range, say 10 to 40 in a 10W40 oil, the more polymers it contains and the greater the potential for thermal breakdown of the polymers. Since it's the oil that does the lubrication, you're better off selecting a narrow-range multigrade best suited for the temperatures your Wing is likely to encounter. Check your owner's manual for recommended ranges.

**Viscosity Index** indicates the rate of change in viscosity of an oil within a

given temperature range. High numbers indicate less change, deemed to be better for engine bearings and such.

**Flash point** is the temperature at which an oil gives off vapors that can be ignited. The higher the flash point the better, as oil that burns easily leaves residue on cylinder walls and

pistons. Look for oils with a minimum of 400 F. **Pour point** is 5 degrees F above the point at which a chilled oil shows no movement at the surface for five seconds when inclined. If you live where winter temperatures abound, look for oils with low pour points to ensure your Wing's oil stays fluid on frozen mornings.

**Percentage of sulfated ash** is how much solid residue remains when the oil burns. High ash content yields more sludge and deposits, low ash lengthens valve life. **Percentage of zinc** tells how much zinc is included to fight extreme pressures and prevent metal-to-metal wear beyond what the oil can prevent. This figure is primarily of concern if the engine lives on a constant diet of high revs—not typical of a Gold Wing's life. However, if you should lose all your oil suddenly, zinc does offer some protection. But be aware that high zinc content can create engine deposits and fouled plugs.

Synthetic oils have some advantages over natural petroleum oils, but they usually cost more. They resist high temperature oxidation better, have high film strength, form few deposits, have very stable viscosity indexes, and exhibit good low temperature flow characteristics. Synthetics usually can be used longer (sometimes two or three times the mileage prescribed for natural oils) reducing the frequency of oil changes. Premium oils are often all-synthetic or synthetic/natural oil blends.

Oil additives containing polytetra-

fluoroethylene (PTFE) (frequently referred to by its DuPont trademarked name, Teflon) aren't recommended for use in Gold Wings as they can adversely affect your transmission and oil filter.

#### **Coolant: Not Just Antifreeze**

Your Gold Wing engine is often referred to as "water cooled." By circulating a constant flow of liquid through a network of channels in the engine, engine heat is carried to the Wing's radiator(s) where air flow cools it. To extend the effective temperature range of the liquid, Honda prescribes use of a 50/50 mixture of distilled water and high quality ethylene glycol antifreeze containing corrosion inhibitors specifically suited for aluminum engines. While you can purchase coolant in concentrated form and mix it yourself with water, be careful if you do. Using a solution containing less than 40 percent antifreeze and your corrosion protections rapidly decreases; use more antifreeze than recommended and the system's efficiency decreases. An advantage to purchasing premixed water/antifreeze coolant mixtures is the ability to add some to the reserve tank without changing the percentages. Read the label of any coolant you intend to purchase or use to be sure its corrosion inhibitors are suitable for use in aluminum engines. Use of the wrong kind of coolant could nullify your warranty. Most dealers stock good quality coolant for use in motorcycle engines; check to be sure you're buying the right stuff, then keep your receipts or work orders. Never use coolant containing silicates, as they can damage the water pump's seal.

#### **Brake Fluid: Maintaining Your Grip**

The Gold Wing depends on compression of hydraulic fluid to apply ample braking forces to the front and rear disc brakes. As the brake pads wear down with use, the brake fluid level in the system will drop. If the brake fluid level in either your front or rear reservoir is at or below the lower level mark, check your brake pads for excessive wear and replace them if needed. If your system is leaking, track down the leak and have it repaired. If the brake fluid needs replenishment or

replacement, use Honda DOT 4 brake fluid or equivalent. Never use DOT 5 brake fluid. Use fluid from a fresh container; in an open environment, the fluid will absorb moisture from the air losing some effectiveness. Be careful not to spill it on plastic or painted surfaces, and if you don't have the expertise to bleed the brake system of all air, you'd be best served to leave brake fluid replacement to a pro, as air compresses more easily than fluid, so your brakes won't work if bubbles exist in the system. Replace hydraulic fluid every two years, and never add fluid from an opened container.

### Keeping Your Final Drive Juiced

It's the job of your Wing's final drive to transform the mostly horizontal rotations of the driveshaft into vertical rotations of the rear wheel with a minimal loss of force due to friction. Fighting friction is the purpose of hypoid gear oil. Honda recommends final drive oil with a viscosity of SAE 80. The procedure to establish the viscosity index of hypoid oils is different from engine oils. Hypoid gear oil is formulated in a different way than engine oil and is meant to withstand the high temperatures of metal clashing with metal. Because of the location of the final drive oil filler cap underneath the bike, practically speaking, the only time the final drive oil ever gets checked (unless you specifically ask for it to be done during servicing) is when your rear tire is replaced, and sometimes not even then. Honda's recommended maintenance schedule calls for inspection of the final drive oil at 8,000-mile intervals with replacement at 24,000 miles. But with touring tire longevity now reaching into the 20,000-mile range, it's far too easy to be completely unaware that you're running without any lubrication in your Wing's final drive. A major cause of contaminated final drive lubrication is the direct blast from a wand-type car wash nozzle. If you wash your Wing at a coin-operated car wash, use care to avoid blasting underneath the saddlebags, and make sure the final drive inspection is done as scheduled.



### Zap It With Dielectric Grease

Dirt and corrosion are lousy conductors of electricity. While many motorcyclists won't ride in the rain, many Wings do, effectively rinsing away the conductive lubricant that was packed into your Wing's electrical connections at the factory, and replacing it with dust, dirt and, eventually, corrosion. Perhaps the most notorious instance of this is at the stator and regulator/rectifier plugs on pre-1988 Gold Wings. Reduced conductivity equals increased resistance, and like the wires inside a toaster designed to resist the flow of current, the result is hot, hot, hot. Sensing resistance, these older Wings kept their alternators working overtime in an effort to compensate, eventually causing them to expire from overwork. Particularly if you own a GL1000, GL1100 or GL1200, having a tube of dielectric grease handy and using it on all connectors can save a lot of expense and agony. Be sure to clean the connectors with contact cleaner and allow them to dry before applying dielectric grease. As they say, a little dab'll do ya. For GL1500 owners, especially those who have added electrical accessories, a dab here and there will keep the current flowing.

### Other Useful Potions To Know and Love

Contact (brake) cleaner is useful for removing grease, dirt, oil and other contaminants from hard-to-reach areas. Sold in aerosol cans (usually with a thin tube attachment to direct the spray into tiny crevices) this handy cleaner can be

used on all engine and suspension parts, brakes, spark plugs, carburetors, etc. Check the label before using, though, because some contact cleaners can damage paint or plastic. For some uses (say, freeing up a stubborn MUTE button), you should use an aerosol all-purpose cleaner safe for use with plastic or painted surfaces, rubber, alloy or chrome.

Fork oil must maintain consistent viscosity over a wide temperature range. It must be non-reactive with fork seals, and resist rust and corrosion. Available in a variety of weights, use the fork oil recommended by Honda or the aftermarket suspension component manufacturer whose products you have installed. Most likely, the only times you need concern yourself with fork oil are (a) if you notice dampness seeping out from around the fork seals (indicating you need to have the seals replaced and the fluid replaced) or (b) if you're having aftermarket springs or cartridge emulators installed.

White lithium grease is used primarily for lubricating the wheel bearings, steering head and swingarm. Due to the extreme pressures and high temperatures these components must withstand, as well as their exposure to the elements, this grease must adhere well and last almost indefinitely.

While there are plenty of other oils, lubricants, and greases you can buy to handle a host of specialized uses, we hope this overview provides a bit of insight without trying to evaluate which potions are best for which purposes. For the most part, your dealership's service department and parts counter personnel can explain these products' contents and uses. Many of the front-line people have developed preferences for one product over another, and are more than happy to share with you their experiences. Hopefully, this article will make those discussions a bit more meaningful.



# ENGINE OIL

## FUNCTIONS

LUBRICATES & COOLS INTERNAL PARTS  
PREVENTS CORROSION & OXIDATION  
HOLDS/FILTERS CONTAMINATES  
ADDITIVES PERFORM MANY TASKS

## DIFFERENCES

AUTO  
CHEAPER  
LIMITED ADDITIVES  
ENGINE ONLY

MOTORCYCLE  
EXPENSIVE  
MORE ADDITIVES  
USED IN CLUTCH & TRANS.

## SAFEGUARDS

DON'T USE ADDITIVES - STP, TEFLON, ETC  
CHANGE OIL & FILTER OFTEN  
USE PREMIUM OIL

## BENEFITS

QUIETER ENGINE  
SMOOTHER SHIFTING  
LONGER ENGINE LIFE

## ENGINE OIL

Most of us view our motorcycles not only as a hobby but also as an investment. We usually demand only the best parts and finest chrome our pocketbooks will allow. But often, when it comes time to change the oil, we lower the standards and use whatever oil is on sale. Recognizing the difference between automotive and motorcycle oils and what each is expected to do, can prolong the life of your engine and make your bike run smoother.

Oil does more than lubricate and cool the engine's parts. Additives like Zinc, Copper and TFCP reduce friction and wear. Zinc coats the metal and prevents microscopic welding under heat and pressure. Copper acts as a cushion and transfers heat from the parts to the oil. The oil is then circulated to the sump and oil filter where it can be exposed to the cooling air flow.

Detergent additives clean the engine and prevent varnish and carbon from sticking to the various parts. Dispersants hold contaminants like dirt, acid, and water in suspension and carry them to the filter where they are captured. Oil additives also prevent oxidation and corrosion.

There are two major differences between automotive and motorcycle oil. First, automotive oil has to work with catalytic converters. The converters tend to foul when confronted with large amounts of phosphorous which is an essential ingredient in anti-wear additives. Therefore, the law limits the amount of phosphorous that can be added to oil marketed for cars. (The new SJ rating released in 1996 lowered the maximum amount of phosphorous from .12% to .10%. A newer standard for automobiles will likely lower the level further to .08%). Motorcycle oils generally contain more of this essential ingredient.

The second difference lies with what each oil has to cool and lubricate. Although the engines may be similar, motorcycle oil has to function in the gearbox as well as the clutch. The clutch has to be cooled but not lubricated to the point where slippage occurs. The gearbox subjects the oil to shearing forces not found in automobiles with their separate transmissions. This shearing force tears the oil's essential polymer molecules apart.

The polymer molecules are small when cold and gradually enlarge when heated. (Which is why multi-grade oil pours thin and gets thicker as it heats up). As these molecules are sheared the oil becomes thinner and when the polymers are gone the oil is worn out. Can you replace the worn out additives? Possible, but not recommended.

For example: STP is a heavy base oil with lots of polymers. Teflon, found in many additives, acts as a reserve lubricant. Both enrich the oil but neither replaces

the worn dispersants and detergents. Both reduce friction but may cause clutch slippage. When you start using additives you are blending your own oil and you are a amateur. This is better left to the pros and their bottled oil.

Is the added cost of the motorcycle specific oil worth it? Additives, which can make up to 50% of motorcycle oil verses 10%-20% for car oil are very expensive. Combine this with limited demand and production, and the cost of good motorcycle oil rises accordingly, but is it overkill for the average rider? Let's see.

"Joe" drives his 3.0 liter automobile to work every day. He seldom exceeds 3000 rpm as the 140 horsepower is more than adequate to move through heavy traffic. On the weekend the bike comes out. His 1500 cc's makes 90 hp, nearly 1/3 more horsepower per liter than his car. He rides it hard, cornering, braking and frequently taking it to the

redline. When he arrives home the bike is stored until the following week, or longer, if the weather is bad. Combine this with the clutch and transmission and then ask if motorcycles need different oil. You bet they do. A word on synthetic oils.

*Oil not only cools and lubricates but must do a dozen other things most people aren't even aware of!*

Synthetic oils were originally developed for turbine engines and the higher heat they produced. The heat is not a problem with water cooled bikes but can be for those with air cooled engines. The good news is that riders who switch to synthetics report that their bikes tend to run and shift smoother. Bad news is that you should not use synthetic oil on a new bike as the piston rings and valves may not seat properly. Once the bike has been broken in it is O.K. to switch oils.

How often should you change oil? Honda recommends every 7500 miles on the 1500 Gold Wing. However, if you pull a trailer, ride two up or travel in dusty conditions perhaps you should consider changing it more frequently. Thousands of riders change their oil at 3000 mile intervals religiously and, despite the added cost, feel it is cheap insurance against a future breakdown or repair bill. (Regardless of when you change your oil, always change the oil filter every time you change the engine oil.)

JASO standards became available in 1998 to classify motorcycle oil standards. The T4 rating indicates the oil is designed not to induce clutch slippage under high torque and horsepower. Few oils carry this label due to the lack of demand but more are expected to use it in the future. (See the Sept. 2000 issue of Wing World for more info.) In summation, use good oil and change it often. Ride Safe