TUNING MANUAL

MRD

MANITOU RACING DEVELOPMENT

MANITOU

1999 Suspension Forks

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• Chapter 1: INTRODUCTION

Thank you for choosing a Manitou suspension fork. The 1999 Manitou suspension forks have been designed to give you more performance than ever. To take best advantage of your fork though, you'll need to tune it to your own particular riding style and weight. By reading this MRD Tuning Manual, you will gain the knowledge necessary to do this and make your fork work perfectly.

A note on MRD (Manitou Racing Development). Manitou Racing Development is the race division of Manitou that is responsible for developing products for use by top pro racers like John Tomac, Shaun Palmer and Hubert Pallhuber. The information included in this manual is a result of many years spent working with these racers and is written by MRD tech mechanics who's job it is to ensure that Manitou riders are riding perfectly-tuned suspension forks and shocks. If the information here seems at first complicated, don't get frustrated. The MRD techs who wrote this manual have many years experience with suspension and only through much time and effort have learned the intricacies of suspension technology. With time, and the information provided in this manual, you too can gain the necessary insight to make your suspension work optimally.

Some thoughts on 1999 forks before we begin. For 1999, the travel of most of the forks has been increased. Most 1999 SX forks now have 80 millimeters of travel versus 70 millimeters the year before (the SX Carbon is the exception, putting out 70 millimeters), the Spyder R has 80 millimeters of travel and the X-Vert line of forks now have 100 millimeters of travel or up. This, of course, means that you now have more tunable travel, but, in addition, the standard setup of 1999 forks is designed to use this increased travel to create a plusher ride. We're sure you noticed this on your first ride on the fork.

Before you begin your tuning, we recommend taking a few rides and getting accustomed to the longer travel and softer feel of the suspension. You may even find that the stock set up is perfect for you, even though the spring charts in this tuning manual recommend something different entirely.

Also, before you begin tuning your fork, start a log book that tracks the changes your have made to the fork and the conditions (i.e., wet, dry, big bump hits, small repetitive bumps) you rode the fork in. Make sure you put a rating on how the fork felt that day somewhere on that same page. That way you can also return to this setting should you encounter similar conditions again. Be aware that the outside temperature should also be considered when tuning the fork as well. A hot day, for example, will have an effect on the stiffness of the fork (because MCU's and oil are sensitive to temperature), so make sure you write down the weather in your log book as well. It might seem like a lot of work when you're writing it out, but a well-kept log book will pay dividends in suspension performance.

• Chapter 2: BEFORE YOU BEGIN

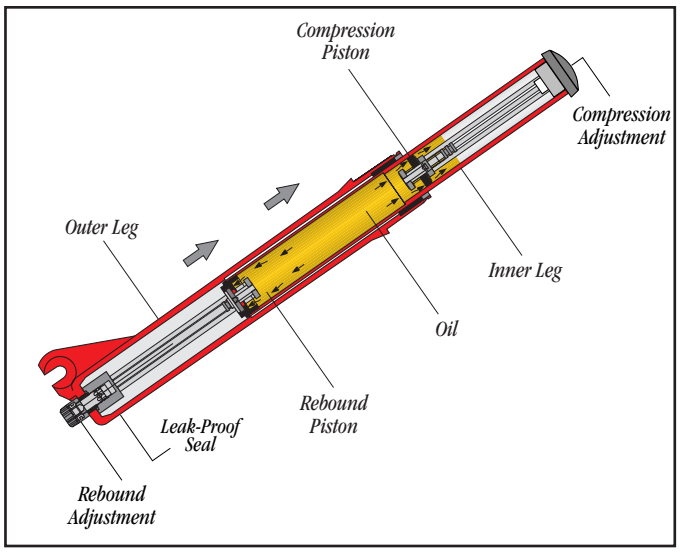
1. TPC EXPLAINED

TPC stands for Twin Piston Chamber, the next generation in damping technology. A TPC fork consists of four main components: the compression assembly, the rebound assembly, the inner leg and the fork fluid.

TPC is an open system like an open-bath fork, but better. TPC is contained like a cartridge, but better. What does all this mean? TPC provides a damping system that's more reliable than a typical cartridge (no more blown cartridges) as well as being easier to care for than an open bath (no more frequent and messy oil changes). It's also lighter than an oil bath design because oil and springs are only needed in one leg each.

2. HOW TPC WORKS

The theory behind TPC is oil displacement. For those unfamiliar with physics, simply visualize a bucket filled close to the top with water. What happens if a brick is lowered slowly into the bucket? The displacement of the brick—the space that it takes up—replaces a similar amount of water; the water has been displaced and the water level in the bucket rises.



TPC works on this same principle. As the lower or rebound shaft enters the inner leg (as the fork is compressed), it pushes fork fluid up through the compression valve resulting in displacement much like the brick being introduced in the bucket. The compression piston controls or dampens this oil flow, allowing the fork to control the reaction to bumps. As the shaft returns to its original position, the fluid level does likewise through the rebound piston that offers return surface control. A benefit of this design is that the fork has very little compression damping over small bumps, permitting it to be very plush. Conversely, on large bumps when more oil is pushed through the compression piston at a higher speed, there is more compression damping, exactly what you want on on big hits.

3. TPC SPORT EXPLAINED

TPC Sport is very similar to TPC. The four main components are compression assembly, rebound assembly, the inner leg and the fork fluid, and the theory behind the function of TPC Sport is oil displacement (again like TPC). As the lower (rebound) assembly is compressed, fork fluid flow through the compression valve to provide compression damping; as the fork extends, the oil flows back through the rebound piston, providing rebound damping. The difference between the two designs is that TPC Sport uses simple orifices to monitor oil flow through the piston where TPC has shim stacks to control oil flow.

4. ABOUT MICROLUBE

All 1999 forks come standard with the Microlube lubrication system. Located at the back of the fork, at the top of the slider tubes, is a small fitting which is the heart of the Microlube system. All you need now is a Microlube grease gun (85-3812) and Manitou's Prep M (85-3810) suspension fork lube. Once you have the two aforementioned pieces, the next step is to brush off any dirt from the grease ports then just put the tip of the grease gun (85-3812) into the small eye and squeeze a few times. After you've given the fork a few squirts, push down on the fork and see if you feel any stiction (notchiness as the fork compresses). If you do, continue injecting grease and checking for stiction until it is eliminated. Don't overdo it either. Some people think that if a little is good, a lot will be great. That's not true with Microlube. The proper amount of grease is when stiction is eliminated-no more, no less.

Something to remember with Microlube is that it does not mean the end to servicing your fork. Periodically, depending on the conditions you ride in, you'll have to disassemble the fork, clean it thoroughly and then reassemble it. We recommend doing this every 100 hours of riding, but since keeping track of hours in the saddle can be difficult, make sure you work it into your maintenance schedule.

• Chapter 3: REAL TECHNICAL STUFF EXPLAINED SIMPLY

This section is for those who want to know the basics behind suspension before they get started trying to tune their suspension fork. Damping, preload or other terms, are defined in this section.

A. THE PURPOSE OF SPRINGS AND PRELOAD

A suspension fork or rear shock unit uses springs primarily to support the weight of the rider and bicycle, as well as isolate both from impacts encountered while riding over rocks, holes, jumps and other obstacles. Generally speaking, you want to use a spring with a rate just stiff enough to prevent bottoming on all but the biggest bumps.

Spring Rate Defined

Spring rate is a measure of the spring's stiffness or softness and is rated by the amount of force (weight) necessary to compress the spring a given distance; it's most often expressed in pounds per inch or kilograms per centimeter. A coil spring's rate is determined by its wire diameter, the number of coils and the coil diameter. An MCU's spring rate is determined by its SP2 durometer hardness and density of the mixture.

Manitou forks from 1997 onward use a combination of coil spring and MCUs. Why? A coil spring, by nature, wants to release all of its energy from compression, thus providing a very lively, active ride on small-to medium-size continuous hits. An MCU also does a good job on small stuff, however, an MCU's spring rate ramps up very quickly the more it's compressed. Around the middle of fork's stroke, an all MCU fork begins to feel dead and adds a harsh packing feel to the fork.

This is where the coil spring comes in. Manitou's coil springs feature a constant or straight rate. This means that if it's rated a 50 pounds per inch, 50 pounds of force is required to compress it one inch; 100 pounds are required to compress it two inches (50 pounds x 2 inches=100 pounds) and so on (see Figure 2). On the other hand, an MCU which requires 50 pounds of force to compress one inch is likely to jump to 150 pounds (or more) needed for two inches. This is known as a progressive spring rate.

As such, there are several advantages to combining a coil spring with MCUs. For example, it provides a truly progressive spring rate, with both suppleness on small bumps and protection from bottoming out due to big hits; it allows you to take advantage of the full travel designed into the fork; the combination of an MCU and coil spring is lighter than a single progressively-wound coil spring would be; and it provides added options when it comes to dialing in the springs.

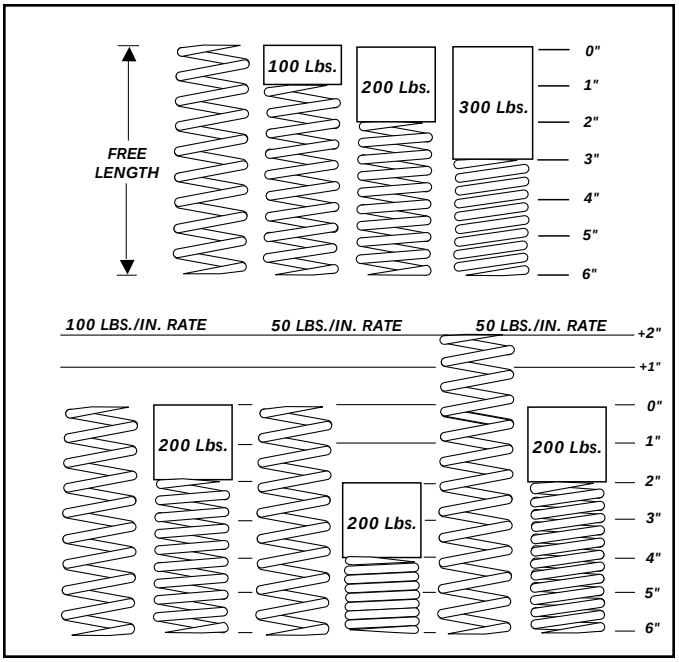


Figure 1

Fork spring compression is dependent on the weight placed on them, the length and the progressivity on the spring.

Preload is a term that is often misunderstood. Defined, preload is the amount you initially compress a spring in order to control the point at which it begins to move. It is useful because it provides a quick and easy way to alter ride height without having to change the springs.

On a coil spring, preload increases the amount of force required to begin to move the spring. It does *not* alter the overall spring rate. In other words, it still takes the same amount of force to continue to compress the spring, regardless of how much it's been preloaded.

Preload does affect overall spring rate in an MCU. This is because MCUs work by being compressed and distorted. More preload on an MCU compresses and distorts it, which results in it being farther along its progressive curve due to the inherently progressive nature of the material.

But preload is not the end-all to spring woes. If it becomes necessary to increase preload to near maximum adjustment, the fork has springs with too light a rate and they need to be changed. Preloading MCU or coil springs too much not only restricts travel, but tends to make the ride of the fork harsh and makes rebound control more difficult.

B. DAMPING: WHAT IT IS & WHY IT'S IMPORTANT

Damping is the act of absorbing shock by changing the energy of motion into heat and then dissipating it by way of an oil-based fluid. The purpose of a damping system (such as that contained in a suspension fork) is to limit both the rate at which a spring is compressed (compression damping) when it hits a bump and to slow the resulting rate of return (rebound damping).

Piston and shim stack damping, like that used in TPC Damping systems, is speed-sensitive. That means the resistance to movement increases with speed and force. When talking about speed in reference to damping, it is the speed of fork movement being referred to, not the speed of the bike. As fluid tries to flow through a given piston and shim stack, it encounters more resistance if it tries to flow faster, due to added speed and force. Damping adjusters allow you to alter how easily the fluid flows, thus helping to control the speed at which the fork both compresses and returns. If damping systems didn't exist, a fork would behave like a pogo stick, resulting in very poor control of your bike.

• The Benefits of Compression Damping

Compression damping usually permits the use of lighter-rate fork springs than would be possible in non-damped forks. That's because compression damping affects the down stroke or compression phase of suspension movement, sharing the workload with the spring(s) as speed and force increase (thus, the term "speed-sensitive"). The use of compression damping results in a wider range of optimum performance, as it's possible to maintain a plush, supple ride over small hits and still resist hard bottoming on hard landings. (thanks to the speed sensitivity of the compression damping).

• The Benefits of Rebound Damping

As you hopefully learned in school, for every action, there is an equal and opposite reaction. Therefore, when a spring (coil, elastomer, MCU) is compressed, it wants to return to its decompressed state; in other words, it wants to rebound [see Figure 2]. If allowed to rebound completely freely, the resulting suspension action would result in a very pogo-stick like ride, with the fork returning very quickly and erratically. Rebound damping slows and controls the extension stroke to keep the front wheel on the ground at all times.

Spring Note: MCUs and other elastomer springs, even those made of high-resiliency material, do absorb some energy when compressed and will not have the same amount of rebound energy as a coil spring.

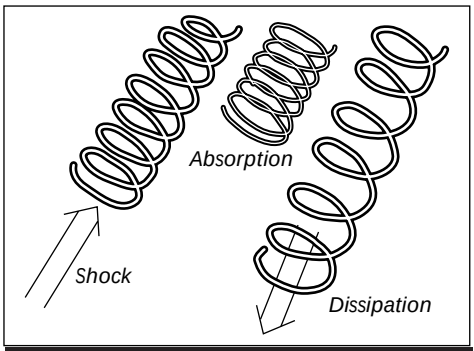


Figure 2

Shock causes the spring to compress and absorb. Rebound occurs as the spring returns, dissipating the energy of the bump.

C. ABOUT HYDRAULIC DAMPING INTERNALS

1999 Manitou forks feature either a TPC (Twin Piston Chamber) on TPC Sport Damping System, that can easily be serviced and tuned by a competent owner or qualified technician.

Damping can be dialed in with TPC by either changing fluid viscosity or the amount and sizes of the shims. The damping of TPC Sport, because it uses orifices in the piston to provide damping rather than shim stacks, can only be altered by changing the weight of the fork oil. The stock fork fluid is Maxima 5-weight; other weight fluids are recommended options depending on your weight and riding style. We recommend Maxima fork fluid for optimum performance and service life. The accompanying chart (see Figure 3) shows how different fluid weights affect damping, though the graphs have been exaggerated to make the differences more visual.

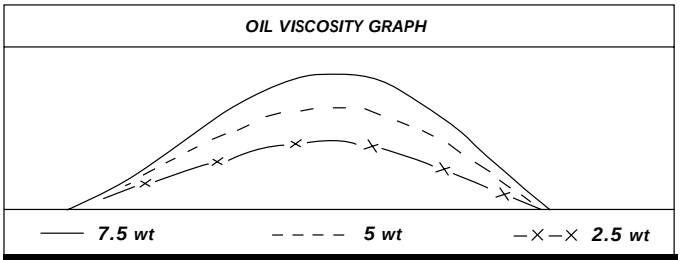


Figure 3

The heavier the fork oil weight, the more damping it will provide. 5-weight Maxima oil is stock in Manitou TPC and TPC Sport forks, but this oil viscosity can be increased or decreased in weight for differing riding conditions and styles.

The TPC shim stack (see fig. 4) meters fluid flow through the damping piston within the cartridge. Changing the number of shims, their thickness and their diameter will alter damping character as will changing the oil weight. You can't change the diameter of the shim closest to the piston though, as this is fixed and based on the piston's ports and its diameter. Changing a large-diameter shim has more effect than changing a small-diameter shim.

• Chapter 4: PRE-SET UP TIPS

Service

Servicing your fork is the first step that should be taken before any tuning is performed. The owner's manual you received with the fork provides detailed descriptions on how to accomplish this. Servicing your fork will also provide some familiarity with your fork parts, so that when you get to the point of tuning the fork, you will feel comfortable taking it apart and making changes. Luckily, new for 1999 features like Microlube (*see "About Microlube"on page 4*) make servicing your fork easier than ever. If you did not receive an owner's manual, contact your bicycle dealer or call Manitou at (805)257-4411, or download from www.answerproducts.com

- If the suspension fork is new, break it in with at least one hour of riding before making any evaluations or changes.
- The three major factors which must be considered in suspension tuning are rider weight, rider ability and course conditions. Additional influences include the rider's style and the rider's positioning on the bicycle.
- Make suspension changes in small increments. A little bit goes a long way, and it's very easy to over-adjust a setting.
- On full-suspension bicycles, the front and rear suspension must be balanced in order to provide the best-performing total pack age. Same brand front and rear components is not the key, nor necessary, for suspension harmony. Proper set up and suspension balance is the key to superior performance, so keep in mind that a front suspension change often requires a similar change to the rear and vice-versa.
- When evaluating suspension performance, the rider must ride as consistently as possible and recognize the effects of his input. Such things as minute changes in rider position and increased fatigue may lead to incorrect judgments about suspension set tings and required adjustments.
- Always keep a record of adjustment changes made and the performance differences that resulted. When proper settings are achieved for a particular course, terrain or conditions, they should be written down for future reference.

• Chapter 5: SUSPENSION SET UP 101

With the preceding points in mind, let's begin with suspension set up. First of all, remember that the Manitou's damping and spring characteristics have been determined by a team of very experienced test riders, which should make the standard settings work well for most riders under most conditions (meaning a 150- to 170-pound Sport-to Expert-level rider with a bike using geometry typical of current mountain bikes and riding primarily dry terrain).

If you're outside of these parameters, your suspension may need dialing in to get in the ballpark. Those who are heavier or more experienced than average may need stiffer springs; likewise, those who are lighter or less experienced may need softer springs. Be aware that changing spring rates often requires a change in rebound damping adjustment to compensate *(refer to "Real Technical Stuff Explained Simply")*. Also, don't be fooled: sometimes you may think the fork is bottoming when it's not; the sensation may be due to an overly stiff spring rate or excessive damping. Conversely, a harsh sensation may be due to a soft spring rate which is causing the suspension to ride too far into the firm portion of its travel. Here's how to dial-in your suspension as quickly, yet correctly, as possible.

1. SET SAG BEFORE ALL ELSE

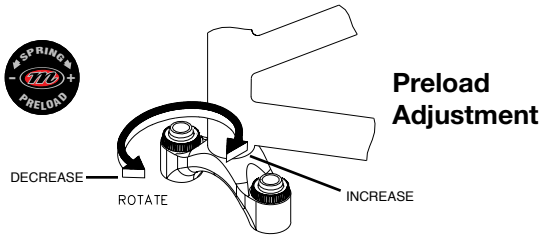
In order to ensure optimum performance of your Manitou fork, the preload on the springs must be correctly adjusted to obtain the proper ride height or "sag." Suspension sag helps the tires to remain in contact with the ground under dynamic loading as braking and cornering.

Have a friend help you measure sag. One person can adjust the preload, but it takes two to measure sag. The only equipment needed is a tape measure, a pencil and a piece of paper. Here's how to do it:

1. Measure the distance from the front axle's centerline to the bottom of the upper crown when no one's sitting on the bike. (Remember the exact locations of the two points because you'll need to use them later.)
2. Write this distance down.
3. Have the rider sit on the bike. It's important to be in the nor mal riding position with feet on the pedals; this is where having a helper comes in handy.
4. Measure the distance between the same two points as in step one.
5. Subtract the second measurement from the first. The result is the static sag or ride height.

Correctly adjusted springs should yield 20 percent of the fork's travel in sag, approximately 8-10mm for a suspension fork that offers 65-70mm of travel, 10-12mm for a 75-80mm-travel fork, 18-25mm for a 100-115mm-travel fork and 30-35mm for a 160mm-travel fork. If your fork doesn't have the correct sag, use the preload adjuster *(refer to page 7 "Tuning '99 Manitous*). You should be able to use between 0 and eight clicks (not turns) on the preload adjusters to achieve the correct sag. If more than eight clicks are required (indicating more

preload is needed for correct sag), stiffer springs are needed *(refer to page 7 "Tuning '99 Manitous)*. If it requires less than the 0 click setting (indicating less preload is needed), softer springs are needed.



Should a spring change be necessary, you'll be glad that Manitou forks allow doing so by simply changing one or more of the MCUs . Changing MCUs will make a noticeable difference in effective spring rate and will be much less expensive than changing the coil spring.

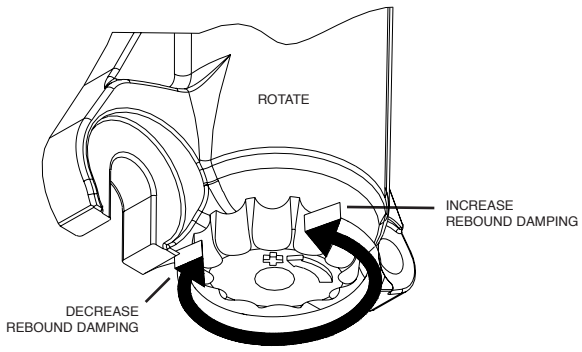
2. GET FAMILIAR WITH YOUR TPC FORK

After you set the sag, before you started making further changes you must establish a baseline or point of reference to test your bike on. Lay out a test course so you can determine how the suspension works in an unaltered state first and then how it compares in practically identical conditions after adjustments are made. The course shouldn't be too long (15 to 20 minutes per lap is fine). It should be rough and similar to the most demanding conditions you ride.

After coming up with a satisfactory test-course layout, ride a lap. Concentrate on how the suspension performs, your body positioning in various sections on the course and how the bicycle handles. When you're done with the lap, try the following exercise to help get familiar with what suspension adjustments produce what results.

With your bike and fork in its normal upright position, turn the fork's rebound damping adjuster knob (TPC Forks only TPC Sport is non-adjustable), counterclockwise, all the way into position number one (slowest return); write down where it was so you don't forget.

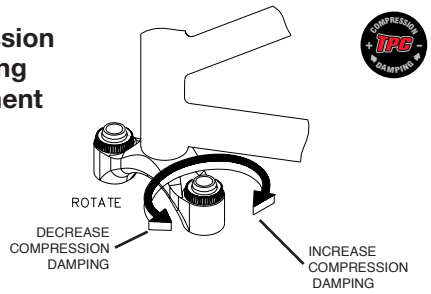
Rebound Damping Adjustment



Now ride the test course again, attempting to duplicate the effort and body positioning used on the first lap, and note how the fork acts. Concentrate on how the bike handles and what it does where. After finishing the lap, turn the rebound knob clockwise to the fully open position (quickest return) and ride another lap, taking the same mental notes. After these three laps, you should have a good idea of how the bike handles at the extreme ends of fork rebound damping adjustment and how that compares to the original setting. The differences should be rather pronounced.

If you have a full-suspension bicycle you should also follow the same procedures when adjusting the shock (see below "A Balanced Bike is Best"). Remember: Make only one change at a time so you can keep track of what does what and keep a written record you so can return to your original settings if something goes wrong. Sometimes, an adjustment will produce an undesirable effect so you'll want to return to the previous setting.

Compression Damping Adjustment



Generally speaking, cross-country riders prefer rebound damping on the slow side. That's because at their slower actual speeds, the time between bumps tends to be longer. Also, with slower rebound settings the fork is not as active while climbing.

Downhill riders, on the other hand, because of the high speeds result in a shorter time between bumps, and, as a result, typically prefer quicker rebound. Remember that a properly adjusted suspension system may bottom very slightly at least once on a lap, or run, under hard riding. If it doesn't bottoming occasionally, you won't be taking advantage of all the suspension travel.

3. REAR SUSPENSION: A BALANCED BIKE IS BEST

If you have a full-suspension bicycle, you must make sure that both ends work in unison. This is what is termed having balanced suspension. It is not necessary to have the same brand front and rear components to achieve a balanced, high-performance package. The important factors are quality, tuneable components that the rider takes the time to set up properly.

After the fork's sag is set correctly, perform the following quick check to see if the rear suspension is in reasonably good balance:

1. Hold the bike upright on level ground.
2. While standing next to the bike, pull on the front brake lever so the bike doesn't go anywhere.
3. Place your foot on the pedal closest to you and lower the pedal to bottom dead center.
4. Now push down on the pedal with your foot and note the attitude of the bike. Do it a few times. If the suspension is well balanced, the bike will maintain a level attitude as it's pushed down and rebounds. (i.e., the front and rear suspension will compress equally)
5. Next, sit on the bike in your normal riding position. If either the front or rear end drops beyond proper "ride sag", you'll need to adjust the preload and/or change springs. If you've adjusted the fork's preload, chances are you'll need to adjust the shock preload or even change its spring rate in order to achieve better balance. Consult the shock owner's manual if you're not sure how to do this.

• Chapter 6: TUNING 1999 TPC MANITOUS

Now that you have a basic understanding of the theory behind TPC, See "Before you Begin" to review let's look at another benefit: The compression and rebound damping can be tuned completely independent of each other. This can be done in one of two ways depending upon the particular model Manitou. Adjustments can be made either internally or externally and can be done without having to remove the fork fluid. Most riders will find the stock setting quite satisfactory. If a different setting is desired, refer to *page 8 "TPC Valve Stack Tuning"*. This section identifies what tuning and adjustments can be made by diving into the internals of the fork. Experiment and exhaust external tuning adjustments before you attempt procedures that require disassembly or replacement of fork components. Once a problem is identified, it's easier to determine a solution and the steps necessary to achieve it.

1. SWITCHING SPRINGS

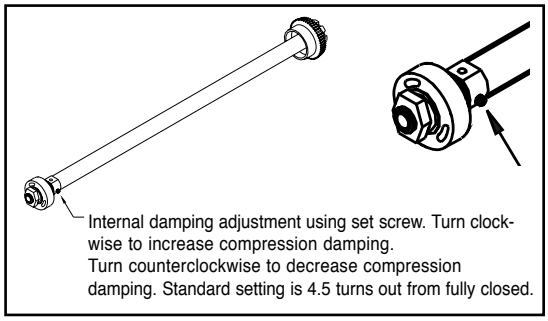
If you can't attain proper sag using the procedures explained in the previous section (Set Sag Before All Else), change either the MCU or the coil spring.

1. Remove the preload adjuster by unscrewing the cap from the top of the crown/leg assembly. A pair of channel locks may be necessary; if so, use only light pressure. Remember: The springs are housed only in one leg so remove the cap from the right side only (Rider right).
2. With the adjuster assembly removed, the spring stack is now accessible.
3. Select the appropriate MCU or coil spring (refer to the following spring charts for proper rate).
4. Put the new MCU or coil spring in the old one's place in the spring stack, apply a liberal amount of light grease to the spring stack (particularly the plastic spring connectors and the coil spring that may come in contact with the inside of the leg). Reinstall the spring stack inside the leg.
5. Reinstall the preload adjuster assembly, taking care not to cross-thread the cap. It should thread in by hand and does not need to be tightened with a wrench. Making it finger-snug is quite acceptable.
6. With the new spring rate, it'll be necessary to ensure that the sag is set correctly, so run through that procedure again, making any adjustments required.

2. INTERNAL COMPRESSION DAMPING ADJUSTMENTS (1999 SX ONLY)

Internal damping adjustments are done via a small set screw housed in the piston seat The stock setting for the compression damping adjuster (the upper piston in TPC) is four and a half turns out from fully closed. If you ever get "lost" or forget the settings, always return to the stock settings. In addition, make only one change at a time. Note: See below for instructions on how to remove both the compression and rebound assembly.

Once you make the desired adjustments, reinstall the assembly. Now is also a good time to check the oil level. You should be able to feel when the compression piston hits the fluid upon reinstallation. (See *"Checking Oil Level"* below. At that point, the top of the assembly should still be sticking out of the leg approximately two inches. If the oil level is less than one inch or greater than three inches, follow the steps in the section *"Checking Oil Level"* below.



Internal damping adjustment using set screw. Turn clockwise to increase compression damping.
Turn counterclockwise to decrease compression damping. Standard setting is 4.5 turns out from fully closed.

3. EXTERNAL COMPRESSION AND REBOUND DAMPING ADJUSTMENTS

A simple turn is all that's required to make external damping adjustments, due to the knobs at the top (compression) and bottom (rebound) of the left fork leg. The stock settings for 1999 SX models are 12 clicks out from fully closed on compression and six clicks out from fully closed on rebound. 1999 X-Vert forks are set to 12 clicks out from fully closed on both compression and rebound. Once again, the stock settings should be quite satisfactory for most riders, but thanks to the external knobs, experimenting or fine-tuning is quick and easy.

4. REMOVING THE REBOUND DAMPING ASSEMBLY

To remove the rebound damping assembly, the fork must be disassembled first (please refer to *"Manitou Disassembly Procedure" Chapter 8, page 12)*. Once the slider has been pulled off the inner leg, turn the inner leg assembly upside-down. With the fork upside-down, reinstall the damper dropout nut then stroke the shaft 3-4 times. Notice that the fork fluid is slowly being pushed to the compression side of the leg.

The rebound damping assembly can now be removed with a 15/16-inch wrench. Be careful when removing the assembly as a small amount of fork fluid may remain on top of the piston. In addition, ensure that no contaminants enter the now-exposed fluid.

To reinstall the assembly, torque the end cap as specified in the owner's manual. Turn the fork right side up and stroke the rebound shaft a few times to transfer fluid back down to the bottom of the leg. Remove the damper dropout nut and follow the steps outlined in *Chapter 8, page 13"Manitou Reassembly Procedure."*

5. CHECKING THE OIL LEVEL

Having the correct oil level is critical to keep a TPC fork working its best (although slightly varying oil height will not alter the performance of the fork). To measure the oil level, all that's required is a tape measure. Begin by unscrewing the compression valve assembly at the top of the left fork leg. Leave the spring stack (riders: right side) installed as it should not be removed to check oil height. Once the assembly is completely unthreaded from the inner leg, pull the assembly about halfway out. You should be able to feel when the piston is no longer in the fork fluid. When this happens, slowly lower the assembly to where it again contracts the oil, which can be felt by increased resistance, and measure the distance from the top of the crown to the top O-ring (located on the knob above the cap threads). This distance should be approximately two inches, but can range from

one to three inches. **Note: Running the oil level greater than three inches risks fork damage or possible personal injury.**

6. CHANGING FORK FLUID

Though all suspension forks demand fluid changes in order to maintain damping and prevent internal damage, a TPC or TPC Sport equipped fork needs fluid changes far less frequently because the TPC design doesn't break fluid down quickly due to its greater oil volume. We recommend changing fluid just once a year for heavy users and only every other year for sport and recreational users.

The first step in changing the fluid is to remove the compression damping assembly. Next, pour the old fluid out of the top of the leg into a clear container in order to inspect the fluid. Dark fluid is normal and not an indication of a problem. If metal flakes or other contaminants are present, disassemble the entire left leg following the procedures outlined in *Chapter 8, page 12 "Manitou Disassembly Procedure" and page 7* "Removing the Rebound Damping Assembly." Flush all parts off with a suitable cleaning solution, wipe clean and then reassemble if no damaged parts are found. Some discoloration (grey, cloudy) is normal in old fork fluid. Fill the leg with the recommended amount of fluid (Manitous are filled at the factory with 5-weight Maxima) and set the oil level according to the previous section "Checking Oil Level." Reinstall the compression damping assembly.

7. TPC VALVE STACK TUNING

The valve shim stacks in a TPC fork are the ultimate tuning devices. However, determining the correct combination of shims is time consuming and a tedious process that would take weeks to explain and longer to learn. The standard valving in your TPC fork has been tested and developed during many months of racing on the World Cup circuit, but should you wish to customize your fork's valve shim stacks, keep the following hints in mind:

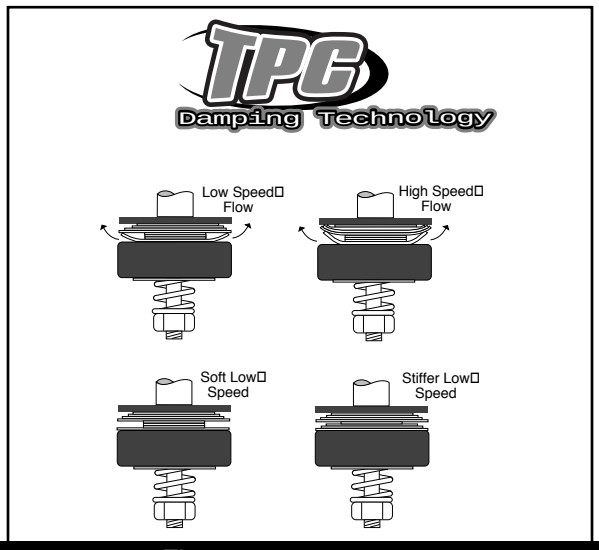


Figure 4 (Shim Stack Tuning)

1. Make only small changes—a little bit goes a long way.
2. Always keep notes on what you've tried and how it worked.
3. Do not change the diameter of the shim closest to the piston. This shim must always cover the entire port (22mm for compression and 18 or 16mm for rebound, depending on whether you have an X-Vert 30mm dia. inner leg or SX fork 28.6mm dia. inner leg).
4. Changing the larger diameter shim(s) will have greater effect on damping characteristics.
5. More shims and/or thicker shims will increase damping. (See figure 4).
6. Fewer shims and/or thinner shims will decrease damping. (See figure 4).

8. TUNING 1999 TPC SPORT

TPC (or Twin Piston Damping) is one of the hottest developments in suspension technology and it's more-moderately priced brother, TPC Sport, is equally revolutionary. Like TPC, TPC Sport uses separate pistons for rebound and compression, no leak seals and large oil volume to eliminate heat-related problems. It is not adjustable externally, but that doesn't mean you can not vary the feel of the fork; changing the fork oil weight in your TPC Sport-equipped fork will significantly change the damping character of the fork. *See "Changing Fork Fluid" for instructions on how to do this.*

The standard fork oil in your fork is Maxima 5-weight. This should work fine for most riders, but if you find the settings are not to your liking, increasing or decreasing the oil weight will increase or decrease the TPC Sport damping in your fork. *See page 9, "1999 TPC AND TPC SPORT FORK TUNING"* for recommended oil weights. Remember though, changing the oil weight will affect both compression and rebound damping equally; so while you may be slowing rebound down by say, adding heavier fork oil, you also may be adding compression damping to the point of the fork feeling harsh. The best thing to do is to experiment with different oil weights until you find that perfect setting for you. Since changing the fluid is so simple (all you must do is remove the compression rod-the cap on the left leg when you view the fork from above-drain the oil and refill), it's not too difficult finding that perfect feel. Note: Changing the size of the orifice holes of the TPC Sport rebound or compression pistons will affect the damping of the fork components, but it is not recommended. Not only do you risk damaging the fork permanently, but you will also void the warranty on the fork and most likely compromise the performance as well.

1999 TPC AND TPC SPORT FORK TUNING

(Other Model Years Require Different Tuning Specifications)

The following tuning charts will help determine the optimum springs and settings for you to start with, depending on which model fork you have.

MODEL	RIDER WEIGHT	SPRING STACK	COMPRESSION DAMPING*	REBOUND DAMPING*
TPC Damped Forks				
SX	100-125 lbs.	std. coil (2) 2” red (1) 2” blue	18 clicks	10 clicks
	125-130 lbs.	std. coil (3) 2” red	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	std. coil (2) 2” red (1) 2” yel	12 clicks	6 clicks
	170-190 lbs.	std. coil (1) 2” red (2) 2” yel	8 clicks	6 clicks
	190+lbs.	std. coil (3) 2” yel	5 clicks	4 clicks
SX-R	100-125 lbs.	std. coil (2) 2” red (1) 2” blue	18 clicks	10 clicks
	125-150 lbs.	std. coil (3) 2” red	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	std. coil (2) 2” red (1) 2” yel	12 clicks	6 clicks
	170-190 lbs.	std. coil (1) 2” red (2) 2” yel	8 clicks	6 clicks
	190+lbs.	std. coil (3) 2” yel	5 clicks	4 clicks
SX-Ti	100-125 lbs.	120 Ti coil (1) 2” red (1) 2” blue	18 clicks	10 clicks
	125-130 lbs.	140 Ti coil (2) 2” red	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	140 Ti coil (1) 2” red (1) 2” yel	12 clicks	6 clicks
	170-190 lbs.	140 Ti coil (2) 2” yel	8 clicks	6 clicks
	190+lbs.	Ti coil (1) 2” red (1) 2” yel	5 clicks	4 clicks
SX Carbon	100-125 lbs.	120 lb. Ti coil (1) red or blue	18 clicks	10 clicks
	125-150 lbs.	140 lb. Ti coil (1) blue	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	140 Ti coil (1) red	12 clicks	6 clicks
	170-190 lbs.	140 Ti coil (1) yel	8 clicks	6 clicks
	190+lbs.	160 Ti coil (1) yel	5 clicks	4 clicks
X-Vert	100-125 lbs.	120 lb. coil (1) 2” red (1) 1” red (1) 2” blue	18 clicks	10 clicks
	125-150 lbs.	140 lb. coil (1) 2” red (1) 1” red (1) 2” blue	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	140 lb. coil (2) 2” red (1) 1” red	12 clicks	6 clicks
	170-190 lbs. 1	140 lb. coil (1) 2” red (1) 1” red (1) 1” yel	8 clicks	6 clicks
	190+ lbs.	160 lb. coil (1) 2” red (1) 1” red (1) 1” yel	5 clicks	4 clicks
X-Vert R	100-125 lbs.	120 lb. coil (2) 2” red (1) 2” blue	18 clicks	10 clicks
	125-150 lbs.	140 lb. coil (2) 2” red (1) 2” blue	15 clicks	8 clicks
Standard Set Up	150-170 lbs.	140 lb. coil (3) 2” red	12 clicks	6 clicks
	170-190 lbs.	140 lb. coil (2) 2” red (1) 2” yel	8 clicks	6 clicks
	190+ lbs.	160 lb. coil (2) 2” red (1) 2” yel	5 clicks	4 clicks
X-Vert Carbon	100-125 lbs.	(1) 140 lb. Ti coil (1) 120 Ti coil (1) 2” red (1) 2” blue	20 clicks	20 clicks
	125-150 lbs.	(2) 140 lb. Ti coil (1) 2” red (1) 2” blue	18 clicks	18 clicks
Standard Set Up	150-170 lbs.	(2) 140 lb. Ti coil (2) 2” red	16 clicks	16 clicks
	170-190 lbs.	(2) 140 lb. Ti coil (1) 2” red (1) 2” yel	14 clicks	14 clicks
	190+ lbs.	(1) 140 lb. Ti coil (1) 160 Ti coil (1) 2” red (1) 2” yel	12 clicks	12 clicks

*Settings are from full close

Note: Use only 1998 and 1999 MCU’s

MODEL	RIDER WEIGHT	SPRING STACK	OIL WEIGHT
TPC Damped Forks			
Spyder	100-125 lbs.	std. coil (1) 4” blue (1) 2” red	
	125-150 lbs.	std. coil (1) 4” red (1) 2” blue	
Standard Set Up	150-170 lbs.	std. coil (1) 4” red (1) 2” red	
	170-190 lbs.	std. coil (1) 4” red (1) 2” yel	
	190+lbs.	std. coil (1) 4” yel (1) 2” red	
TPC Sport Damped Forks			
Spyder R	100-125 lbs.	std. coil (1) 1.5” red (2) 2” blue	5 weight
	125-150 lbs.	std. coil (1) 2” red (1) 1.5” red (2) 2” blue	5 weight
Standard Set Up	150-170 lbs.	std. coil (2) 2” red (1) 1.5” red	5 weight
	170-190 lbs.	std. coil (1) 2” red (1) 1.5” red (1) 2” yel	7.5 weight
	190+lbs.	std. coil (1) 1.5” red (2) 2” yel	15 weight
SX-E	100-125 lbs.	std. coil (2) 2” red (1) 2” blue	5 weight
	125-130 lbs.	std. coil (3) 2” red	5 weight
Standard Set Up	150-170 lbs.	std. coil (2) 2” red (1) 2” yel	5 weight
	170-190 lbs.	std. coil (1) 2” red (2) 2” yel	7.5 weight
	190+lbs. 160	std. coil (3) 2” yel	15 weight
X-VERT E	100-125 lbs.	std. coil (1) 2” red (1) 1” red (2) 1” blue	5 weight
	125-150 lbs.	std. coil (2) 2” red (1) 1” red (1) 1” blue	5 weight
Standard Set Up	150-170 lbs.	std. coil (3) 2” red (1) 1” red	5 weight
	170-190 lbs.	std. coil (2) 2” red (1) 1” red (1) 1” yel	7.5 weight
	190+lbs.	std. coil (2) 2” red (1) 1” red (1) 1” yel	15 weight
X-Vert T	100-125 lbs.	120 lb. coil (1) 2” red (1) 1” red (1) 2” blue	5 weight
	125-150 lbs.	140 lb. coil (1) 2” red (1) 1” red (1) 2” blue	5 weight
Standard Set Up	150-170 lbs.	140 lb. coil (2) 2” red (1) 1” red	5 weight
	170-190 lbs. 1	140 lb. coil (1) 2” red (1) 1” red (1) 1” yel	7.5 weight
	190+ lbs.	160 lb. coil (1) 2” red (1) 1” red (1) 1” yel	15 weight
Note: Use only 1998 and 1999 MCU’s			

1999 SPRING TUNING KITS

85-3844 SPYDER SOFT RIDE KIT
85-3845 SPYDER MEDIUM RIDE KIT
85-3846 SPYDER FIRM RIDE KIT
85-3755 SPYDER R SOFT RIDE KIT
85-3756 SPYDER R MEDIUM RIDE KIT
85-3757 SPYDER R FIRM RIDE KIT

85-3751 SX E SOFT RIDE KIT
85-3752 SX E MEDIUM RIDE KIT
85-3753 SX E FIRM RIDE KIT

85-3751 SX SOFT RIDE KIT
85-3752 SX MEDIUM RIDE KIT
85-3753 SX FIRM RIDE KIT
85-3751 SX R SOFT RIDE KIT
85-3752 SX R MEDIUM RIDE KIT
85-3753 SX R FIRM RIDE KIT

SUSPENSION FLUIDS

85-3814 MAXIMA SUSPENSION FLUID 5-WT-8OZ.
85-3820 MAXIMA SUSPENSION FLUID 7.5-WT-8OZ.
85-3822 MAXIMA SUSPENSION FLUID 10.-WT-8OZ.

CONTINUED

1999 SPRING TUNING KITS CONT.

85-3841 SX TI SOFT RIDE KIT
85-3842 SX TI MEDIUM RIDE KIT
85-3843 SX TI FIRM RIDE KIT
85-3841 SX CARBON SOFT RIDE KIT
85-3842 SX CARBON MEDIUM RIDE KIT
85-3843 SX CARBON FIRM RIDE KIT

85-3838 X-VERT E SOFT RIDE KIT
85-3839 X-VERT E MEDIUM RIDE KIT
85-3840 X-VERT E FIRM RIDE KIT
85-3871 X-VERT R AND T SOFT RIDE KIT
85-3872 X-VERT R AND T MEDIUM RIDE KIT
85-3872 X-VERT R AND T FIRM RIDE KIT
85-3838 X-VERT SOFT RIDE KIT
85-3839 X-VERT MEDIUM RIDE KIT
85-3840 X-VERT FIRM RIDE KIT
85-3841 X-VERT CARBON SOFT RIDE KIT
85-3842 X-VERT CARBON MEDIUM RIDE KIT
85-3843 X-VERT CARBON FIRM RIDE KIT

SERVICE MANUALS

X-VERT FORKS 062168
SX FORKS 062167
SPYDER FORKS 062166

• *Chapter 7: TROUBLESHOOTING TIPS*

A. IDENTIFYING PROBLEMS

Following are symptoms that will help you identify a suspension problem. Remember that some problems might be due to more than one cause and that it is easier to pinpoint the cause by looking for more than one symptom. While riding, pay attention to how the suspension feels and what that feel might be attributed to.

OBSERVATIONS	LIKELY CAUSE
Fork bottoms; needs more than maximum preload; front end too low on downhills	Spring rate too soft or fork oil weight too low Compression damping too soft backed out too far
Fork rarely/never bottoms; doesn't use full travel	Spring rate too stiff; Fork oil weight too high or compression damping too firm
Static sag excessive; front end too low entering turns; front end "knifes" (oversteers, turns in too easily)	Not enough preload Spring rate too soft
Static sag non/barely existent; fork feels stiff or harsh; hard to turn into corner; low-speed turning ability sluggish	Too much preload Spring rate too stiff
Fork extends too quickly; wheel springs up from ground after landing from jumps; difficult to maintain straight path in rocks; front end tries to climb berm or groove while cornering; tall ride height; hard to turn into corner	Not enough rebound damping
Fork rarely bottoms; harsh feel; tall ride height despite soft spring and/or minimum preload; hard to turn into corner	Too much compression damping
Fork feels too hard or stiff	Too much rebound damping; spring rate too stiff; too much compression damping; fork fluid weight too heavy; spring rate possibly bit soft
Fork feels too soft	Spring rate too soft; compression damping too light; fork fluid weight too light; fork fluid worn out; cartridge lacks fork fluid
Harsh feel, especially through successive rapid hits (braking bumps, etc.); bottoming after 3-4 successive large hits; failure to rebound after landing from jumps; low ride height; easy to turn into corner; fork bottoms despite correct compression damping & spring rate	Too much rebound damping
Fork bottoms; "diving" feel while braking for turns; easy to turn into corner; fork unstable	Not enough compression damping Spring rate too soft

B. TYPICAL PROBLEMS AND SOLUTIONS

Here are some typical problems encountered by riders in various situations and what can be done to solve them, step by step—or at least help alleviate their severity until an authorized technician can be consulted. If you have one of these problems and wish to solve it, start with solution one. If that doesn't solve it completely, try solution two. Still not good? Go to solution three.

Front end searches or is nervous when descending hills

1. Increase spring preload
2. Increase compression damping
3. Use stiffer springs
4. Increase rebound damping

Front end "washes out" in turns (understeers, tends to push outward)

1. Increase rebound damping
2. Reduce preload
3. Reduce compression damping
4. Use softer springs

Front end "knifes" in turns (oversteers, tends to turn inward, dives)

1. Reduce rebound damping
2. Increase preload
3. Increase compression damping
4. Use stiffer springs

Fork doesn't respond to small bumps in turns

1. Reduce rebound damping
2. Reduce compression damping
3. Reduce preload
4. Use softer springs

• Chapter 8: MAINTAINING SUSPENSION BLISS

Don't forget, though, that like any moving part, a Manitou suspension fork requires regular maintenance. If it doesn't receive such service, it will lose performance, wear out quickly, negating all of the work put into dialing it in—not to mention the money it cost in the first place. Riding in severe conditions such as mud and water make regular maintenance even more important. If you maintain your fork on a regular basis and microlube it often, you won't have wasted your time and you won't waste your fork. Thus, learn how to maintain your Manitou properly in this section.

The fork boots and wiper seals that are standard equipment on all 1999 Manitou forks greatly reduce the chance of contamination from the elements. We recommend keeping the fork boots on at all times—even in good conditions—for extended service life and optimum performance.

When servicing the fork, take the time to inspect all parts for excessive wear or damage. Pay close attention to the bushings, which can be damaged by contamination in severe conditions. Replace any worn or damaged parts that are discovered. This will ensure optimum performance from the fork.

There are basically four things that will require attention: the stanchions (inner legs), the bushings in the outer legs, the spring stack and the damping fluid. All of this requires disassembly of the fork. It isn't particularly difficult, but those uncomfortable with disassembling mechanical things should let a qualified technician do it. The last thing you want to do is butcher the things that allow your Manitou fork to work.

One thing to remember is that the fork fluid needs changing regularly, just like the oil in a car's engine. Fresh fluid ensures quality, consistent damping, and it also acts as a lubricant for the piston and inner wall. When changing fork fluid, we recommend that you also replace the TPC chamber seals and replace any parts that are excessively worn or broken. Manitou offers rebuild kits for all forks that makes this both easy and convenient.

MANITOU DAMPER REBUILD KITS

1999	Spyder R Rebound	85-3802
	SX RR/TI Carbon Rbd	85-3804
	SX Rebound	85-3807
	SX E Rebound	85-3806
	X-Vert/R Rebound	85-3808
	X-Vert E/T Rebound	85-3809
	X-Vert Carbon Rbd	85-3819
	Spyder R/Sx E Comp	85-3801
	SX Comp	85-3803
	SX R/Ti/Carbon Comp	85-3805

MANITOU DAMPER REBUILD KITS

	X-Vert Comp	85-3805
	X-Vert E Comp	85-3801
	X-Vert R/Carbon Comp	85-3817
	X-Vert T Comp	85-3816

MANITOU BUSHING-SEAL REBUILD KITS

1999	Spyder/R	85-3826
	SX/E/R/Ti	85-3827
	X-Vert/E/R/Ti	85-3828

SERVICE SCHEDULE

If you simply bolted on a new Manitou and rode, you'd notice an immediate improvement over other suspension forks. One of the benefits of investing in a Manitou fork is the ability to adjust the suspension for riders of very different sizes and abilities, as well as variations in terrain and conditions. Yes, it takes a little time and effort, but if you dial in your suspension, you'll find each ride more enjoyable and rewarding, and you'll be able to ride faster easier and with more control.

For those who go to the races, look for the Manitou Racing Development technical-support vehicles at many major events worldwide. They're there for you. Our technicians will try to answer any technical questions or solve equipment problems. We offer emergency service out of these vehicles to riders of all levels, not just our sponsored elite. Our goal is to ensure that our customers enjoy each event to its fullest. For more information...don't forget to check our website at www.answerproducts.com.

Suggested Service For Manitou Forks/Normal Conditions	
Short/Sporadic Rides	**Long/Frequent Rides**
Lube fork as needed with Prep M grease via Microlube lubrication ports	Lube fork as needed with Prep M grease via Microlube lubrication ports
Disassemble fork per owner's manual; clean and grease every 4-5 months Grease spring stack as needed	Disassemble fork per owner's manual; clean and grease every 8-10 weeks Grease spring stack as needed
Service TPC and TPC Sport by changing fork fluid every year	Service TPC and TPC Sport by changing fork fluid every year
Suggested Service For Manitou Forks/Severe Conditions (mud, rain, snow, extreme dust)	
Short/Sporadic Rides	**Long/Frequent Ride**
Lube fork as needed with Prep M grease via Microlube lubrication ports	Lube fork as needed with Prep M grease via Microlube lubrication ports
Disassemble fork per owner's manual; clean and grease every 6-8 weeks	Disassemble fork per owner's manual; clean and grease every 4-6 weeks
Grease spring stack as needed	Grease spring stack as needed
Service TPC and TPC Sport by changing fork fluid every 8 months	Service TPC and TPC Sport by changing fork fluid every 8 months

• Chapter 9: DISASSEMBLY/ REASSEMBLY

A. MANITOU DISASSEMBLY PROCEDURE

All 1996 and later Manitou oil-damped forks use the same general disassembly/assembly methods. The fork doesn't *have* to be removed from the bicycle for general disassembly/assembly or cleaning, as the crown and inner legs can remain on the bike. Here's how to remove the outer legs and arch assembly:

1. Remove the lower compression rod screw from the right-leg dropout with a 4mm Allen wrench.
2. Pop out the damping adjuster knob from the left-leg dropout (a small screwdriver may be helpful for this). Then remove the retainer screw with an 8mm Allen wrench.
3. Pull down on the outer leg assembly (sliders) to separate them from the inner legs and the crown.
4. Remove the fork boots.

(NOTE: Removing the dust seal every time the fork is disassembled is not recommended. The seal and bushings in each leg may be cleaned and regreased while in place.)

Inspection

1. Clean all parts thoroughly with non flammable solvent.
2. Check the fork boots and felt wipers for excess wear, tears or other obvious damage.
3. Check the dust seals for tears or other damage; replace the seals if necessary.
4. Inspect both the lower and upper bushings for excessive wear or damage; replace them if necessary.
5. Check each outer leg/arch assembly for nicks or deep gouges on both the inner and outer surfaces; replace if necessary.
6. Check each inner leg for deep gouges and other obvious damage. Minor wear resulting in color change is not detri mental to the gold-anodized surface. If there's excessive wear or damage, replace the inner leg.
7. Check the inner legs at the bottom of the crown for cracks or flaking of the anodizing. Replace the leg if a crack is discovered or if the gold anodizing is starting to flake.
8. Check the underside of the crown for cracks; replace if cracked.

B. MANITOU REASSEMBLY PROCEDURE

1. After thoroughly inspecting the fork and replacing parts where necessary, lightly grease the inner diameter of the top and bottom bushings.
2. Liberally grease the wiper.
3. Grease the compression rod lightly.

(NOTE: Before proceeding with the rest of the reassembly process, make sure that the black second-stage elastomer, the cup washer and the orange third-stage elastomer are installed on the compression rod, and that the detent ball and orange third-stage elastomer are installed on the damper shaft.)

4. Slide the fork boots onto the inner legs; push them up until they are in position beneath the crown and lightly grease the inner leg.
5. Slide the outer leg/arch assembly onto the inner legs and fully compress the fork.
6. Install the compression-rod screw back into the right-leg dropout with a 4mm Allen wrench and the dropout nut into the left-leg dropout with an 8mm Allen wrench. Tighten to a torque reading between 10-30 inch-lb. (1.1-3.5 N-m). **Beware: Over-torquing the dropout nut may damage the damper shaft.**
7. Pop the damping adjuster knob back into the left-leg dropout. (An O-ring holds the knob in place.)
8. Slide the skirt of each fork boot onto the outer leg's corre sponding groove. Be sure the skirt's lip sits down into the corresponding groove. Be sure the skirt's lip sits down into the groove.

GLOSSARY of USEFUL TERMS

Compression damping: The act of controlling the compression of a fork by changing the energy of motion into heat and then dissipating it by way of an oil-based fluid.

Coil Spring: A wound spring made of metal.

Damping: The act of absorbing shock by changing the energy of motion into heat and then dissipating it by way of an oil-based fluid.

Elastomer: A urethane bumper which is used as a spring in a suspension fork.

MCU:A urethane bumper, like an elastomer, which is used as a spring; a special process forces air into the elastomer during construction allowing it to both compress and deform, providing limited damping in some uses.

Preload: The loading of a spring via dial adjuster.

Rebound damping: The act of controlling the extension of a fork by changing the energy of motion into heat and then dissipating it by way of an oil-based fluid.

Sag: The amount the suspension settles under normal rider weight.

Spring rate:A measure of the spring's stiffness or softness.

TPC: (Twin Piston Chamber): Manitou's revolutionary system of damping which uses two independent pistons for control of compression and rebound damping.

MRD: Manitou Racing Development is the division of Manitou Performance Bicycle Components responsible for ensuring that Manitou-sponsored racers are riding the best suspension forks and shocks in the world.

SERVICE MANUALS

1999 Spyder	062166
1999 SX	062167
1999 X-Vert	062168

1999 SPRING TUNING KITS

85-3844	SPYDER SOFT RIDE KIT
85-3845	SPYDER MEDIUM RIDE KIT
85-3846	SPYDER FIRM RIDE KIT
85-3755	SPYDER R SOFT RIDE KIT
85-3756	SPYDER R MEDIUM RIDE KIT
85-3757	SPYDER R FIRM RIDE KIT
85-3751	SX E SOFT RIDE KIT
85-3752	SX E MEDIUM RIDE KIT
85-3753	SX E FIRM RIDE KIT
85-3751	SX SOFT RIDE KIT
85-3752	SX MEDIUM RIDE KIT
85-3753	SX FIRM RIDE KIT
85-3751	SX R SOFT RIDE KIT
85-3752	SX R MEDIUM RIDE KIT
85-3753	SX R FIRM RIDE KIT
85-3841	SX TI SOFT RIDE KIT
85-3842	SX TI MEDIUM RIDE KIT
85-3843	SX TI FIRM RIDE KIT
85-3841	SX CARBON SOFT RIDE KIT
85-3842	SX CARBON MEDIUM RIDE KIT
85-3843	SX CARBON FIRM RIDE KIT
85-3838	X-VERT E SOFT RIDE KIT
85-3839	X-VERT E MEDIUM RIDE KIT
85-3840	X-VERT E FIRM RIDE KIT
85-3871	X-VERT R AND T SOFT RIDE KIT
85-3872	X-VERT R AND T MEDIUM RIDE KIT
85-3872	X-VERT R AND T FIRM RIDE KIT
85-3838	X-VERT SOFT RIDE KIT
85-3839	X-VERT MEDIUM RIDE KIT
85-3840	X-VERT FIRM RIDE KIT
85-3841	X-VERT CARBON SOFT RIDE KIT
85-3842	X-VERT CARBON MEDIUM RIDE KIT
85-3843	X-VERT CARBON FIRM RIDE KIT

MANITOU DAMPER REBUILD KITS

1999	Spyder R Rebound	85-3802
	SX RR/TI Carbon Rbd	85-3804
	SX Rebound	85-3807
	SX E Rebound	85-3806
	X-Vert/R Rebound	85-3808
	X-Vert E/T Rebound	85-3809
	X-Vert Carbon Rbd	85-3819
	Spyder R/Sx E Comp	85-3801
	SX Comp	85-3803
	SX R/Ti/Carbon Comp	85-3805

MANITOU DAMPER REBUILD KITS

	X-Vert Comp	85-3805
	X-Vert E Comp	85-3801
	X-Vert R/Carbon Comp	85-3817
	X-Vert T Comp	85-3816

MANITOU BUSHING-SEAL REBUILD KITS

1999	Spyder/R	85-3826
	SX/E/R/Ti	85-3827
	X-Vert/E/R/Ti	85-3828

LUBRICANTS

85-3810 Manitou Prep M lubricant

85-3812 Manitou Prep M lube gun

MRD LOCKOUT

85-3704 1999 Manitou SX-E

85-3734 1999 Manitou SX, SXR, SX Ti

85-3759 1999 Manitou SX Carbon

85-3703 1998 Manitou SX

Log on to our website at www.answerproducts.com and you can download service manuals for 1999 model year forks.

Part No. 85-3578

ANSWER PRODUCTS, INC.
28209 AVENUE STANFORD, VALENCIA, CA 91355

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