# Introduction

## Why A Gary Fisher Bicycle?

### The Invention of the Mountain Bike

Gary Fisher's love of bicycles began at an early age. As young road racer, Gary rode in the hilly terrain north of San Francisco called the Marin headlands. As he did his road miles, he was constantly admiring the wooded mountain and open hillsides of Mt. Tamalpais. The many fire roads and trails called to him, but leaving the manicured surface of the paved roads was asking too much of his road bike. Using his knowledge of bicycles to "soup-up" a coaster-brake clunker, Gary found his escape from the pavement. And he never looked back.

Gary's adventures on Fat-Tired bikes eventually brought he and his friends to a test of equipment and riding skills they called The Repack. This downhill race on dropped thousands of feet in a very short distance, and the constant braking left their clunker's coaster brakes sizzling hot. The name was coined because the grease in their coaster brakes had to be "repacked" after every run.

Gary soon realized that with a little modification of bike and motorcycle parts, the coaster brake clunkers could be made into multi-geared bikes. With Gary's new bike, you could not only descend the Repack, but now you could ride up as well. Gary went into business producing these new bikes, and the name Mountain Bike was born.

### Gary Fisher- Test Pilot

Although the idea of multi-speed, fat tire bikes soon was spreading like wildfire, these other bikes often came up short of Gary's designs. The difference was, and still is, that Gary was personally involved in the bikes bearing his name. His record time on the Repack is a small testimony of Gary's ability to push the envelope.

Riding the edge of a bike's capabilities, Gary was able to find the flaws. As he showed with his first fat-tired inventions, he was also capable of solving the problems with new, well-conceived designs.

Gary Fisher bicycles continue to benefit from Gary's ideas. Many things which are standard in the industry today can be



credited directly to Gary. The use of oversized headsets which greatly increased steering precision and bike durability is a direct descendant of Gary's Evolution design. Short chainstays for better climbing came from Gary's desire for better traction. The list goes on.

### Function First

Although virtually all modern fat tired bikes have profited from Gary's creativity, only Gary Fisher bikes have the complete package of Gary's latest ideas.

A customer shopping by simply comparing rear derailleurs may think that a Fisher bike seems more expensive than comparable bikes. But when that same person is out in the rough stuff, the performance edge offered by Gary Fisher bikes will come shining through. The added function of a Gary Fisher mountain bike is the true meaning of value. More tire clearance. Better fit and balance. Clean cable routing. Low weight. Components that work together.

### Bikes That Fit

Early in his design experiments, Gary built a bike with an adjustable frame so that he could experiment with different bottom bracket heights, frame angles, fork offsets, and wheelbases. He learned a lot about what works and what doesn't.

With Fisher bikes you'll find all sizes of frames benefit from Gary's experience. With Fishers, seat tubes and head tubes are carefully matched for every size to maximize comfort and handling. Every size of bike in a given model works equally well. Different rises and lengths of stems. Different crank lengths. Gary even offers different handlebar widths on the sizes within a model. Other companies cut corners to reduce cost by using the same sizes on both big and small bikes.

### Performance

Gary goes to this trouble because he loves bikes and wants others to feel his passion. He knows that people buy a Fisher expecting it to ride better than any other bike. He goes the extra mile to make sure that every Fisher owner can smile knowing they've got a bike which rides the way Mountain Bikes were meant to be.

# Geometry Terminology

Head Angle: The angle formed by the intersection of the centerline of the head tube and a horizontal plane. This angle affects steering quickness, and the steeper the head angle, usually the quicker the steering.

Seat Angle: The angle formed by the intersection of the centerline of the seat tube and a horizontal plane. This angle affects the fit of the bike, particularly addressing the length of the femur (upper leg bone) by changing the rider's position over the crankset. Usually, smaller bikes will have steeper seat tubes, while larger bikes will have more relaxed seat angles.

Seat Tube Length: The distance from the center of the bottom bracket to the center of the top tube, although alternate methods may measure to the top of the top tube or top of the seat tube. This relates to overall leg length, but with the advent of super-long seatposts, is less meaningful than it once was.

Top Tube Length: The distance from the junction of the centerlines of the head tube and top tube to the junction of the centerlines of the seat tube and the top tube. This measurement relates to torso length and positioning on the bike.

Effective Top Tube Length: The length of a horizontal line from the junction of the centerlines of the head tube and top tube to the imaginary centerline of the seat tube. This measurement is important due to the sloping top tube (with extra long seat post extension) currently favored by mountain bikers. A more accurate version of the top tube measurement, this relates to torso length and positioning.

Chainstay Length: The distance from the center of the bottom bracket to the center of the rear axle. This dimension effects weight distribution over the rear wheel.

Bottom Bracket Height: The distance from the center of the bottom bracket to the ground. This measurement effects ground to pedal clearance, as well as stability of the bike by dictating the height of the rider's center of gravity.

Offset (Rake): The perpendicular distance from the centerline of the head tube to the center of the front hub. Rake combined with the head tube angle yields another steering term, trail.

Wheelbase: The distance from the center of the rear hub to the center of the front hub. This determines handling characteristics like turning radius, tracking stability, and shock absorption.



Trail: The distance between where the head tube centerline intersects the ground and a vertical line dropped from the center of the front hub. This measurement effects the stability of the steering system and the feel of the steering. Longer trail usually means a "heavier" or more stable feel, while less trail usually feels "quicker" or "lighter".

Front Center: The distance from the center of the bottom bracket to the center of the front hub. This distance effects both weight distribution and toe clip /front wheel overlap. Given that most mountain bikes use only a narrow range of steering angles and offsets, front center also refers to the amount of "cockpit room" the rider will have.

Stem: This should be considered part of the bike's geometry because it effects weight distribution and steering feel. Along with handlebar width, it also relates to arm and torso length.

## It All Works Together

Every facet of bike design will effect another, so we can only talk in generalities about what any one dimension does to the bike. Its obviously true that each part of the bike is connected to another part of the bike. However, it isn't always apparent how changing one dimension on a bike will effect the others.

Here's an example: If you shorten the chainstays, you decrease the wheelbase while increasing the weight over the rear wheel. This must in turn decrease the weight over the front wheel, which will effect the steering feel.

# Gary Fisher Geometry

Gary rides mountain bikes. A lot. For a long time. In fact, Gary invented Mountain Bikes. And over the years Gary has found things which work, and others that don't. He is very particular about the way a bike rides. Trial and error have shown him distinct features which make a bike ride better. Among those features:

**Short Chainstays**- Gary likes his at 16.5 inches. Shorter chainstays provide better traction, both in climbing and braking, because more weight is on the rear wheel. The limiting factor on chainstay length on most bikes is tire clearance, a problem Gary solved with Hipstays.

**Hipstays**- Specially curved chainstays which provide plenty of room for fat tires and still give clearance for the crankset.

**Evolution**- Gary's stronger, stiffer, and lighter 1 1/4" steering system which revolutionized the mountain bike industry. Before Evolution, almost all bikes used the 1" headset size. With Evolution, the steerer, head tube, and headset are all larger, so stress and wear are distributed over a wider area.

Evolution also means larger frame members. The larger joints the larger tubes create add stiffness to the whole system. Overall frame stiffness is enhanced, including the torsional rigidity required in hard descents in rough terrain. The wheels go where you point the handlebars. So its not just turning the handlebars: overall frame response is improved.

**Top tubes**- Gary likes bikes with good top tube room. Longer top tubes allow a rider to stretch out on the bike for comfort. A larger cockpit also allows a rider to move his center of gravity around more to better balance the bike in technical terrain. But longer top tubes are just part of that story....

**Steep seat angles**- For the best pedaling efficiency, the rider's seat will always be positioned with respect to the bottom bracket. The most important aspect of the seat angle is that it should allow the rider to adjust his seat to meet this position. However, if a steep seat tube is paired with a long top tube, there will be even more room for the rider. Probably the biggest benefit here is that the rider can more easily move from a seated to a standing position without effecting weight distribution on the wheels, and therefore will maintain traction.

**Steep head angles**- While most of the industry embraces 71° head angles as the norm, Gary likes his bikes to have a little more nimble steering. Maybe its his road heritage. But that's what he likes. What difference can 1/2 a degree make? Its not a lot, but combined with the same offset (rake) as everybody else uses, Gary's steering geometry has a little less trail for a lighter, quicker feel that is just right for climbing gnarly single track or flashing a screaming descent.



**Size specific geometry**- Gary's bikes aren't just steeper with longer top tubes. They're size specific. That means that the angles and top tube lengths are adjusted to make each bike fit better and ride better for a given size of rider. For example, a tall rider's upper thigh (femur) is longer. To get the proper position over the pedal spindle, this taller rider will need a slightly less steep seat angle. Another example: a smaller rider will ride a smaller bike. Smaller bikes have a shorter wheelbase, which makes a bike quicker handling. By adjusting the head angle on a shorter bike, the net steering feel can be maintained. This also keeps the rider balanced correctly between the wheels.

**Fisher sizing**- Gary may seem like a laid back dude. But actually, he's pretty scientific in his approach to bike design. That's why Gary's frame sizing is based on center to center dimensions, just like an engineer's blueprints of frame geometry. All Fisher frame sizes are measured from the center of the bottom bracket to the intersection of the centerlines of the seat tube and top tube. If you're unsure as to the fit of a Gary Fisher bike, we recommend that you check the straddle height clearance. Most people can ride 2 frame sizes comfortably. Which one is best? Of those two frame sizes, determine which handlebar height and reach best fits your personal style of riding.

**Cable routing**- The best cable routing involves taking the shortest route between the two ends of the cable, with the fewest turns, with the longest radii to those turns. Then make sure the cables can be easily serviced. Its a simple but complex task that Gary figured out. All componentry works better on a Gary Fisher bike because of the small details like this. Examples of Gary's attention to detail include the Brake Snake, a short tube that allows the rear brake cable to get around the seat cluster in a clean, unobtrusive way with a minimum of friction. Another example is the cable hanger built into the stem on many Fisher models.

## Every Fisher is a winner-

Every Gary Fisher bike gets Gary's designs. Gary thinks that in its price range, an Advance should offer the same advantages as a Mt. Tam. The differences come from materials, weight, and manufacturing costs, not from having a lesser design. In this way, every Fisher rider is pedaling a winner.

# OCLV

OCLV is the name that the Trek Bicycle Corporation has coined to describe its patent-pending breakthrough with carbon fiber composites. This leap in technology allows the manufacture of composite lugs and tubes that offer **Optimum Compaction** of the carbon fiber, with **Low Void** content in the laminate.

## The Process

Carbon Fiber Composite is composed of two parts: carbon fibers and the epoxy resin that holds them together. Composite means that these two substances have been combined to blend the best characteristics from the two parts. But wait- not all carbon composite is the same! The benefits of a composite material varies according to the quality and quantity of the ingredients in the mix, as well as the quality of their blending: in this case, the arrangement of the fibers in the epoxy matrix.

To achieve the benefits of OCLV, top quality carbon fibers and epoxy are used. The fibers are pressed tightly together to maximize the benefits of a top-quality laminate, a condition engineers refer to as Optimum Compaction. Still, the most important part of the OCLV process is that it places the fibers, and therefore the strength, exactly where they are needed. The precise locations are determined by use of FEA, or Finite Element Analysis. FEA is the use of computer modeling to determine the stresses with a given construction or thickness of material. The model can be changed and re-analyzed. Using FEA, you can eliminate material in a design where its not needed, to provide you with the lightest bike possible.

How good is the OCLV process? For composite parts on airplanes, quality specifications are very strict. Voids, or inconsistencies in the composite material like air bubbles or epoxy pockets, create the possibility of a weakness. For safety's sake, no more than 2% of the laminate used in these flying machines may contain voids. The OCLV process commonly achieves a quality level of less than 1% voids, yielding a super strong, uniform material that optimizes the benefits of carbon fiber composite.

With a carbon fiber composite that has Optimum Compaction and Low Void, you get a material that is by far the strongest, stiffest, and lightest material used in the bicycle industry today. The control of carbon fibers yielded by the OCLV process allows this new breed of bicycles to have the correct stiffness for a unique blend of great efficiency, comfort, and handling. They also have the durability required to come with a Lifetime Guarantee!



## The Manufacturing

OCLV is definitely a revelation in materials, but the difference doesn't stop there. These framesets are manufactured with a level of precision that is unmatched in the industry. The processes used to assemble these framesets yields an exact image of the engineers' CAD (Computer Aided Design) drawings for frame layout, and each frameset shows a flawless finish.

This precision is in the design. The frame parts only fit together in one way, so the alignment of every frameset is guaranteed. The lugs and tubes are built individually so that each part's quality can be carefully inspected, ensuring that they are built to very high standards. Building the lugs as well as fabricating the frame itself allows total control over the entire process- something totally unique in the cycling industry.

After the different pieces of the OCLV frames have been manufactured, they are assembled using proven bonding procedures. Bonding is a process which uses aerospace adhesives to glue the lugs and tubes together, but this is no ordinary glue! Similar to the adhesives used to hold helicopter rotor blades together, it would take about 16 tons of force to pull two pieces of an OCLV frame apart. Actually, the material surrounding a bonded joint would give way before the bond could be broken.

Extensive testing was done on completed OCLV frames and the results were compared with information gained from running the bikes through a series of analytic tests. In one of the most abusive tests performed, the Low Cycle Fatigue Tester roughly mimics the forces which a bike goes through while running into a brick wall at 15 miles per hour. OCLV bikes came through with flying colors. A good steel bike will go through about 15,000 cycles before it fails, which is more than required to offer a Lifetime Warranty. At last count, an OCLV frame had gone 160,000 cycles!

## The Ride

The OCLV process offers such precision that the carbon fibers can be placed exactly where you want them. This way, a bike can be made to ride any way a rider wants. A little stiffer here? No problem. A little softer there? Again, no problem. A great deal of effort was invested to fine tune the OCLV performance. By constructing lugs which are very long, the major stresses experienced by a bicycle frame will occur within the lug, and not in the tube or frame joint as in "normal" construction. Tubing can be kept as thin as possible, and the lugs fully address the specific forces which occur at a given point. The bike allows very little lateral frame flex, making it very efficient in hard climbs or sprints, even for big riders. But with carbon fiber, the bike can still eat up shock, and a light rider will find that the terrain will fly by with very little fatigue (which may be helped by the fact that the bike weighs several pounds less than most!). For the racer in all of us, there is an excellent feel for the ground beneath you. Cornering becomes a dream.

Much of this good feel has to do with size specific design and size specific stiffness. Each frame size gets specific angles and tube lengths to [illegible] fit the rider, and carefully place the rider [illegible] optimum weight balance. In addition, both [illegible] different sizes of bikes offer different [illegible]

[illegible]

[illegible] make faster transitions (shorter butts) with greater differentiation (more change) of wall thickness.

This new technology allows a tube set to be manufactured which has enough thickness at the ends to allow TIG welding. Yet the tubing is thin enough (and the thin portion is long enough, because it starts so close to the end) to achieve a ride very similar to the performance of bikes built with brazed construction.

In addition to True Temper's technology breakthrough, the manufacturing technology used on Gary Fisher bikes is equally impressive. To begin with, a laser is used to miter the tubes, and the laser cut is at a constant 90° angle to the axis of the tube. In traditional mitering operations, the cut is made at the angle of the joint. This produces a very sharp, thin edge over much of the tube end. When welding, the weld is applied at the junction of the outside of the two tubes. This means welding to a very thin portion of the tube, with little heat penetration. When welding to a laser cut tube, the edge of the tube is very thick, allowing a stronger joint, larger weld surface, and the slight notch allows better heat penetration.

To prevent heat distortion and misalignment, 'Signature' welding is used on Gary Fisher's U.S. Cro-Moly models. This involves welding portions of a joint, allowing [illegible] and then welding another portion of the joint. [illegible]

[illegible]

[illegible] stays are thin-walled overall, but thicker at the cantilever brake attachment points where the major stresses are. The Fisher Hipstay design yields ultra-short chainstays, while still providing lots of mud clearance.

• **Internal head tube reinforcements**- Head tube construction of most bikes starts with a thick, heavy tube which is then milled where the headset cups are inserted. This makes the head tube round, but creates a thin wall where the headtube has its highest stresses. Gary uses head tube reinforcements welded into a thin head tube. This reduces weight, but adds strength where its needed the most- at the headset cup insert area.

• **Seat lug reinforcement-** Like the head tube, the top of the seat tube is a high stress area that gets reamed for roundness to allow the seatpost to slide easily. With Gary's new U.S. Cro-Moly bikes, an internal reinforcement is welded in, adding strength at the weld area of the seat cluster, but leaving the seat tube thin and light for a better ride. An added benefit is that even though the seat tube is a larger 1 1/4" diameter, the Aquila and Hoo Koo E Koo still use a standard 27.2 mm seatpost.

• **Brazed-on ACSD mount-** Chain suck is a fact of life on mountain bikes. Gary's new ACSD (AntiChainSuck Device) is the best protection available. It's super strong, easily adjustable, very effective, and part of the frame.

• **Welding area is maximized-** Look at the way the Hipstays meet the bottom bracket shell. The lower Hipstay placement lessens chainslap, but even more importantly, the weld surface area is maximized to add strength and stiffness in this critical area.

• **Ergonomic sizing-** Gary Fisher bikes are renowned for the way they become an extension of your body, and these new bikes are no exception. The frame and component fit is adjusted for different body sizes, and so are the tubing wall thicknesses.

• **Brazed dropouts-** Should a rider manage to damage one of these forged steel dropouts in a crash, they are replaceable, because they're brazed, not welded.

• **Lighter-** Even with all these extras added to the frame, the new Gary Fishers are light enough to be called "poor man's titanium"!

# 6061 T6 Aluminum alloy

Aluminum has long been recognized as a great metal for manufacturing. As an element, aluminum is readily available and cheap to extract from the earth. It is easy to work and manufacture. It has many alloys, and its strength can be enhanced through a variety of mechanical treatments such as heat treating and aging. Best of all, because of aluminum's popularity it is readily available at an economical price.

Pure aluminum would not make a good bicycle frame. It is quite soft (not stiff) and not very strong. However, when mixed with



other elements to form an alloy, aluminum exhibits very good properties for bicycle construction. The various alloys of aluminum are designated by an alloy number, such as 6061. This number refers to a specific mixture of elements mixed with the aluminum. Each alloy exhibits specific properties in terms of strength and stiffness, and workability. As an example, 6061 aluminum is about 50% stronger than pure aluminum. 6061 is also weldable, although some aluminum alloys are not.

Various strength enhancements can be applied to aluminum and its alloys, depending on the alloy's properties. Heat treatment is the most recognized of these treatments. In heat treatment, the material is heated to a specific temperature or series of temperatures (often close to the materials melting temperature) for a specific period of time. With some alloys, further strength enhancement includes aging, where the material is then cooled at specific temperatures for specific times. In the case of 6061 aluminum, the most common heat treatment and aging is denoted by the term T6, which adds another 25% to the material's strength. Its important to realize that these treatments cannot be done with all alloys of aluminum.

The main reason to choose aluminum for a bicycle frame is that 6061 T6 aluminum demonstrates great features for performance cycling. It has a low density, so it is light per unit volume. This means that bikes built from aluminum will be light in weight. 6061 T6 aluminum is quite strong, so less material is needed to build a bike, further reducing the weight. Aluminum also has a reputation for absorbing shock. However, 6061 T6 aluminum is not as stiff as other materials, so careful design is a must if the bike is to have the correct ride.

In addition to light weight and strength, aluminum allows a great deal of fine tuning of the ride 'feel'. By varying wall thickness and tubing diameter, different manufacturers have distinguished their aluminum bikes with raves for comfort or stiffness.

With Gary Fisher's designs, the properties of 6061 T6 aluminum are maximized. Moderately oversized, thin walled tubes provide plenty of comfort, a lively ride, and excellent shock absorption. Frame strength and stiffness are provided by carefully selecting wall thicknesses and butt lengths, maximizing weld areas, using Evolution sized steering components, and adding external gussets.

Gary's Hipstay design allows a stiff rear triangle through shorter chainstays, yet plenty of tire and chainring clearance. These are the type of frame details that you can only find on Gary Fisher bikes.

# For mechanics-

## ACSD AntiChainSuck Device

Unfortunately, the ugliness of chainsuck is an off-road fact of life. Even with the best equipment in great shape, a little mud can stick a chain to a chainring in nothing flat. The Gary Fisher ACSD (Anti Chain Suck Device) is the best protection there is for protecting those tender chainstays.

To adjust the ACSD, loosen the two mounting bolts which attach the ACSD plate to the chainstay. Position the ACSD plate so that there is between 1 and 2 mm of clearance between the ACSD and any part of the chainrings. Tighten the ACSD adjusting bolts. If the chainrings are bent or misaligned, it is critical that they be straightened before performing this adjustment. It is advisable to test ride the bike after adjusting the ACSD because some chainrings may deflect under pedaling loads, causing the ACSD to rub.

In some cases, accumulated mud and goo may cause rubbing even with a correctly adjusted ACSD. These same gooey conditions are the times when ACSD adjustment is most critical. Avoid leaving extra room for goo to pass the ACSD, as this may also allow the chain to go through the larger gap if the chainrings flex further under pedal pressure.

## ACSD fender mounting bracket

To prevent excess mud buildup in the bottom bracket/ACSD/ front derailleur area, the Procaliber and Procaliber Ltd. do not have chainstay bridges. Through careful design, they are not required for strength or stiffness. This reduces weight and helps these areas avoid mud build up. However, if a rider wants to install fenders on a Procaliber and Procaliber Ltd., most full coverage fenders require a bottom bracket mounting location.

We have thoughtfully provided a fender mount which may be installed as an accessory to the ACSD. To install the fender mount, simply remove the ACSD attachment bolts, install the fender mounting bracket between the ACSD and the chainstays, and readjust the ACSD as normal.

## OCLV seat lugs

Do not grease the seatpost on bikes with OCLV construction. The seat lug on the Procaliber and Procaliber Ltd. are built with a unique construction. After the lug is built, a carbon fiber tube is laminated into the lug. The interior of this tube in lined with a thin layer of fiberglass.



This fiberglass layer prevents galvanic corrosion between the aluminum and carbon fiber by keeping them separated. If you apply grease to the seatpost, the grease will permeate the fiberglass, and you will not be able to adequately clamp the seatpost. If the seatpost has been inadvertently greased, remove the grease with solvent on a rag (but don't get any solvent into the bottom bracket).

## Dry firing

One of the first things that customers love to do with all the new shifting systems is "dry-fire" the shifters. Dry-firing is shifting the shifters on a derailleur equipped bike without moving the chain. If the shifter is shifted so that cable tension is removed, the cable end may become disengaged from the shifter. As the shifter is then shifted again, the loose cable end can get jammed, and its head can damage other shifter parts. In particular, the gear indicators on the new Shimano shifters can be damaged, and are time consuming to repair.

## Chainring bolt hole circles

Over the years Shimano has introduced an amazing array of new products to enhance the performance of mountain bikes. SIS shifting, RapidFire Plus, HyperGlide, SPD, and more. For 1994, Shimano is introducing reduced size mountain bike drivetrains called Compact groups. These groups use smaller chainrings and smaller cassettes. This reduces weight while increasing shifting accuracy.

In order to accommodate these new, smaller pieces, the bolt hole circles on Shimano cranks have changed. For your use and reference, these crank arms use the following bolt hole circles:

| | |
|---|---|
| '93 XTR, XT, DX, LX, Altus, '94 XTR | 74 mm/ 110 mm |
| 400CX, 700CX | 58 mm/ 110 mm |
| '94 XT-C, LX-C | 58 mm/ 94 mm |
| '94 STX, Alivio | 58 mm/ 95 mm |

Note: STX inner ring is not interchangeable with XT, LX, 400CX, or 700CX due to ring shape.

## Cassette interchangeability

Although larger in size, '93 cassettes will fit on '94 compact freewheel bodies. However, the reverse is not true. '94 Compact cassettes will not fit on '93 freewheel bodies. However, complete wheels are interchangeable because the cog spacing remains the same within the 8 speed and 7 speed families.

# Ride-On Cables

The Ride-On Hyperformance cable system on the Procaliber LTD. is a unique feature which employs several thin layers of PTFE (also known as Teflon) to greatly reduce cable friction, which is a big benefit in indexed shifting systems.

By installing the RideOn system, you have essentially sealed the shift cables. This is accomplished by running the coated innerwire inside the liner, a clear hollow tube, all the way from the shifter to the derailleur. The liner is inside special, slightly oversized housings and ferrules. To be fully sealed, the liner must extend all the way from the shifter to the derailleur. If the front derailleur cable is routed under the bottom bracket, a special "umbrella tube" is used to keep water from trickling down the cable where it could enter the liner.

The parts of the RideOn system are:

- Innerwire, like a coated cable (2)
- Liner - small diameter, clear plastic tube about the same length as the innerwire (2)
- Guide armor - 2 larger diameter tubes about 2.5 and 3.5 inches long
- Umbrella tube - 8 inch larger diameter tube (1)
- Ride-On housing with special ferrules with oversize openings
- Cable ends (2)



## Notes before starting installation:

- Only use the Ride-On housing and special ferrules. Do not grease any of the cable or housing parts.
- Pay special attention to the housing ends. Make sure they are open and free from burrs.
- Be especially careful not to scratch or tear the coating on the innerwire. Pulling the innerwire across any sharp edge (such as a shifter or the edge of a ferrule) can pull the coating off and ruin the cable.
- When referring to the routing of the cable and housing, <u>first or front</u> indicates the closest part to the shifter, while <u>last or back</u> refer to the part closest to the derailleur.

***1. Thread the cable***

After disassembling the GripShift shifter and removing the standard cable (see the Gary Fisher Owner's Manual for instructions if necessary), remove the liner from the coated innerwire. Thread the innerwire through the shifter.

***2. Install the liner***

Slide the liner back over the innerwire. Next slide the first piece of housing over the liner. The front end of the liner should line up with the front end of the housing. Make sure the liner does not extend past the front end of the housing as this could jam the shifter. Run the liner and innerwire through the first housing stop and position the housing in its shifter and housing stop.

•If the liner does not easily pass through the housing, do not force it. Recheck the housing and ensure that there are no snags or burrs.

***3. Install the guide armor***

Slide the short guide armor into the bottom bracket cable guide. Align the front of the armor with the front of the bottom bracket cable guide.

***4. Continue routing the cable***

For the rear derailleur, continue routing the innerwire and liner through its housings and guides, but do not thread it through the derailleur yet. At this point, the innerwire and liner should extend out of the last piece of housing.

***5. Remove the slack, Mark the liner***

Make sure each piece of housing is firmly in its housing stops. While pulling on the innerwire (only) mark the liner with a felt pen. Mark the rear liner where it exits the back of the last piece of housing. With the front derailleur cable in place (but not clamped in the derailleur) mark the front liner about 2 inches below the front derailleur cable clamp bolt.

***6. Cut the liner***

Pull the front housing out of the shifter about 12-18 inches. The liner should stay located in the housing, making the innerwire pull into the liner past your mark. Cut the liner at your mark.

***7. Take out the slack again***

Slide the housing back into the shifter. The innerwire should now extend past the liner. Pull <u>only the innerwire</u> enough to pull the slack out of the system.

*8. Check the liner for alignment*

Make sure each piece of housing is firmly in its housing stops and that the front end of the liner is correctly aligned in the front housing (see Step 2).

*9. Trim the REAR derailleur innerwire*

With the housings and liner in place, pull the coated innerwire tight. Use a razor blade or sharp knife to score the cover of the innerwire at the back end of the last housing. Avoid nicking the cable. Slide or peel the coating off the end of the innerwire, leaving a bare cable.

*10. Attach the rear innerwire and adjust the derailleur*

Attach the bare end of the innerwire to the derailleur as normal. Follow normal procedures to adjust the derailleur and adjust cable tension. Install a cable end to prevent fraying. Shift the chain onto the largest rear sprocket.

*11. Position the front derailleur*

Position the front derailleur for height and angle, and tighten to the frame. With the chain on the smallest chainwheel, adjust the inner limiting screw of the front derailleur.

*12. Front derailleur- install the umbrella tubing*

Slide the umbrella tubing over the innerwire and liner. Position the umbrella tubing so that it will overlap the liner by about 2 inches, but cannot contact the guide armor when you shift.

*13. Clamp the front innerwire*

Pull the innerwire (only) along its normal path through the cable clamp bolt and clamp the innerwire WITH the umbrella tubing in the front derailleur cable clamp bolt. Tighten the cable clamp. Be sure the liner is not caught in the cable clamp (it should end about 2" below the cable clamp). The installed innerwire must be free to move inside the liner, and the umbrella tube will move outside the liner.

*13. Adjust the derailleur and cut the cable.*

Adjust the front derailleur. Cut the innerwire and umbrella tubing about 1.5" past the derailleur cable clamp and install the special oversize cable end cap over both the umbrella tube and innerwire.



# Onza Pedals

Clipless pedals have become the norm for performance mountain biking. By securely attaching the rider's feet to the pedals, a great deal more pedaling power can be transmitted to the rear wheel and overall control of the bike is improved.

The Owner's Manual included with each Fisher bicycle has usage tips for the rider in the first chapter, titled "Read Before You Ride". You should instruct anyone purchasing a Gary Fisher bike to read this chapter before their first ride.

For your own education, we'll cover some tips on use and adjustment of Onza pedals and cleats.

Onza pedals offer several different adjustments allowing the user to fine tune their performance. Cleat positioning, including angular, lateral and for/aft adjustment is accomplished by positioning the cleats on the shoe sole prior to tightening the attachment screws. Please note that there are two lengths of screws supplied with the cleats to accommodate the various shoe sole thicknesses found on the market.

Onza pedals offer either 6° or 10° rotational 'float', or free pivoting action. These numbers are stamped on the underside of the cleat. Place the cleat so that the numbers indicating the preferred amount of float are pointing towards the toe of the shoe.

Adjusting the force required to enter and release from Onza pedals is done by exchanging the supplied elastomers. The clear elastomers creates the lowest resistance, followed in order of stiffness by gray, blue and the stiffest, black. Do not mix different elastomers, as inconsistent release will result.

After adjusting the cleats, it is recommended that the rider practice entry and exit of the pedals to familiarize themselves with these actions. This is particularly important with Onza pedals because there is a 'break-in' period which normally requires 15 to 20 cycles of each side of each pedal.

## *Gear Charts*

Tyro

| | 28 | 38 | 48 |
|---|---|---|---|
| 11 | -- | 83 | 105 |
| 13 | 58 | 70 | 89 |
| 15 | 50 | 61 | 77 |
| 18 | 32 | 45 | 64 |
| 21 | 27 | 39 | 55 |
| 24 | 24 | 34 | 48 |
| 28 | 27 | 37 | -- |

Advance, Tassajara
Rangitoto, Aquila,
Hoo Koo E Koo,
Montare

| | 24 | 34 | 42 |
|---|---|---|---|
| 11 | -- | 83 | 103 |
| 13 | 59 | 71 | 87 |
| 15 | 43 | 61 | 76 |
| 18 | 36 | 51 | 63 |
| 21 | 31 | 44 | 54 |
| 24 | 27 | 38 | 58 |
| 28 | 23 | 33 | -- |

Paragon

| | 22 | 32 | 42 |
|---|---|---|---|
| 11 | -- | 79 | 103 |
| 13 | 46 | 75 | 96 |
| 15 | 40 | 65 | 83 |
| 18 | 33 | 48 | 63 |
| 21 | 28 | 41 | 54 |
| 24 | 25 | 36 | 47 |
| 28 | 21 | 31 | -- |

Mt. Tam, Supercaliber,
Procaliber, Procaliber Ltd.

| | 22 | 32 | 42 |
|---|---|---|---|
| 11 | -- | 79 | 103 |
| 12 | 49 | 72 | 95 |
| 14 | 42 | 62 | 81 |
| 16 | 37 | 54 | 71 |
| 18 | 33 | 48 | 63 |
| 21 | 28 | 41 | 54 |
| 24 | 25 | 36 | 47 |
| 28 | 21 | 31 | -- |

*These gear charts are for comparison only. Actual roll-out, or distance travelled in one rotation of the crankset, will vary according to wheel and tire size. For this reason, all calculations are for a 27 inch wheel except Tyro, which is for a 24 " wheel.*



## *Torque Specifications*

| Item Specifications | Torque LB•IN | KGF•CM |
|---|---|---|
| Handlebar clamp bolt, forged stem | 150-180 | 170-200 |
| Handlebar clamp bolt, welded stem | 100-120 | 115-140 |
| Stem expander bolt | 175-260 | 200-300 |
| Direct connect steerer clamp bolt | 100-120 | 115-140 |
| Bar end attaching bolts | 130-150 | 150-170 |
| Seat attaching bolt | 175-350 | 200-400 |
| Seat post binder bolt | 150-180 | 170-200 |
| Crank arm bolt | 300-390 | 350-450 |
| Chainring bolt | 50-70 | 60-80 |
| Pedal attachment | 350-380 | 400-440 |
| Cartridge bottom bracket (Shimano) | 345-460 | 395-530 |
| Wheel axle nuts | 130-210 | 150-250 |
| Anti Chain Suck Device | 30-40 | 35-45 |
| Front derailleur clamp bolt | 40-60 | 50-70 |
| Rear derailleur attaching bolt | 70-85 | 80-100 |
| Front and rear derailleur cable clamp bolt | 35-52 | 40-60 |
| Brake lever attaching bolt | 40-60 | 50-70 |
| Cantilever brake attaching bolt | 40-60 | 50-70 |
| Cantilever brake pad attaching nut | 70-80 | 80-90 |
| Brake cable clamping bolt | 50-70 | 60-80 |
| Strut-S | | |
| Brake arch-slider attachment bolts | 105-110 | 121-127 |
| Slider retaining screws | 60-70 | 69-81 |
| Brake cable housing stop-brake arch | 26 | 30 |
| RockShox | | |
| Brake arch attachment bolts | 60-70 | 68-80 |

# How to Use This Section

This section is designed to help the mechanic in the shop as well as the sales person on the floor. Of special benefit is the information listed to help you upgrade your customer to the next model, or fit a customer on a Gary Fisher bike. To help you use the model specifications listed in this section, the following definitions of terminology are given:

1. **Stand over height**- the distance from the ground to the top of the top tube, measured in the middle of the top tube.

2. **Top tube**- the length of the top tube measured from the centerline junction of the seat and top tubes to the centerline junction of the head and top tubes.

3. **Effective top tube**- the horizontal distance from the intersection of the head tube/top tube centerline intersection to the seat tube centerline. The more accurate way to talk about bike fit. Sloping top tube bikes have a longer effective top tube than actual top tube, because the actual top tube "takes a shortcut" to the seat tube.

4. **Stem extension**- the length of the stem measured from the center of the handlebars to the centerline of the steerer and stem, along the centerline of the stem. Because some stems are horizontal and some stems angled, there are two other stem dimensions to be aware of: reach (the horizontal component of the stem) and rise (the vertical component of the stem). Example: A 100 mm stem with a 25° rise in a bike with a 71° head tube will have a 44° rise when measured from the ground. In the bike this 100 mm stem has a reach of 71 mm and a rise of 71 mm. Also listed is the steerer clamp height of Direct Connect stems, because this effects steerer length.

5. **Reach**- the horizontal distance from the handlebars to an imaginary vertical line extending above the junction of the centerlines of the seat and effective top tubes. This information is also listed in compiled form so that if needed you can more quickly find a bike to fit a customer.

6. **Handlebar width**- the end to end dimension on mountain style handlebars, or the center to center dimension of the end of the drops on road handlebars. Also listed is the stem clamp diameter and amount of bend on mountain style bars.

7. **Crank arm length**- length of cranks measured center of bottom bracket axle to center of pedal axle.

8. **Head tube length**- original length of head tube. A more accurate way of determining steerer length is to combine stack height, head tube length, and stem requirements (different direct connect stems and spacers require different steerer lengths).



9. **Seatpost length**- includes diameter of post. With some smaller frame sizes, longer posts will not allow the seatpost to slide entirely down into the frame. If substituting seatposts, please ensure that the new seatpost is measured accurately for diameter.

10. **Gearing**- a listing of the number of teeth on the chainrings and freewheel cogs. A gear chart is found on pages 36 and 37.

## *General Information*

*Hubset type:* describes the hub configuration for freewheels or drum brakes, and the number of spokes required.

*Spokes:* describes the length and gauge (thickness) of the spokes. D/ND refers to the Drive/NonDrive spokes of the rear wheel, with the freewheel side being the drive side.

*Tire size:* indicates the original Gary Fisher tire size. On many models other sizes will fit.

*Front derailleur:* indicates the seat tube diameter, or "braze-on type" if the derailleur doesn't use a band or clamp attachment.

*Bottom bracket:* indicates model, shell width, and axle length.

*Rear dropout width:* indicates the distance between the inside dropout faces. With modern designs, this does not necessarily indicate the rear hub's outer locknut dimension.

*Headset size:* indicates the stem outer diameter/inner head tube diameter/ fork crown race seat diameter in millimeters.

*Stack height:* the height of a headset when installed in the frame. This dimension is added to head tube length (along with steerer clamp height and spacers for direct connect systems) to calculate steerer length.

*Weight:* actual weight of a complete bike, usually a 17.5" model

*Upgrades:* this is a feature designed to help you upgrade your customer to a better model by listing several key features of a bike that are not found on the model before it. Example: the customer is test riding a Montare, and you want to sell the customer a Paragon. The upgrades found on the Paragon are listed for your quick reference. If you need further information about a bike, such as frame angles or parts not listed in Upgrades, refer to your Gary Fisher catalog for a complete breakdown of specs and geometry for each bike.

## *Tyro*

| Sizes | 11.5 |
|---|---|
| 1. Stand-over height | |
| Inches | 25.4 |
| Centimeters | 64.5 |
| 2. Effective top tube | |
| Inches | 20.7 |
| Centimeters | 52.5 |
| 3. Stem (extension/25 degrees rise) | |
| Millimeters | 100 |
| 4. Reach (effective top tube + stem reach) | |
| Inches | 23.5 |
| Centimeters | 59.7 |
| 5. Handlebar width (25.4 mm diameter) | |
| Millimeters | 540 |
| 6. Crank arm length | |
| Millimeters | 165 |
| 7. Head tube length | |
| Inches | 3.31 |
| Millimeters | 84 |
| 8. Seatpost length (26.6 mm diameter) | |
| Millimeters | 300 |
| 9. Gearing | 28/38/48 11-13-15-18-21-24-28 |

### *General Specifications*

| | |
|---|---|
| Hubset, type | Cassette |
| Spoke number | 36 |
| Spokes, front | 239 15ga. |
| Rear (D/ND) | 237/238 15ga. |
| Tire size | 24 x 2.1 |
| Front derailleur | 28.6 mm/1 1/8" |
| Bottom bracket | BB611NW |
| Shell width | 73 |
| Axle length | 129.5 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 35 mm |
| Weight | 27.4 lb/12.4 kg |

### *Features*

- *Full Fisher-featured mountain bike for smaller riders*
- *4130 Cro-Moly main triangle*
- *21 speed Shimano shifting*
- *Nutted axles for youth safety*
- *Aggressive tires*
- *GripShift*



## *Advance*

| Sizes | 13.5 | 15.5 | 17.5 | 19 | 20 |
|---|---|---|---|---|---|
| 1. Stand-over height | | | | | |
| Inches | 28.0 | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 71.1 | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | | |
| Inches | 21.0 | 21.6 | 22.3 | 22.9 | 23.5 |
| Centimeters | 53.4 | 54.8 | 56.7 | 58.2 | 59.6 |
| 3. Stem (extension / 25 degrees rise) | | | | | |
| Millimeters | 100 | 115 | 115 | 130 | 145 |
| 4. Reach (effective top tube + stem reach) | | | | | |
| Inches | 23.9 | 24.8 | 25.6 | 26.6 | 27.6 |
| Centimeters | 60.6 | 63.1 | 65.0 | 67.6 | 70.0 |
| 5. Handlebar width (25.4 mm diameter, 9° bend) | | | | | |
| Millimeters | 560 | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | | |
| Millimeters | 170 | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | | |
| Inches | 3.35 | 3.54 | 4.13 | 5.71 | 7.28 |
| Millimeters | 85 | 90 | 105 | 145 | 185 |
| 8. Seatpost length (26.6 mm diameter) | | | | | |
| Millimeters | 300 | 300 | 300 | 300 | 300 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | | |

### *General Specifications*

| | |
|---|---|
| Hubset, type | Cassette |
| Spoke number | 36 |
| Spokes, front | 266 15ga. |
| Rear (D/ND) | 263/264 15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 28.6 mm/1 1/8" |
| Bottom bracket | BB-LP20 |
| Shell width | 73 |
| Axle length | 113 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 35 mm |
| Weight | 27.4 lb/12.4 kg |

### *Features*

- *Full Cro-Moly frame and fork*
- *Shimano Alivio compact group*
- *Psycho tires, stainless spokes, and Araya rims*
- *Complete Gary Fisher geometry and frame details*

## Tassajara

| Sizes | 13.5 | 15.5 | 17.5 | 19 | 20.5 |
|---|---|---|---|---|---|
| 1. Stand-over height | | | | | |
| Inches | 28.0 | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 71.1 | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | | |
| Inches | 21.0 | 21.6 | 22.3 | 22.9 | 23.5 |
| Centimeters | 53.4 | 54.8 | 56.7 | 58.2 | 59.6 |
| 3. Stem (extension / 15 degrees rise) | | | | | |
| Millimeters | 105 | 120 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | | |
| Inches | 24.4 | 25.5 | 26.2 | 27.3 | 28.3 |
| Centimeters | 62.1 | 64.7 | 66.6 | 69.4 | 72.0 |
| 5. Handlebar width (25.4 mm diameter) | | | | | |
| Millimeters | 580 | 580 | 580 | 580 | 580 |
| 6. Crank arm length | | | | | |
| Millimeters | 170 | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | | |
| Inches | 3.35 | 3.54 | 4.13 | 5.71 | 7.28 |
| Millimeters | 85 | 90 | 105 | 145 | 185 |
| 8. Seatpost length (26.6 mm diameter) | | | | | |
| Millimeters | 300 | 300 | 350 | 350 | 350 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | | |

### General Specifications

| | |
|---|---|
| Hubset, type | Cassette |
| Spoke number | 36 |
| Spokes, front | 265 15ga. |
| Rear (D/ND) | 262/263 15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 28.6 mm / 1 1/8" |
| Bottom bracket | BB-LP20 |
| Shell width | 73 |
| Axle length | 113 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 35 mm |
| Weight | 27.3 lb / 12.4 kg |

### *Upgrades from Advance*

- *STX rear derailleur*
- *RapidFire Plus shifting*
- *Bar ends*
- *Toe clips and straps*
- *Alloy handlebars*



## Rangitoto

| Sizes | 15.5 | 17.5 | 19 | 20.5 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | |
| Inches | 21.6 | 22.3 | 22.9 | 23.5 |
| Centimeters | 54.8 | 56.7 | 58.2 | 59.6 |
| 3. Stem (extension / 25 degrees rise) | | | | |
| Millimeters | 115 | 115 | 130 | 145 |
| 4. Reach | | | | |
| Inches | 24.8 | 25.6 | 26.6 | 27.6 |
| Centimeters | 63.1 | 65.0 | 67.6 | 70.0 |
| 5. Handlebar width (25.4 mm diameter, 9° bend) | | | | |
| Millimeters | 580 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 3.54 | 4.13 | 5.71 | 7.28 |
| Millimeters | 90 | 105 | 145 | 185 |
| 8. Seatpost length (26.6 mm diameter) | | | | |
| Millimeters | 300 | 300 | 300 | 300 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | |

### General Specifications

| | |
|---|---|
| Hubset, type | Cassette |
| Spoke number | 36 |
| Spokes, front | 266 15ga. |
| Rear (D/ND) | 263/264 15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 28.6 mm / 1 1/8" |
| Bottom bracket | BB-LP20 |
| Shell width | 73 |
| Axle length | 113 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 35 mm |
| Weight | 29.7 lb / 13.5 kg |

### *Upgrades from Tassajara*

- *Double-butted Cro-Moly frame*
- *Tange Strut-S elastomer suspension fork*

## Aquila

| Sizes | 15.5 | 17.5 | 19 | 20.5 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 28.8 | 30.2 | 31.6 | 33.1 |
| Centimeters | 73.3 | 76.6 | 80.3 | 84.0 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 23.0 | 23.5 |
| Centimeters | 55.4 | 56.8 | 58.3 | 59.7 |
| 3. Stem (extension / 15 degrees rise) | | | | |
| Millimeters | 105 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.2 | 26.3 | 27.4 | 28.4 |
| Centimeters | 64.1 | 66.7 | 69.5 | 72.1 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 3.54 | 4.13 | 5.71 | 7.28 |
| Millimeters | 90 | 105 | 145 | 185 |
| 8. Seatpost length (27.2 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | |

### General Specifications

| | |
|---|---|
| Hubset, type | HyperGlide |
| Spoke number | 32 |
| Spokes, front | 270 14ga. |
| Rear (D/ND) | 268/269 14ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 31.8 mm / 1 1/4" |
| Bottom bracket | BB-LP30 |
| Shell width | 73 |
| Axle length | 113 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 30.25 mm |
| Weight | 26.8 lb/12.2 kg |

### *Upgrades from Rangitoto*

- *U.S. built True Temper Cro-Moly frame with full Gary Fisher geometry and details*
- *Shimano STX group*
- *32° Bontrager rims with presta valves*
- *6061 T6 bulged and knurled handlebars*



## Hoo Koo E Koo

| Sizes | 15.5 | 17.5 | 19 | 20.5 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 28.8 | 30.2 | 31.6 | 33.1 |
| Centimeters | 73.3 | 76.6 | 80.3 | 84.0 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 23.0 | 23.5 |
| Centimeters | 55.4 | 56.8 | 58.3 | 59.7 |
| 3. Stem (extension / 10 degrees rise) Direct Connect w/ 41 mm steerer clamp height | | | | |
| Millimeters | 105 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.4 | 26.5 | 27.6 | 28.7 |
| Centimeters | 64.6 | 67.3 | 70.1 | 72.8 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 3.54 | 4.13 | 5.71 | 7.28 |
| Millimeters | 90 | 105 | 145 | 185 |
| 8. Seatpost length (27.2 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | |

### General Specifications

| | |
|---|---|
| Hubset, type | Cassette |
| Spoke number | 32 |
| Spokes, front | 270 14/15ga. |
| Rear (D/ND) | 268/269 14/15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 31.8 mm / 1 1/4" |
| Bottom bracket | BB-LP30 |
| Shell width | 73 |
| Axle length | 113 |
| R. Dropout width | 135 mm |
| Headset size | 25.4/34.0/30.0 |
| Stack height | 25.5 mm |
| Weight | 26.9 lb/12.2 kg |

### *Upgrades from Aquila*

- *Rock Shox Quadra 10 elastomer suspension fork*
- *AheadSet system and Direct Connect stem*
- *Butted spokes*
- *Bontrager saddle*

## Montare

| Sizes | 15.5 | 17.5 | 19 | 21 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 22.9 | 23.5 |
| Centimeters | 55.4 | 56.9 | 58.2 | 59.7 |
| 3. Stem (extension / 10° rise) Direct Connect w/ 41 mm steerer clamp height | | | | |
| Millimeters | 105 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.4 | 26.5 | 27.6 | 28.7 |
| Centimeters | 64.6 | 67.3 | 70.1 | 72.8 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 4.13 | 4.84 | 5.57 | 6.32 |
| Millimeters | 105 | 123 | 141 | 160 |
| 8. Seatpost length (27.2 or 31.6 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 24/34/42 | 11-13-15-18-21-24-28 | | |

### *General Specifications*

| | |
|---|---|
| Hubset, type | HyperGlide |
| Spoke number | 32 |
| Spokes, front | 270 14/15ga. |
| Rear (D/ND) | 268/269 14/15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 34.9 mm / 1 3/8" |
| Bottom bracket | KSS |
| Shell width | 73 |
| Axle length | 118 |
| R. Dropout width | 135 mm |
| Headset size | 28.6/37.0/33.0 |
| Stack height | 29.0 mm |
| Weight | 25.9 lb/11.8 kg |

### *Upgrades from Hoo Koo E Koo*

- *TIG welded oversize 6061 T6 frame with full Gary Fisher details*
- *Deore LX-C derailleurs*
- *Direct Connect stem with hidden binder bolt*
- *Evolution system*



## Paragon

| Sizes | 15.5 | 17.5 | 19 | 21 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 22.9 | 23.5 |
| Centimeters | 55.4 | 56.9 | 58.2 | 59.7 |
| 3. Stem (extension / 10° rise) Direct Connect w/ 41 mm steerer clamp height | | | | |
| Millimeters | 105 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.4 | 26.5 | 27.6 | 28.7 |
| Centimeters | 64.6 | 67.3 | 70.1 | 72.8 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 4.13 | 4.84 | 5.57 | 6.32 |
| Millimeters | 105 | 123 | 141 | 160 |
| 8. Seatpost length (27.2 or 31.6 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 22/32/42 | 11-13-15-18-21-24-28 | | |

### *General Specifications*

| | |
|---|---|
| Hubset, type | HyperGlide |
| Spoke number | 32 |
| Spokes, front | 270 14/15ga. |
| Rear (D/ND) | 268/269 14/15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 34.9 mm / 1 3/8" |
| Bottom bracket | KSS |
| Shell width | 73 |
| Axle length | 118 |
| R. Dropout width | 135 mm |
| Headset size | 28.6/37.0/33.0 |
| Stack height | 29.0 mm |
| Weight | 26.4 lb/12.0 kg |

### *Upgrades from Montare*

- *Rock Shox Mag 10 air/oil suspension fork*
- *Deore LX-C group with XT-C rear derailleur*
- *Suspension specific front hub*
- *Bontrager BCX-2 rims*
- *Superlight seatpost*

## Mt. Tam

| Sizes | 15.5 | 17.5 | 19 | 21 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 29.3 | 30.6 | 31.7 | 32.7 |
| Centimeters | 74.4 | 77.7 | 80.5 | 83.1 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 22.9 | 23.5 |
| Centimeters | 55.4 | 56.9 | 58.2 | 59.7 |
| 3. Stem (extension / 10° rise) Direct Connect w/ 41 mm steerer clamp height | | | | |
| Millimeters | 105 | 120 | 135 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.4 | 26.5 | 27.6 | 28.7 |
| Centimeters | 64.6 | 67.3 | 70.1 | 72.8 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 580 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 4.13 | 4.84 | 5.57 | 6.32 |
| Millimeters | 105 | 123 | 141 | 160 |
| 8. Seatpost length (27.2 or 31.6 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 22/32/42 | 11-12-14-16-18-21-24-28 | | |

### General Specifications

| | |
|---|---|
| Hubset, type | HyperGlide |
| Spoke number | 32 |
| Spokes, front | 270 14/15ga. |
| Rear (D/ND) | 268/269 14/15ga. |
| Tire size | 26 x 1.95 |
| Front derailleur | 34.9 mm / 1 3/8" |
| Bottom bracket | KSS |
| Shell width | 73 |
| Axle length | 118 |
| R. Dropout width | 135 mm |
| Headset size | 28.6/37.0/33.0 |
| Stack height | 31.5 mm |
| Weight | 24.6 lb/ 11.1 kg |

### *Upgrades from Paragon*

- *Deore LX/XT mix with 8 speed*
- *Bontrager BCX-1 rims*
- *Psycho KS tires*
- *Onza clipless pedals with Cro-moly axles*
- *Bontrager saddle with synthetic leather cover*



## Supercaliber

| Sizes | 15.5 | 17.5 | 19 | 21 |
|---|---|---|---|---|
| 1. Stand-over height | | | | |
| Inches | 29.1 | 30.1 | 31.2 | 32.2 |
| Centimeters | 73.9 | 76.5 | 79.2 | 81.8 |
| 2. Effective top tube | | | | |
| Inches | 21.8 | 22.4 | 23.0 | 23.5 |
| Centimeters | 55.4 | 56.9 | 58.4 | 59.7 |
| 3. Stem (extension / 10° rise) Direct Connect w/ 45.7 mm steerer clamp height | | | | |
| Millimeters | 120 | 130 | 140 | 150 |
| 4. Reach (effective top tube + stem reach) | | | | |
| Inches | 25.9 | 26.9 | 27.8 | 28.7 |
| Centimeters | 65.9 | 68.3 | 70.6 | 72.8 |
| 5. Handlebar width (25.4 mm diameter) | | | | |
| Millimeters | 560 | 560 | 580 | 580 |
| 6. Crank arm length | | | | |
| Millimeters | 170 | 175 | 175 | 175 |
| 7. Head tube length | | | | |
| Inches | 3.78 | 3.78 | 4.57 | 5.35 |
| Millimeters | 96 | 96 | 116 | 136 |
| 8. Seatpost length (29.4 mm diameter) | | | | |
| Millimeters | 300 | 350 | 350 | 350 |
| 9. Gearing | 22/32/42 | 11-12-14-16-18-21-24-28 | | |

### General Specifications

| | |
|---|---|
| Hubset, type | HyperGlide |
| Spoke number | 32 |
| Spokes, front | 270 14/15ga. |
| Rear (D/ND) | 268/269 14/15ga. |
| Tire size | 26 x 2.1 |
| Front derailleur | 34.9 mm / 1 3/8" |
| Bottom bracket | KSS |
| Shell width | 73 |
| Axle length | 118 |
| R. Dropout width | 135 mm |
| Headset size | 28.6/37.0/33.0 |
| Stack height | 31.5 mm |
| Weight | 23.4 lb/ 10.6 kg |

### *Upgrades from Mt. Tam*

- *Ultralight quad butted Cro-Moly fork*
- *Psycho K folding tires*
- *Bontrager saddle with leather cover and Ti rails*

**Advanced Light Action:** Dual SIS shifting with reduced lever effort for easy, precise shifting.

**Alignment:** The placing of two or more objects in a line. In bicycles this usually refers to the wheels being not just in a line, but in the same plane, with the frame members oriented correctly within this plane. Good alignment is necessary to the function of most systems of the bike.

**Aluminum:** Low density metal with good structural characteristics, its properties can be changed by alloying. Aluminum alloys are usually noted by a 4 digit number which describes the alloy. Example: 6061 aluminum.

**ANSI:** American National Standards Institute. ANSI has developed a helmet testing standard which requires a drop test of 1.5 meter onto both a flat surface and a round anvil using a 13 pound head form. The helmet must register less than 300 Gs to pass.

**Anodized:** An electrolytic plating process which adds a surface treatment to aluminum.

**Butting:** A process that changes the wall thickness of a tube under extreme pressure. If both ends of a tube are thicker than the middle, called double butting.

**Bonding:** A process which uses an adhesive to permanently join two objects without heat.

**CNC:** Computer Numerically Controlled. A very accurate form of machining where the cutting is controlled by a computer program.

**Carbon fiber:** A long strand of carbon molecules, usually noted for light weight, stiffness, and high tensile strength.

**Carbon fiber composite:** A matrix of carbon fibers in epoxy resin which yields a new material with the benefits of both base materials.

**Conservation of Energy:** A law of physics that energy can be neither created nor destroyed. In bicycles, this is the principle behind suspension: you are managing impact energy by converting it to another form, but suspension should not convert a rider's pedaling force into anything other than forward motion.

**Cro-Moly:** A steel alloy with chromium and molybdenum added to provide higher tensile strength.

**Damping:** Increasing the time over which a suspension system absorbs an impact, managing energy transfer.

**Dishing:** The centering of a rim over the axle locknuts of the hub. On the rear wheel, this usually requires dissimilar spoke angles on the drive (freewheel) and non-drive sides of the hub, as the hub flanges are not located in the center of the axle.





**Direct connect:** A special stem which clamps directly to the outside of an unthreaded steerer of a fork.

**Dual Control:** Combination brake and shift levers allowing either function without moving your hands.

**Dual SIS:** The result of combining SIS and HyperGlide with HyperDrive for front and rear indexed shifting.

**Durometer:** The hardness of a material. In suspension terminology, the hardness of an elastomer spring directly relates to its stiffness, or spring rate.

**EPS:** Expanded Poly Styrene. A lightweight and very shock absorbent foam used in helmet construction.

**Elastomer:** A plastic compound with memory, so that it will deflect under pressure, but return to its original form as the pressure is released. Formed by long chains of molecules, the many different types of elastomers use different molecules and lengths of molecules to provide unique characteristics.

**Epoxy:** A two part adhesive developed for aerospace applications requiring high strength.

**Extruding:** A process where a material is pushed through a die, or specially shaped hole, which creates a long rod with the cross section described by the die. This process is used to make rims.

**Evolution:** Gary Fisher's oversize headset, stem, and steerer design which provides extra strength and steering control for off-road use. These advantages were quickly adapted for most high performance tandem usage as well.

**Forging:** A process where material between two dies (half forms of the item being made) is hammered together under pressure, and a rough form is made, usually requiring machining to make the finished product. Forging adds strength through work hardening.

**Freehub:** A Shimano design which incorporates a freewheel ratchet and bearing assembly into the rear hub. This allows moving the right hand wheel bearing race closer to the dropout, creating a stronger axle assembly. Freehubs also offer specific cog placement for accurate indexed shifting.

**GripShift SRT:** GripShift is a shifting mechanism which rotates on the handlebar to change gears. SRT stands for Size, Rotation, and Transition (between the shifter and the stationary grip), all three of which have been reduced to increase performance.

**Hipstays:** Gary Fisher's chainstay design with special curves which look like hips. Hipstays make for loads of clearance for big tires and chainring clearance, even with extra short chainstays.

**HyperDrive-C:** Compact HyperDrive drivetrain with reduced size chainrings and cassette cogs

**HyperDrive (HD):** Front indexing system featuring a left side STI SIS shift lever, front derailleur, low profile crank with SG-X chainrings, and cartridge bottom bracket.

**HD-CX:** Compact HyperDrive drivetrain for use on hybrids. The system consists of a 20/32/42 front SG-X crankset and a rear 11/19 HG cassette. This is found on the 400CX and 700CX groups only.

**HyperGlide:** Special freewheel tooth profiles found on Shimano freewheels to enhance shifting speed, smoothness, and accuracy

**Laser:** Light Amplification by Stimulated Emission of Radiation.

**Lockout:** Suspension term describing a force threshold under which the suspension does not move.

**Miter:** To shape or cut one piece to follow the shape of another piece it will be joined to. In bicycles, this involves cutting the end of a tube so that it follows the curve of the tube its being joined to.

**M-System:** Short for Multi-Condition Braking System, this Shimano system includes low friction cables and housing, modified brake lever geometry, and a special brake pad compound. Although all brakes are affected by moisture, M-System brakes work extremely well even when wet.

**Modulus:** The stiffness of a material, as measured in deflection of a given cross section under a set force.

**OptiGear:** Visual indicators on Shimano shifters.

**OS (OverSize):** Usually referring to a fork or headset system requiring a 1 1/8 inch steerer outer diameter. Also used to refer to oversize tube sets.

**Preload:** Suspension term describing the stiffness of a spring when there is no weight on the bike. If the preload is less than the stationary force of the rider, sitting on the bike will cause the suspension to compress.

**Sag:** The amount a suspension system compresses under a rider's weight.

**Snell:** Testing standard for bicycle helmets requiring less than 300 Gs to register when a helmet with a head form goes through a 2 meter drop onto a flat surface, and a 1.2 meter drop onto a round anvil.

**Specific Modulus:** The modulus of a material divided by its density. In layman's terms, this is stiffness per weight.

**Specific Ultimate Strength:** The ultimate strength of a material divided by its density. In layman's terms, its breaking strength per weight.

**Spring:** The primary device that resists impact in a suspension system, also the device that makes the suspension rebound.





**Spring rate:** The measured stiffness of a spring. As a spring is compressed, its stiffness changes. The springs in different systems change at different rates as they are compressed, and "spring rate" is also used to describe this change in stiffness.

**Sprung Weight:** The weight of everything above the springs of a suspension system.

**Steel:** A metal consisting of an alloy of iron and carbon. Different types of steel are produced by adding specific amounts of alloying agents (see Cro-Moly).

**Stiction:** Abbreviation of "Static Friction", or the frictional force resisting movement of a system at rest.

**Suspension:** A system of energy management that is designed to reduce, change, or absorb the forces acting on a body.

**T6:** A term referring to solution heat treating and aging of aluminum.

**TIG:** Tungsten Inert Gas, a type of welding which flows an inert gas over the weld area and tungsten welding tip to prevent oxidizing the molten material.

**Trail:** The distance between the ground contact of the front wheel and an imaginary centerline through the steering axis (head tube and steerer).

**Travel:** A suspension term indicating how far a suspension system can move. Also, the vertical travel of a wheel in a suspension system which somewhat indicates the shock absorbent abilities of the system.

**Ultimate strength:** The force required to completely separate a given cross section of a material.

**Unsprung weight:** The weight of the pieces below the springs in a suspension system. The lighter the unsprung weight, the less force it will require to move it. Ideally, not much more than the wheels are unsprung so that the system can react faster to impacts.

**Welding:** A process joining two pieces by melting the base materials allowing them to fuse together.

**Yield strength:** The force required to permanently deform a given cross section of material. In some materials, like ceramics or carbon fiber composite, the yield strength and ultimate strength are close to the same..