AVALANCHE SUSPENSION

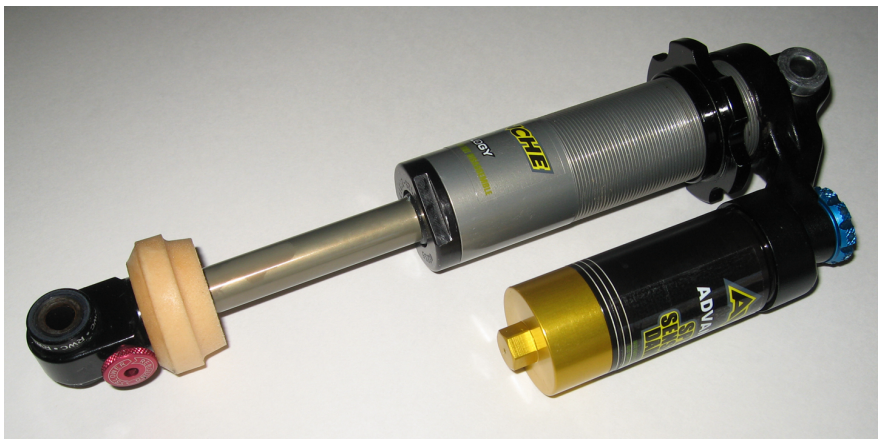
FOX RACING SHOX

Fox DHX 5.0/4.0 SSD Upgrade
Fox VanRC SSD Upgrade

AVA ADVANTAGE

PROGRAM

Making suspension better for everyone.



DHX 5.0/4.0 with Extended Reservoir and Shape Factor Bottom-out Bumper

Why the DHX needs to be upgraded?

Propedal position sensitive damping has one major drawback, the deeper the damper is in the stoke the higher the damping force, this is good for preventing bottoming of the shock but in the real world the terrain has many square edged bumps, rocks and trees. If the shock is deep in the stroke and experiences a square edged hit the compression damping needs to be relieved or blow-off to prevent harsh feel or what is call hydraulic lock. This is prevented from happening with the DHX's damping system. All modern shocks today do this with speed sensitive damping, what we call SSD Technology. This is accomplished by replacing the Propedal Valve with a new ported valve and a series of valving shims that react to the speed of the shock shaft not the pressure created by the stroke position of the shaft.

The design of the Propedal creates a great position sensitive shock. As the pressure in the shock goes up the Propedal valve gets harder to open, this creates more compression damping. The pressure can be increased 3 ways, first my adding more air pressure to the schrader valve, second as the shaft compresses, the displaced oil compresses the reservoir floating piston down, which drives up the pressure in the reservoir, and lastly the chamber compensation bottom out can be dialed in to decrease the reservoir volume and thus cause the pressure to be driven up even faster as the shaft compresses. The Propedal adjuster allows the rider to compensate for the pressure on the valve by applying opposite spring pressure to the valve reducing the force required to overcome this internal pressure and allowing the valve to blow-off more easily.

So this all sounds great but in a real world where courses and terrain are not perfectly smooth and void of square edge holes, this is where the Propedal system fails to allow the valve to blow-off. When the shock hits square edge bumps deep in the stroke the valve becomes harder to blow-off and is actually getting firmer the deeper it gets in the travel (Position sensitive damper).

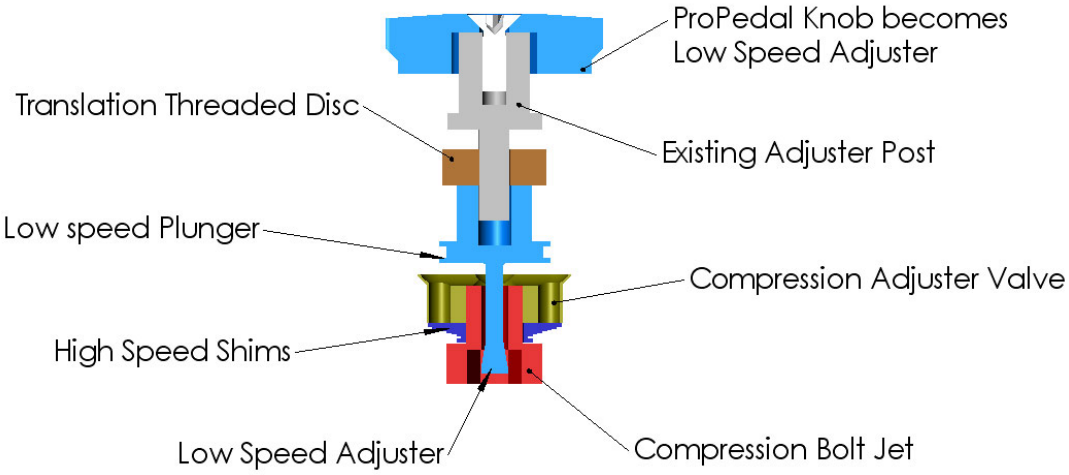
This is why the Speed Sensitive Damper (SSD) is preferred, as the shaft speed needs to increase the compression adjustment valve needs to blow-off when the bumps become square edged or what we call high speed hits. This creates the need for the conversion and replacement of the propedal system to a shimmed ported valve. Since the shim stiffness is not affected by the build up of pressure in the reservoir, the shims can create damping at low and medium speed compression hits and be valved to blow-off when higher shaft speeds occur thus allowing the damper to smoothly resist the square edged hits. Because the main piston was valved for a very progressive position sensitive Propedal valve we can now revalve the main piston to contribute to the compression circuit and due to the decreased ramp up in the overall spring rate of the damper, the rebound stack can be revalved to be more linear . The main piston can now control it's 70% share of the compression damping giving us many more tuning options for rider set-ups. Rebound can be tuned to be more reactive on small bumps and provide lift where needed while preventing that pogo stick feel. Increased reservoir volume reduces pressure build up deep in the stroke, reducing heat build-up and increased oil and seal life. Optional reservoir volume systems available as shown below:

What's been done.

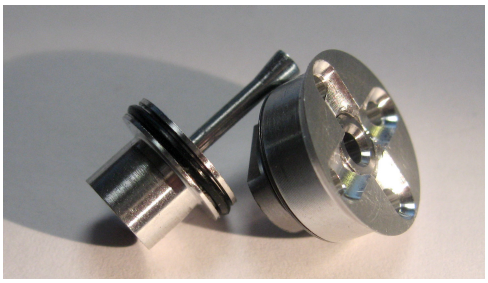
The ProPedal has been replaced with with a new ported valve and a low speed plunger that allows the ProPedal knob to tune the low speed circuit now.

Propedal Valve, compensator spring and Propedal adjuster mechanism

Avalanche Advantage SSD Modification

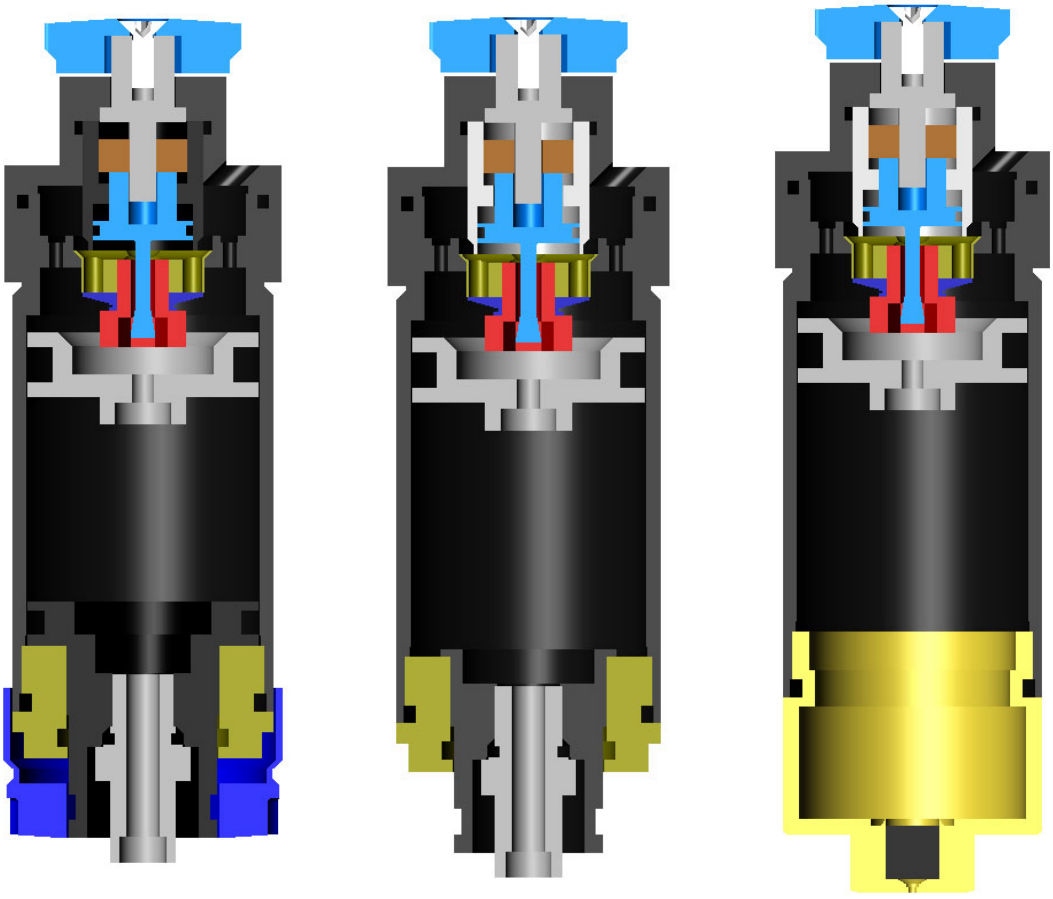


Low Speed Plunger and High Speed Valve

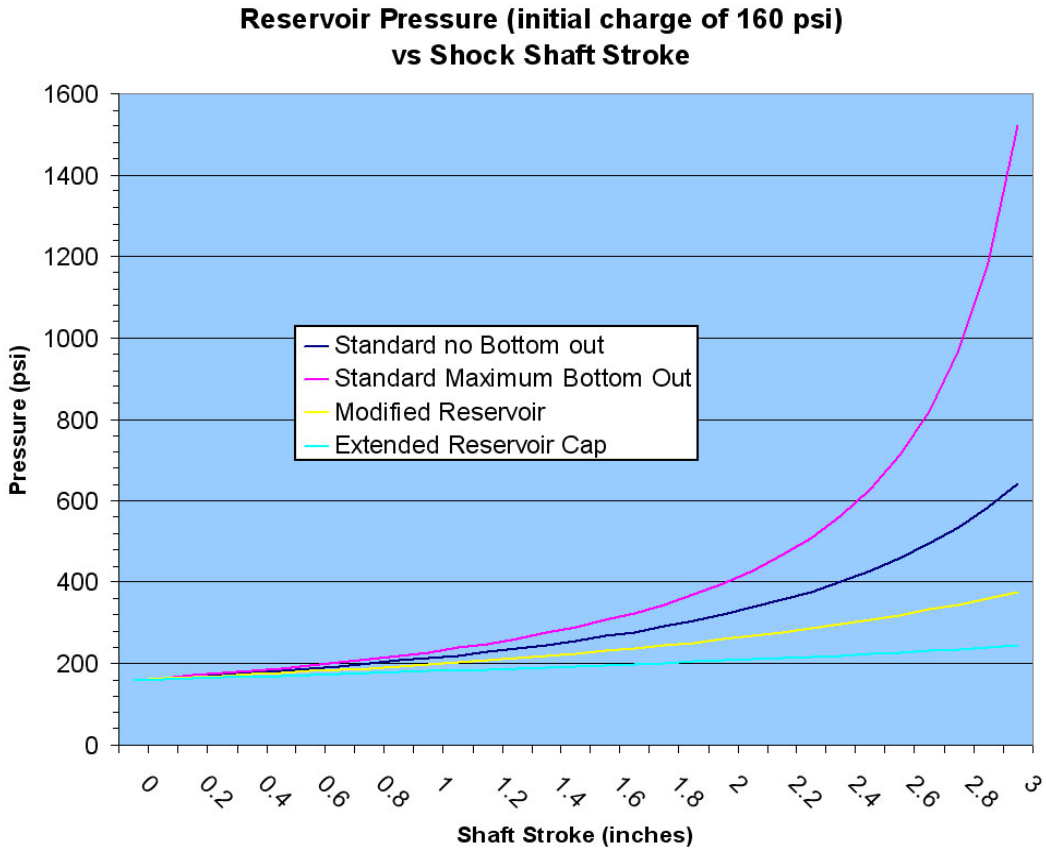


Reservoir Modification Options

DHX Reservoir and Bottom-out piston and adjuster



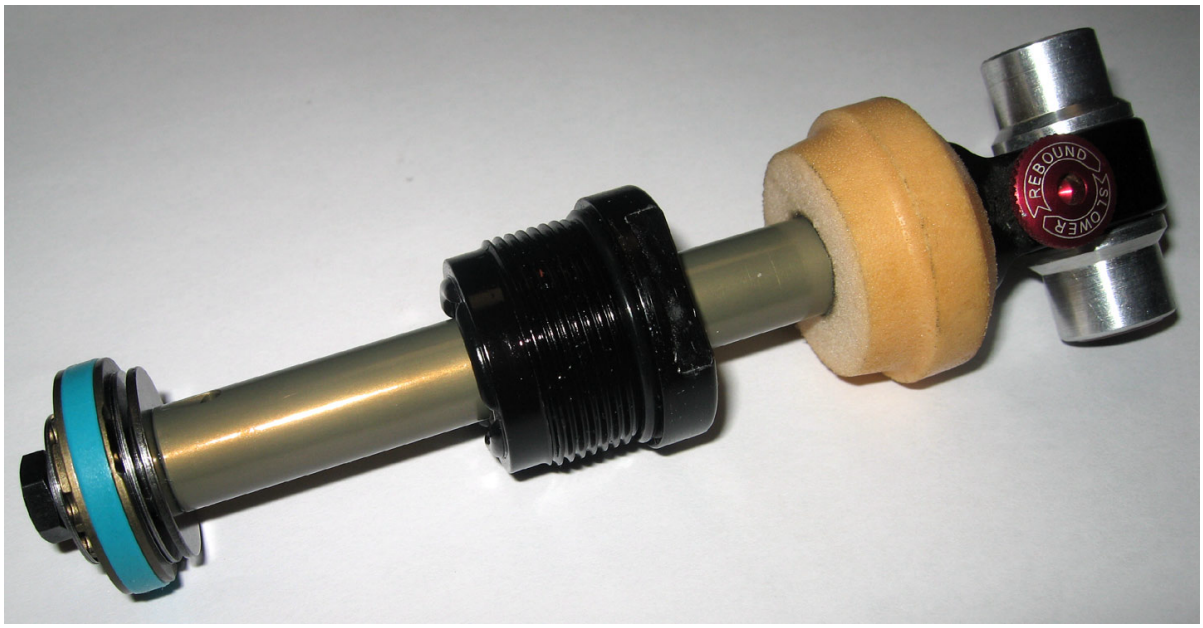
With Bottom-Out Control	Modified Reservoir Volume	Extended Reservoir Volume
.78 max, 0.66 min cubic inches	1.0 cubic inches	1.7 cubic inches
Standard (3 inch Stroke)	30% increase (1.3 times)	120% increase (2.2 times)
use with regressive to linear set-ups	use with linear to progressive set-ups	use with progressive to rising rate set-ups



For a 1/2 inch diameter shaft, 1500 psi equals 294 lbs extra spring force in other words for a 300 lb/in spring at 3 inches of stroke, the spring rate would increase to 400 lb/in.

What does all this mean? For regressive set-ups it might be good to add a bit more compressive force at the end of the stroke, but this does not come at no cost, as the shock compresses rapidly the reservoir also heats up and causes the nitrogen pressure to even further increase. Even though the propedal valve that was activated by this pressure increase has been removed, the seals, the o-rings and the oil have to deal with much higher pressures then needed. Typical initial nitrogen charge of 160 psi is enough to prevent internal cavitation and allow the shock to have proper damping. So generally for most shock set-ups it is advantageous to keep the pressure as low as needed and prevent the pressure from ramping up as the shock is compressed.

The larger the reservoir the less pressure increase during full compression, this pressure effects the midstroke harshness for rising rate linkages. Also the longer the run the hotter the shock gets, and with small reservoir volumes this could double the pressure in the shock at the beginning of the stroke and make it feel topped out or over preloaded. Regressive linkages like the "Sunday" only benefit from the bottom-out original reservoir. Most frames need the modified reservoir.
High rising rate frames and aggressive extended downhill runs on linear and progressive linkages will need the extended reservoir.



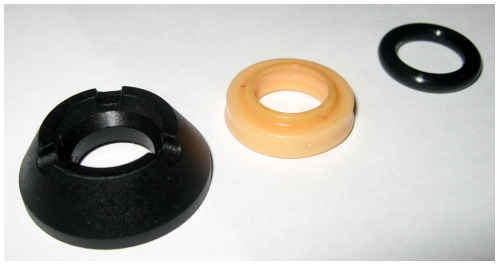
Specifications:

16 mm Speed Sensitive flow controlled 4 port Compression Valve
15 Clicks of Low Speed Compression, uses exiting Propedal knob as new low speed adjuster
* VanRC has Modified High Speed Adjuster Valving with wider range 22 click low speed adjuster
Revalvable 6 mm ID shims
High speed adjustment - Internal Shim Stack
Nitrogen charged to 160 psi, fixed (i.e. no need for adjustment now)
Retains bottom out system to aid with pressure ramp up needed for regressive linkage frames
Installs directly into the DHX housing...which preserves same top housing and adjuster knob for fit compatability of existing frame applications
Low friction main shaft Seal
Shape Factor Bottom-out Bumper, optional
Modified Reservoir Volume , optional
Extended Reservoir rubber plug cap for maximum volume, optional

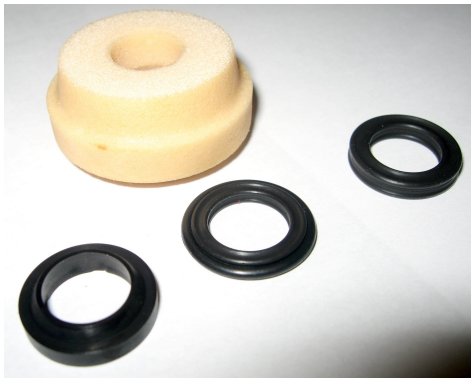
Main Piston Revalved

The removal of the Propedal and replacement with the SSD compression adjuster system now allows the main piston to be revalved for speed sensitive valving shims according to the linkage progression, rider ability and type of terrain.

The shaft seal, bushing and dust scraper have been upgraded to reduce stiction for silky smooth action.



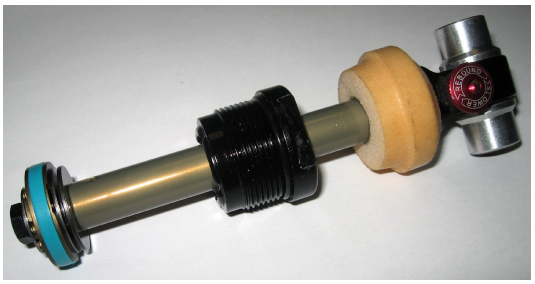
Stock DHX Bumper, Dust Seal and Oil Seal



AVA Advantage Shape Factor Bottom-Out Bumper, HardCoat Friendly Dust Scraper, water and mud seal, and Viton Low friction Oil Seal

An Improved shape factor anti-bottoming
MX-style urethane bumper has been installed.

Fox anti-clunk rubber bumper replaced with:



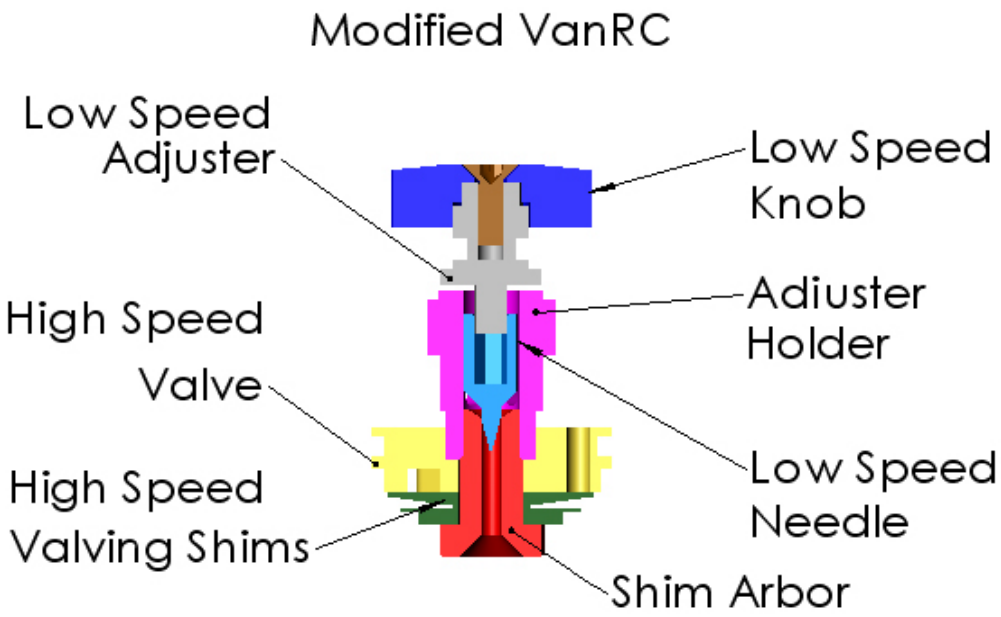
Avalanche Advantage Shape-Factor Anti-Bottoming Bumper

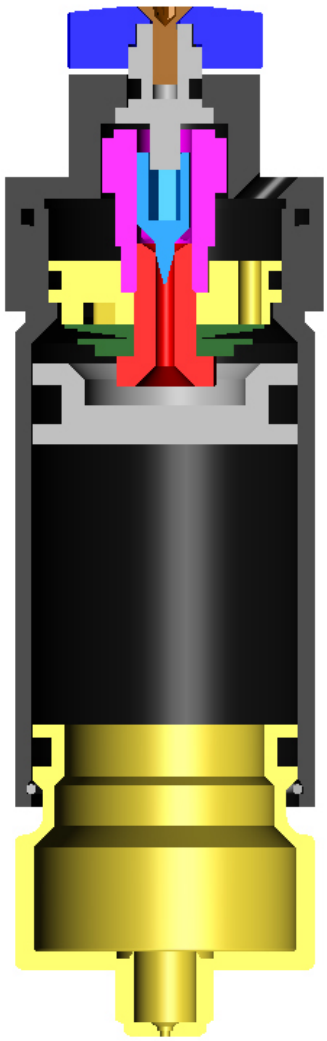
Top View

Bottom View

This compresses inward constrained by the spring inside diameter making the bumper ramp-up to resist bottoming in the last ½ inch of travel. Because the bumper is made of closed cell Urethane it can compress to a very small volume allowing full travel of the shock.

Fox VanRc Modifications





Technical Discussion on the VanRC

The VanRC is Fox's redesigned DHX that has the the Propedal valve removed and replaced it with a high speed regressive blow-off style valve with a very limited external low speed adjuster. This makes the VanRC a speed sensitive damper but with emphasis on pedal performance because of the low speed threshold of the Belleville spring valve set-up in the high speed adjuster valve and limited low speed adjuster range. Since the Propedal has been removed, The reservoir now uses a non adjustable fixed charge system and no longer has the need for the Bottom-out adjuster volume reducer feature. The internal volume is now much larger with these features remove and would be similar to the modified DHX 5.0 reservoir volume. The DHX 4.0 volume does not have the Bottom-out features as well so the volume need not be modified, but will except the extended reservoir cap when available.

We have developed a modified version of VanRC valve that uses shimmed high speed valving and a wider range low speed adjuster for more sensitive low speed performance and more progressive high speed feel while still allowing blow-off on square edged bumps. This now allows us to revalve the main piston valving to complement redesigned adjuster system as we have done with the DHX. The reservoir is charged with fixed nitrogen pressure, but an optional extended reservoir cap is available to minimize pressure ramp-up as we have done with the DHX.

How it works now.
&
How to set-up your Avalanche Advantage SSD upgraded DHX.

Speed sensitive damper technology means that at any shaft speed the damper will adjust flow of oil in the damper to adjust for the shaft speed. As the damper shaft speed increases the damper will produce more damping forces unless it is relieved by some means. The point at which the damper relieves itself can be controlled by the valving shims or blow-off valves. The art of tuning these valving shims and blow-off systems is called revalving. A properly revalved damper will provide the necessary damping for absorbing bumps and jumps while relieving the damping as needed during square edge hits to prevent harshness. Knowing your weight, ability, riding conditions and type of linkage progression a suspension tuner can revalve and set-up your shock to meet these conditions. The compression and rebound adjusters provide the rider with a means to fine tune your suspension to your desired needs.

Spring Rate and Sag

Choosing the proper spring to support your weight is the most essential first step. Your suspension tuner will help you determine this rate. The spring should compress approximately 30% the travel (stroke) of your shock. I.E. for a 3 inch stroke shock the sag will be 30%*3.0 inches = .9 inch of sag. This is called the proper sag. Sag can be adjusted by adjusting the preload on the spring. Tighten the spring preload collar to decrease sag and loosen the preload on the spring to increase sag. The maximum preload is 3 to 4 turns on the preload adjuster after it first contacts the spring; the minimum preload is 1-1/2 turns. If you have too many turns of preload on your spring your low speed rebound damping will be over stressed, too little and the shock will not fully extend for the next bump and cause packing. Too many turns means you will need a slightly stiffer spring and not enough turns you will need a softer spring. When between spring rates, a softer spring will provide less pedal bob because of the increased preload and a stiffer spring with less preload will loosen up the initial travel and add more progression to the suspension.

Low Speed Rebound Adjustment

Once your sag is set properly the rebound adjuster can be set for the ride conditions, standard position is about 8 clicks counterclockwise out from full slow. Turn out 1 click to speed up rebound, this will make it absorb small close together bumps easier. Turn in 1 click to slow up rebound when absorbing big bumps to prevent kicking up. Repeat click at a time until desired results are achieved. Faster rebound is more desirable when trying to achieve plusher setting

Low Speed Compression Adjustment

The low speed compression (LSC) adjuster is used to set the overall firmness of the damper, 7 clicks from full (+) is the standard setting. Turn the adjuster knob in 1 click clockwise (+) to increase LSC damping, i.e., for large rolling bumps. Turn the adjuster knob counterclockwise (-) 1 click to decrease LSC damping, i.e. for small roots and rocky conditions. Repeat click at a time until desired results are achieved. Too little damping will cause the suspension to ride to deep in the stroke, using up most of your stroke causing a harsh ride.

The high speed compression (HSC) has been preset internally with the high speed shims on the adjuster valve and main piston for your riding ability, terrain and linkage. The valving has been pretuned by us to achieve optimum damping while still able to blow-off on the medium to larger high speed square hits. Adding more low speed compression will cause the high speed circuit to engage slightly sooner and vice versa.

Bottom-Out Adjust

The nitrogen chamber bottom-out adjuster on the the DHX 5.0

If you elect to retain this feature can add an additional spring force to the damper at the end of stroke to improve bottoming resistance on regressive linkage systems. We do however recommend that compression and proper spring rates are tried first, decreasing the chamber volume will cause a harsh midstroke as the shock heats up, the larger volume adjust will have the least affect on the reservoir pressure. The reservoir piston height is set to maximize the nitrogen charged reservoir. The nitrogen charge is set to a fixed pressure based on the compression valving, this is no longer an adjustment feature on the DHX damper, decreasing the pressure will not soften or alter the damping in anyway, if released it will damage the set-up of the shock and cause air bubbles to form in the oil during use and cavitation will occur when the nitrogen pressure is not sufficient enough to prevent oil pressure to be reduced below the vapor pressure of the oil during extreme damping conditions.

Warnings:

Under no circumstances should the nitrogen pressure be changed, discharged or checked with a gage as it will disrupt he pressure on the shock oil causing it to foam and cause air bubbles to form under higher damper forces. It is no longer an adjustment feature after conversion to a Speed Sensitive Shock.

Service and maintenance.

We recommend you have you shock serviced by an experienced shock technician yearly or every 100 hours of riding for optimum performance. The oil heats up and absorbs wear particles causing its damping action to decrease over time. The nitrogen charge will also need to be recharged every year regardless of the number of hours used as it will slowly leak down or be absorbed by the oil and o-rings. Do not check the nitrogen pressure with a gage, as the gage will absorb most of the pressure in the reservoir during the test. Do not release the nitrogen charge rapidly during recharging, as it will cause bubbles to for in the oil. The state of the nitrogen charge can be tested by removing the spring from the damper and pressing the shaft against a bathroom scale, readings should fall between 35-40 lbs.

Frequently asked questions and terms.

Why do I have to use nitrogen pressure for the reservoir charge…Nitrogen is a dry inert gas that helps resists pressure changes from heat build-up in the reservoir.

Why is the air pressure adjustment feature no longer used… The speed sensitive valving technology uses a minimum pressure to prevent cavitation, reducing this pressure will damage the oil and not make the damping feel softer.

Eye to Eye: Is the length of shock between the two mounting hole centers.

Sag: Is the amount of shock (& rear wheel) compression caused by the riders weight while sitting on the bike in a normal riding position.

Spike: Is the harsh feeling that occurs when riding over hi-speed bumps if the shock cannot compress fast enough to absorb the size or sharpness of initial bump contact.

Bobbing: Is the up and down (power loss) movement of your suspension that occurs from weight shifts of the rider during pedaling.

Blow-Off: Is the shocks ability to relieve the pressure caused by high speed pressure build-up in a damper valve.

Disclaimer

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