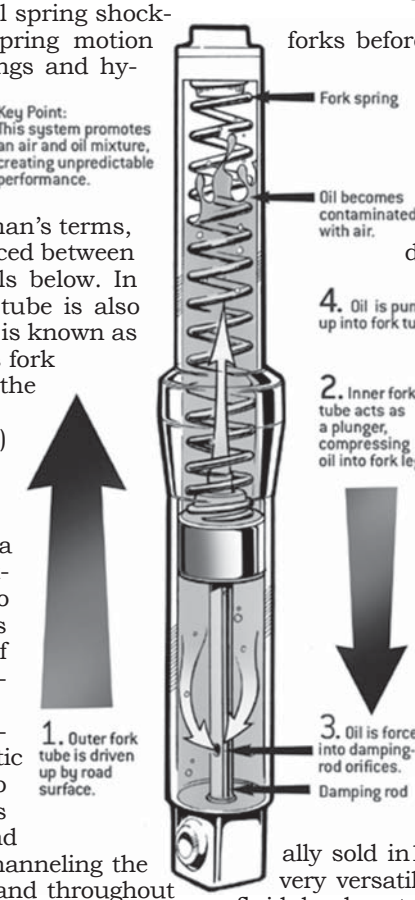
Front Fork Function and Shock Oil Health

As I continue to comb through the internet archives of age-old "Tech Tips" I am always amazed at the prolific information regarding leaking fork seals, and the many methods that have been developed to repair them. What I often wonder to myself is "Does anyone ever think to do anything (proactive) to prevent this? What I mean is that with good preventative maintenance, (namely changing fork fluid), it is entirely possible to prevent this type of damage from occurring in the first place. By my own observations I'd say that fork seal repairs take place more often than fork oil replacement! So to help those here who have never thought about why and how this type of effort might prove beneficial, I will rely on my background in petroleum fluids to explain the details.

Front forks are in essence a mechanical spring shock-absorber. A device that controls unwanted spring motion through a process known as dampening. Springs and hydraulic oil in your front forks slow down and reduce the magnitude of vibratory motions by turning the kinetic energy of suspension travel (movement) into heat energy. This energy can then be gradually dissipated through the hydraulic fluid that fills the forks. So in layman's terms, a fork-spring combo is basically an oil pump placed between the frame of the bike and the bouncing wheels below. In a twin-tube motorcycle fork design, the inner tube is also known as the pressure tube, and the outer tube is known as the reserve tube. The reserve tube stores excess fork oil (hydraulic fluid), while the inner tubes does the work to dissipate the heat.



If left only to exterior springs (no oil) , the motion you contact while riding would give you a mess of a ride. Just ask any "hard-tail bike diehards" what their ass feels like! The uncontrolled energy would bounce you like a rubber ball... much like the oscillation you'd experience jumping on a trampoline. Way high to way low. So to even this bounce out, engineers incorporate a design that allows the energy of front wheel contact to quickly and evenly dissipate.

Through the use of a fluid dynamics (usually petroleum oil) we can redistribute the kinetic energy of motion through a harmless medium so that ride comfort is not interrupted. The springs and hydraulic oil in your fork tubes dampen and absorb the magnitude of vibratory motion by channeling the energy of impact so that it can be absorbed in and throughout the oil volume. Cool huh! The viscosity (thickness) of the oil is carefully chosen so that you neither take too long to expel vibration energy (fluid is too thin to absorb the shock) or retard the return spring recoil (fluid is too heavy). "Dampening" the kinetic energy of impact through optimum dispersion is something like yelling into a canyon where your voice is bounced around until it eventually disappears into nothing.

Now most fork oils/hydraulic fluids I've looked at tend to be very low viscosity (thin) oils, in the 5-20 weight range. Your selection will depend on whether you need constant and instantaneous dampening (dirt track riding) or a more steady, even reduction (like highway riding). There are advantages and disadvantages to both viscosities. Thin oils wear down more quickly and usually suffer degradation at a higher rate. However, they do provide instantaneous ride control under extreme riding conditions (fast rebound). Heavier viscosity oils tend to be more shear stable and do not thermally degrade as quickly. However, due to their heavier viscosity, they provide much frictional resistance within a tube assembly and don't typically provide the instantaneous rebound needed for quick recovery. So proper viscosity and fork tube understanding is paramount when selecting the right oil!

From what I've seen among the oils tested on the market today most, if not all, contain little if any additives to protect against fluid degradation. Anti-oxidation chemistry is very pricey and rarely do I see blenders adding it to their oils. Although heavily hyped by bike shops... many of the best-known and popular fork oils sold in bike shops represent inexpensive formulations and cost little if anything to make. We call them "sewing machine oils" in the industry because that is usually what you are purchasing in terms of quality. Most of them do little to prevent fluid breakdown (mechanical shearing or oxidation) or metal-to-metal wear. In reality... it is easier to put money into advertising, label hype and sponsors than it is to spend it on product quality. We all know that... right? Specifically you want a fork/hydraulic oil to possess excellent anti-foaming chemistry, good oxidation resistance and heat tolerance. And above all... excellent resistance to contact, wear and shear. If you DID have a high quality oil in your forks, I guarantee that when you drained it out... it wouldn't look like the goop that you usually find in there.

Have any of you ever drained old fluid out of your forks before? I'll bet a fair amount of you saw really black, thick oil with lots of abrasive specks. This is because the old fork oil had oxidized and thickened. And the black color represented microscopic corrosion particles that acted like pumice, grinding the heck out of those poor defenseless rubber seals. Not only that, but in this degraded condition, the fork oil possessed little if any of it's designed ability to properly dampen the spring motion by dissipating the heat. Because of the increase in viscosity, the oil actually held more heat than it was designed to, which only put further thermal stress on the rubber seals. By the time fluid reaches this state, you probably felt like your springs were mushy. Not only that but I'll bet that your seals were leaking like a crying baby.

Fluid Maintenance:

To prolong shock life, and maintain excellent seal/spring function I recommend selecting a premium suspension fluid and then adopting a reasonable drain interval as part of your periodic maintenance. I personally use 100% Synthetic hydraulic oil and change my fluid every 2 years.

European cars like Porsche, Boxster, BMW, Mini, Audi, VW, Jaguar, and others are moving toward using a premium suspension fluid for their hydraulic ride systems. I've analyzed this stuff and it is truly a fantastic fluid. It is usually sold in1 liter cans and is labeled Pentosin CHF11S. It is very versatile and can be used as a universal power steering fluid, level control oil, or as a replacement for twin fork shock systems. The fluid is green colored and has a temperature range from -40C to +150C (-80F to 302F) I'd buy it in a heartbeat over other popular brands like Bel-Ray, Klox, Redline, Maxima, Silkolene, or Penske. None, in my opinion, are anything close to the quality of the Pentosin 11S fluid.

Here are some facts: Pentosin 11S provides precise performance in a wide range of temperatures -40C to 150C (-80°F to 302°F). It usually costs $20 a liter but is well worth the investment in terms of additive protection, seal protection and oxidation/shear/wear reduction. The sludge control of this fluid is also another hallmark of its high quality. By inhibiting fluid oxidation, you reduce fluid sludging and viscosity increase, both

of which increase heat and abrasive wear within the fork. These in turn will all accelerate seal degradation and fluid leaks.

I've been providing some of this oil to my local VMOA members, and good V-Max friend Sean Morely, of Morley's MuscleCars and MuscleBikes. He has refilled a few Max's with a lower cost equivalent to the Pentosin 11S fluid and I think he is very pleased with the results. If you want to obtain a product that meets the exact quality of the Pentosin 11S fluid, then check out BG Products (www.bgprod.com). They produce this same Pentosin quality fluid for their European market under part #334. It is an exact match for the Pentose Fluid standard, and will also deliver all the necessary fluid properties to guard against fluid breakdown and seal wear. Not only that, but both BG334 and Pentosin 11S contain state-of-the-art seal conditioners, which are polymers that keep seals pliable and resilient even under high heat and the deforming stress of constant abrasion.

In Closing:

What I recommend is this… drain out your old fork oil. Then spray the inner tubes with non-chlorinated brake cleaner to rinse out all the metallic debris and oxidized oil. When that is done blow the tubes dry with dehydrated compressed air until no more fluid or vapor comes out the drain hole. After rinsing and drying out the inner fork tubes, simply refill, with the exact quantity of new oil, as recommended in the service literature. Work the springs up and down a bit by lightly pressing on the wheel to pump and coat the inside of the tubes with fresh oil. This also works the air out of the system. When completed, this type of quality fluid replacement should protect your seal integrity, and also optimize recoil and ride control. No more bounce, no more leaking oil!

<u>Caution:</u> Do not use chlorinated sprays or acetone based solvents like those sold at Wal-Mart! They attack the polymer structure of the rubber seals and will destroy them in short order. I use BG Products brake cleaner, part # BG403, which is an excellent and fast drying non-chlorinated parts wash. Using any product like this ensures no contamination or damage is done. Harsh solvents will degrade and dry out seals, and common store-bought sprays (like cheap engine cleaners) containing "petroleum solvents" (namely #2 diesel fuel), will not dry clean at all. So choose your spray cleaners carefully. Any debris or film you leave in the tubes will intermingle with the fresh synthetic oil, and lower its overall quality.

I could go on and on by quoting some lab results of how these full synthetic, European, fluids peg out the chart for film strength and resistance to oxidation and wear. But space here prevents me from turning this into a research paper. Let's leave it to be said that you can't go wrong by using them. I know for a fact that most of the fluids sold under all the brand names I mentioned earlier are more hype than help. Judge for yourself… have you bought more fork seals than fork oil lately? Enough said…

Until I write again I wish you all good riding weather, warm days and… and many miles of rides that don't rattle year teeth!

Michael Belluomo #4187

Editors Note:

Michael Belluomo is the Technical Director of BG products, (www.bgprod.com), *and is considered an expert in his field. He is a VMOA member and has very graciously offered his expertise to the VMOA in the form of a series of technical articles to be published in the VBoost. We have decided to name Michaels section "Myth Buster" His quarterly technical articles will be based on questions, from the membership, and will be geared to explaining the "how" and "why" things work and setting the record straight about aftermarket products, by cutting through all of the Marketing Hype attached to many products and gadgets. His expertise is in the area of, but is not limited to, petroleum products both synthetic and natural and all aspects of the fuel air delivery systems, (carburetors) His first series of technical articles were published in the winter 2008 edition.*

So we invite you to contact Michael at; mike33div@yahoo.com or the editor of the VBoost at: wizard@dilligaf.com With your questions…

Michael also runs a side business:
Classic Carbs & More is your "One Stop-Carb Shop"!
Specializes in vintage Yamaha and Honda motorcycle carburetors. A reputation for quality & attention to detail has kept Classic Carbs & More busy! We work year round on restoring vintage carbs. Most shops lack specific expertise in restoring early model Yamaha and Honda carburetors. Our business is renowned for this type of work! Classic Carbs & More is a preferred vendor for professional bike shops.

Not sure if your carburetor is worth saving?
Contact Classic Carbs & More for a professional evaluation!

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