Damping Rod Forks

by Dave Moss

THE INTERNAL COMPONENTS FOR damping rod forks have been the mainstay of most telescopic forks produced by a multitude of manufacturers over the years. Internal components have been upgraded with new cartridge style forks. But even in today's high-tech motorcycle world, base models of sportbikes and cruisers alike still employ the damping rod system.

Principles

Every suspension system tries to manage oil flow in tandem with a spring that provides resistance and rebound during suspension action. Damping rods manage oil flow via holes drilled in a rod that allow oil to flow back and forth in the fork. The most significant component is the spring in this system, as the usually-too-soft OEM spring will allow the fork to bottom by hand. That is why aftermarket companies offer straight-rate and progressive-rate springs to provide increased damping resistance as the fork travels through the compression stroke.

Components

The main spring is kept in place by the fork cap that is normally threaded into the top of the chrome sliding tube. Sometimes the spring is retained by a simple cap with an O-ring that seals oil in. This is held in place with a spring clip that sits in a machined groove inside the chrome tube. Many forks also have a preload spacer (made of steel or aluminum) that adds a static load to the spring. This is indicated by the amount of energy it takes to get the fork cap back in place.

The chrome sliding tube moves back and forth through the fork seal. This seal is locked in place in the fork leg with a spring clip that resides in a machined recess above it. To support the underside of the seal, there is a flat washer and a bushing that is located in the lower fork leg. The seal, washer, and bushing are driven into place by the appropriate tool. The damping rod is kept in place by an allen bolt located inside the base of the fork leg, and also acts as the resting point for the bottom of the main fork spring. Also note that the small/short spring on the damping rod itself provides cushioning during suspension action, and the silver piece that the allen bolt goes through serves as an aluminum bottoming cone to provide a soft metal contact point if the chrome sliding tube truly bottoms out.

Fork Action

Oil sits inside the fork leg (between the chrome sliding tube and the leg) and in the damping rod itself. The oil is trapped by the fork seal, the allen bolt securing the damping rod, and the O-ring in the fork cap. As the fork is compressed by road surface or braking, oil is pushed through the holes in the damping rod. Depending on the forces exerted, the oil will flow with greater or less resistance given the number and diameter of the holes present in the damping rod. The number and diameter of the holes set the damping characteristics of the forks. The same is true during the rebound stroke as the oil flows in the reverse direction. This shows the true rudimentary nature of this type of fork and the very limited oil management the stock components provide.

Improvements

The most immediate improvement is achieved by changing the number and diameter of the holes in the damping rod. Many individuals will braze the holes closed and then drill fewer holes with smaller diameters. This is a little tricky as you do not want to completely restrict oil flow and make the forks harsh. A little experimentation is necessary to get the desired response in oil flow. Experimentation can be done with one fork leg off the bike using body weight to compress the fork to see how it is working (once rebuilt and with the appropriate amount of oil). While the oil can be re-used, it is a lot of work to constantly wash the damping rod in solvent and parts cleaner prior to brazing. Other great resources of information are internet message boards for the OEM and model bike you have as someone has undoubtedly already done the work.

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Most OEM manuals prescribe the capacity for oil in the forks as well as the weight of the oil. In general, it is preferable to use 20W or 30W fork oil depending on your physical weight as the increased viscosity of the oil assists with damping. You can use the OEM specified capacity or start with an oil height of 130mm (measured from the top of the chrome tube when it is depressed in the fork leg). This measurement is done with no fork spring, emulators, etc. inside the chrome tube. That fork oil height can be raised a maximum of 20mm (so the measurement from the top of the chrome tube is 110mm).

You should preferably purchase a straight-rate fork spring for your weight or at least purchase a set of progressive springs. The spring is such a major component in this system that you should change it, as it will provide a much better riding experience due to overall improved fork action.

A set of emulators is also an option to improve the hydraulic damping characteristics. An emulator is basically a set of shims that can help restrict oil flow. These little gems have up to five settings so you can step up the firmness of the damping as needed. The only issue is that they have to be removed from the fork (along with the spring and preload spacer) to do this, and that can be a little messy. However, the great thing about telescopic forks is that you simply remove the fork caps and leave the tubes in place on the bike. **FZ**

Dave Moss started riding in 1974. He currently works with Bay Area Yamaha (formerly Redwood City Yamaha) helping new bike owners set up their bikes as well as providing chassis geometry/suspension classes for customers at the dealership and at track day events with local groups.

Product Review

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Overall, the Aire Tronics gear is an excellent safety device, with certain understandable limitations. It is designed to protect primarily the torso, and requires some time and effort by the rider to prepare the equipment and rig it up prior to a ride. However, even the one time it activates itself in an accident may be well worth the mentioned time and effort.

Aire Tronics deserves a hearty commendation for being to first to bring such an innovative product to the US market. The Aire Tronics vest and jacket are available in black. The vests come in four different models: #100, 101, 102, and 103, with the main difference being in the style, material, and collar design. The jackets come in six different models: #200, 201, 202, 300, 301, and 302. The 200-series jackets are made of leather, while the 300-series are made from ballistic nylon. The vests and jackets are available in sizes S–XXXL, and range in price from $299.99–$499.99. Accessory CO_2 cartridges, as well as lanyard kits, are available from Aire Tronics at $9.99 and $19.99, respectively. The gear can be ordered directly from Aire Tronics by calling 949.585.0202 or logging on to www.airetronics.com.

Look for a test of this gear in an upcoming *Crash Science* article. **FZ**