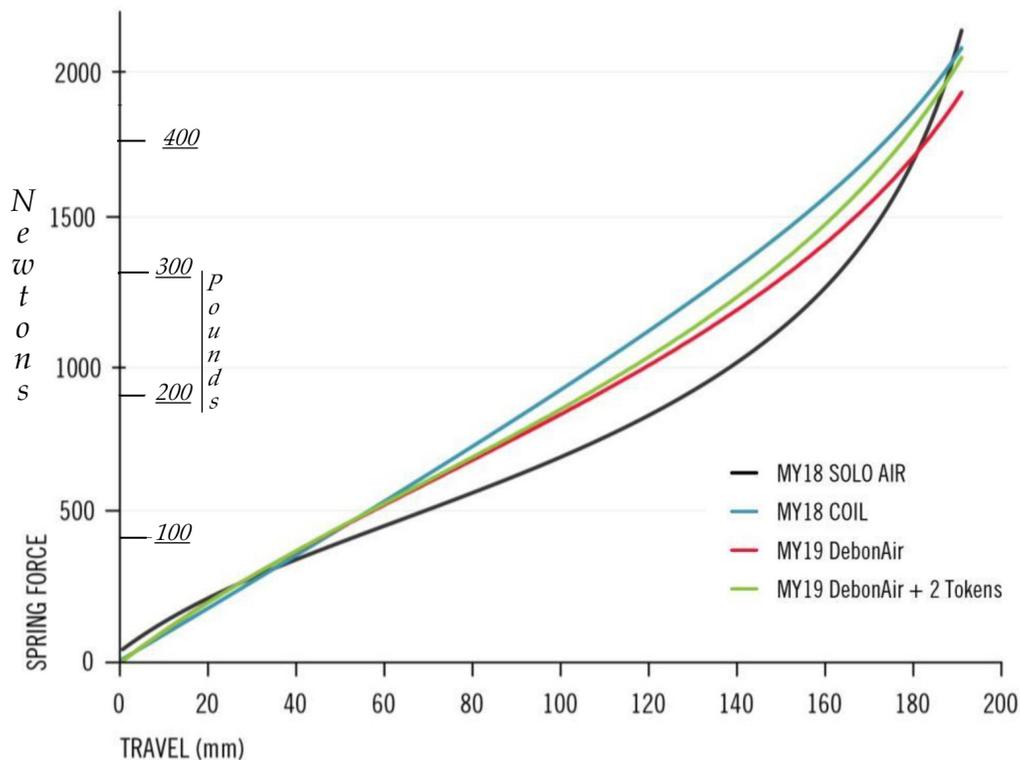
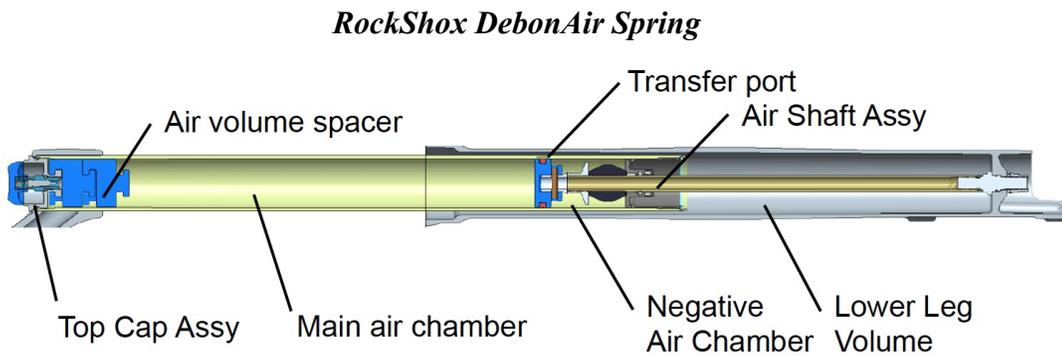


AVALANCHE

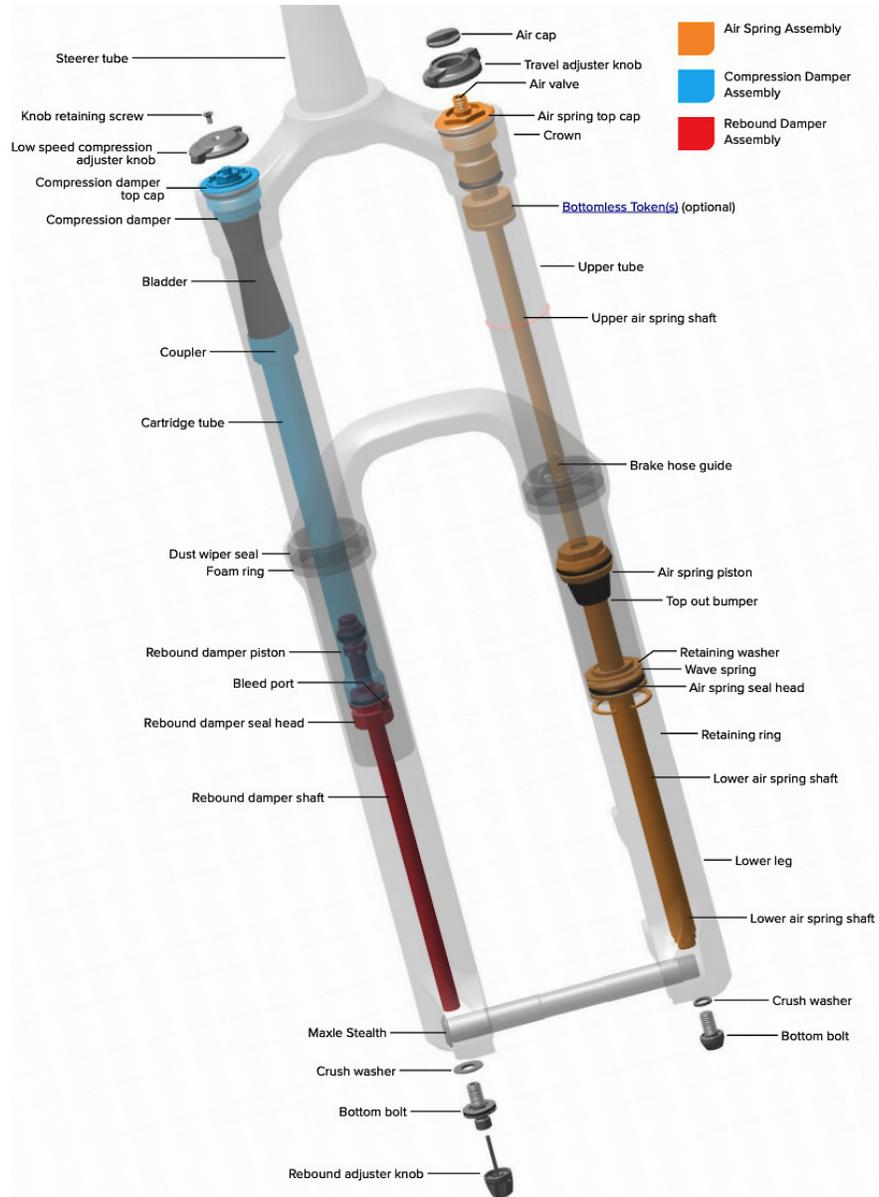
SUSPENSION

**How does an air fork spring work?
What is the advantage of both air and coil?**



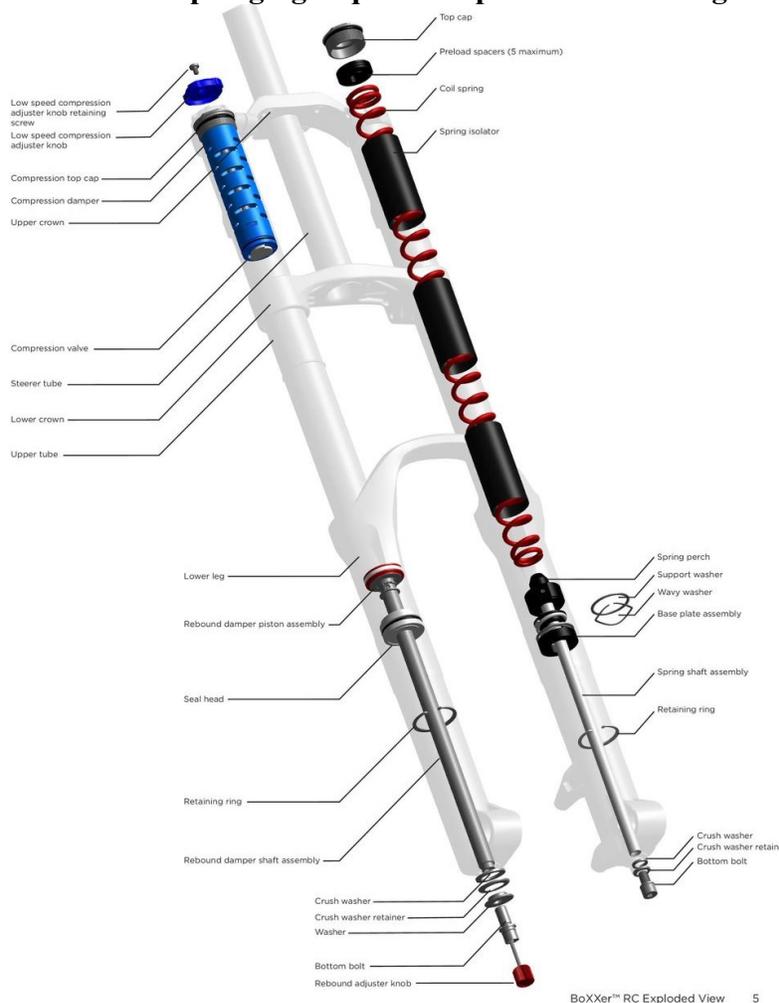
1) Linear Coil Spring Rate of approximately 50 lb/in

Air only for (Progressive, no preload) (spring rate is dependent on sag percentage)



Most modern forks employ the dimple system to create a functioning air spring that closely emulates a coil spring system. The key word here is closely, the two things that are missing are preload (to set the sag/ride height for the rider to meet the intended geometry of the bike) and lack of a linear curve thru the middle to end of the stroke (not enough spring rate in the middle and way too much in the end). Also since the emulation is created by the use of separate chambers that require separate dynamic seals that add to the overall stiction and maintenance interval.

Coil Only Fork (linear, no ramp-up) Over springing required to prevent bottoming



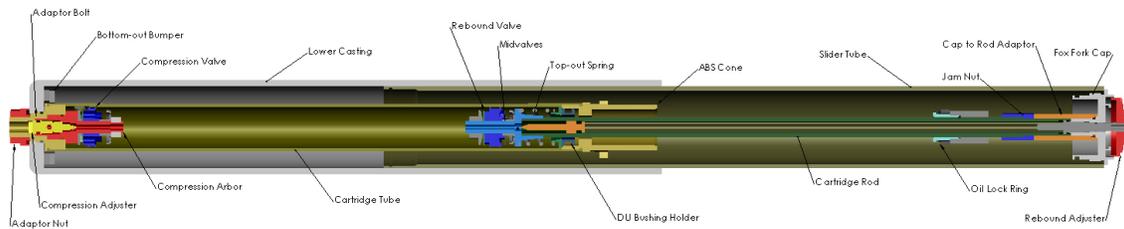
Coil only forks evolved out of dual damper/dual coil systems from the early 2000's. In order to reduce weight and cost, the major manufactures eliminated a damper and went to one single coil. The damper also evolved from being enclosed within the stanchion to a self contained damper cartridge to further reduce weight and to make maintenance or replacement easier. Coil only forks are generally limited to 4-5 spring rates that cover 100 lb to 250 lb riders, dialing in the correct spring rate is a balance between small bump performance and bottoming resistance and you may end up between spring rates. When the damper cannot create quality supportive compression without a harsh feel at higher speeds, the rider is forced to reduce or bypass(open mode) the damper compression and over spring the fork to prevent fork dive and bottoming. Keep in mind the reason the for coil forks was to improve small bump performance by reducing friction and creating the proper ride height. Many ramp up devices have been employed to help prevent bottoming, such as rubber bumpers, hydraulic anti-bottoming systems and ramp control systems in the lowers. None of these created the feel of air over oil ramping up in each leg.

Avalanche Advantage Open Bath Cartridge System

(with air over oil ramp-up and ABS option)

To be used with coil only forks or coil replacement upgrades(air side replacement)

Such as Boxxer RC/Race, BomberZ1 coil, Push ACS-3 and Smashpot



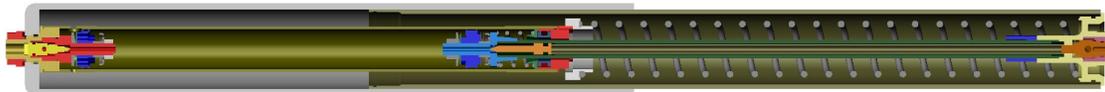
- Advantages**
- 1) Improved damper functions with replacement of stock damper.
 - 2) Reduced coil spring requirements.(about 5-7 lb/in)
 - 3) Preload can be set independent of the spring rate.
 - 4) Can be used with the stock air spring without the benefits of the coil conversion (ABS not needed due to the progression of the air spring)

- Disadvantages**
- 1) Ramp-up limited to last part of the travel with limited control.
 - 2) Uneven forces on each leg causes more friction especially with small bump performance.

Hybrid coil/air Cartridge System

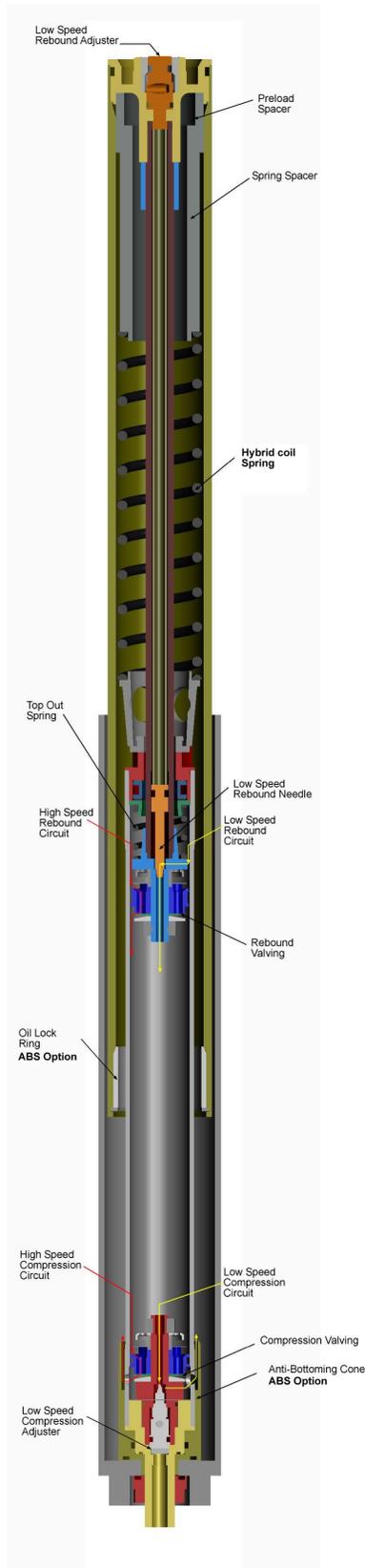
(With Hybrid coil spring and air over oil ramp-up)

To be used with stock air side springs (DebonAir/Evol)



- Advantages**
- 1) Improved damper functions with replacement of stock damper.
 - 2) Much lighter coil spring requirements.
 - 3) Equal force on each leg for reduced friction and much improved small bump performance.
 - 4) Adjustable ramp up and fine tuning of overall spring rate with the air side.
 - 5) Sag can be set independent of spring rate with preload spacers on hybrid coil.
 - 6) Midstroke support can be dial in with air side or progression added with token

- Disadvantages**
- 1) Hybrid Coil Open Bath system adds about 200 grams to the overall weight of the fork over stock air spring system.



So what makes this a hybrid coil/air system: The open bath cartridge damper side now contains a coil spring and open bath oil. The air side of the fork continues to function as before but at a much lower pressure because the coil spring and air over oil pressure build up no support about half the riders weight.

Why keep the air spring system: The air spring system can still help support the rider weight, its just not as good as a coil in the initial stroke (small bump compliance) and more linear feel through the stroke. It also controls the travel and the overall progression of the fork. The forces are also distributed about equally between the left and right side, Equal Force System (EFS).

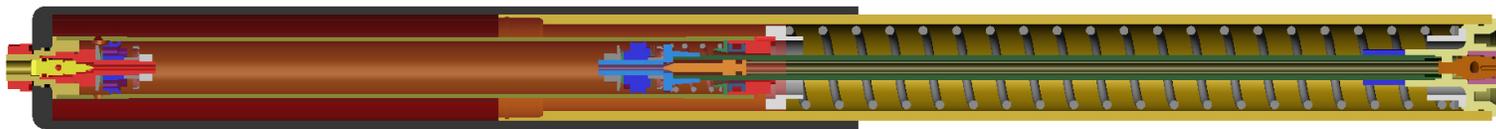
How does the Hybrid spring and open bath cartridge system damper add more function to the fork: The open bath cartridge is self bleeding and requires almost no maintenance. The air space above the oil creates pressure on the oil to prevent cavitation and adds ramp pressure depending on the oil height setting. The stock damper is sealed and adds no additional spring rate and requires regular service to bleed the damper oil.

How is the sag set with two different springs involved: The initial starting preload on the hybrid coil is based on the rider weight and the selected coil for the Hybrid system. One can add preload spacers on top of the coil to decrease the sag or add air pressure to the air spring to create a more progressive spring system. If increased spring rate is needed deeper in the stroke to prevent bottoming or simply create a more poppy lively feel then tokens can be added as desired.

Avalanche Advantage Open Bath Cartridge System

How an open bath cartridge system works

Shown fully extended with the oil height (shaded red) just above the red cartridge cap



The lower half of the damper leg is filled with oil up to about the top of the cartridge tube red cap. This becomes the oil bath that the damper is completely immersed in. As the fork compresses the damper cartridge rod displaces oil thru the compression base valve and out thru the relief holes at the bottom of the cartridge tube. This displaced oil and the oil displaced by the stanchion cause the oil height to rise thus increasing the air pressure on the oil above. This oil volume or as we say measured oil height can be lowered or increased to change the pressure ramp up a small amount (typical range is 25 mm)

Shown fully compressed with the oil height (shaded in red) half way up the coil spring.



So as the air volume above the oil compresses to a smaller volume creating a much higher pressure adding a small amount of spring rate deeper in the stroke (ramp up). The damper side stanchion seals (dust wipers/seal) need to hold back this increased pressure so they must be clean and in good condition or the oil will weep out. We recommend the stock seals or SKF replacements, low friction seals will not be necessary as the seal is constantly lubricated and these seals may weep even when new.

The midvalve moves thru the oil and create dynamic damping like your hand waving thru the water, the faster the rod moves the more the shims bend back creating compression that resists fork dive and blow thru without the harsh feel. Trying to create this much damping with the base valve alone (as with most cartridges out there) will cause a harsh crude damping feel. Rebound is controlled by the bottom side of the midvalve and keeps the fork from bouncing back too fast, it is tuned to the rider weight (springs needed to support the riders weight). Compression is also metered by the cartridge rod displacement thru the base valve low speed adjuster and high speed shims, this resists bottoming from g-outs and jumps. It also has to blow off or relieve the damping on high speed square edged chunk to prevent harshness. We offer The FvAT/HSB system to help minimize this compromise soft and stiff valving shims when accounting for jumps or chunk.

How can we better make a coil fork even better!

A little history as to how this happened

The original or traditional coil forks were designed for MX and the early MTB forks with a damper and spring in each side, filled about 2/3's with oil. This allowed the fork to create a coil spring like feel for the first half of the travel. The air space above the oil is compressed which produces an additional spring force in the last half of the travel. This additional air spring effect does two things, it allows the selected coil spring rate to be much softer because the air supplements and increases the spring rate and the ramp up or progression can still be controlled by the air volume compression by changing the oil height.

MTB forks eliminated one damper to save weight and reduce the cost to produce over the past 20 years and used a single long over rated spring with no oil in the coil leg. This led to an air spring version that emulates a coil to further reduce the weight.

This is essentially is where we are now with your typical air spring system single damper front fork.

Our hybrid coil conversion brings back the ideal coil/air spring system without the added weight of traditional spring/oil filled fork. The air side is still used to create the additional spring rate and ramp rate at a much lower pressure. We use our open bath damper with a lighter and shorter coil spring on top of it. The air spring side remains unchanged and creates the additional spring rate. The air side now uses about 1/3-1/2 of the pressure that you currently used to create the additional spring rate which can be adjusted to support your weight and ramp up desired.

This hybrid system works in conjunction with our open bath custom valved damper with our exclusive midvalve and high speed blow off system (FvAT/HSB). Our damper creates a very supportive compression system that prevents fork dive and still feels plush on small bumps. This midvalve system and base valve will still blow off to prevent deep square edged harshness without bottoming.

Available For:

Rockshox Boxxer, Fox 40, Fox 49, Bomber 58, BomberZ1 (160/150/140), Fox 38 (170/160), Fox 36 (160/150/140), some Fox 34 and Z2 (150), Pike 29er (2014-17) 150, Zeb (180/170/160/150), Yari/Lyrik, 160/150/140 (riders under 200 lbs), MRP (160,150), Bartlett 200.

Keep in mind that air forks are trying to emulate the way actual coil springs do it naturally and because of this emulation, air springs don't do a very good job in the beginning and end of the stroke.

The main reason for our Hybrid coil system is to provide the support needed for proper ride height/sag without having to over pressurize the air spring resulting in too much spring rate which restricts the travel and makes the fork feel too stiff.

For most stock air forks, if you try to run 22-25% sag you can't get full travel and the overall feel is too stiff. So you are forced to use 30-35 sag. The open damper settings also contribute to the fork riding low in the stroke because it feels too harsh so you have to run the run the compression mostly all the way out. Riding low in the travel reduces the effective travel and makes you feel like you need increase the travel to make up for this.

Compatibility with other air side upgrades

We do recommend the stock air shaft/spring system with a spring/rubber bumper top out to control the forks length for consistence preload on the hybrid coil.or using the best version of it.

The MRP Ramp system: Still will provide external ramp or progression.

The Runt system: Still will provide external ramp or progression.

Disclaimer

Avalanche Suspension Inc. is not responsible for any damages to you or others from riding, transporting or other use of your Avalanche Advantage Rockshox Pike or mountain bike. User fully understands that mountain bike riding and/or racing is dangerous and hard on equipment. In the event your Avalanche Advantage cartridge kit fork breaks or malfunctions, Avalanche Suspension Inc. will assume no liability or obligation beyond the repair or replacement or your fork.



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