Your vehicle has been assembled and tuned. The front wheel, seat and handlebars may have been disassembled for more compact shipment. There are a few items to reassemble, bolts to be tightened and adjustments to be made. Your front wheel and other accessories may be in the cargo box or cargo pod on your trike. Your control cables have been pre-stretched; however it is normal for the control cables to stretch during use (a lot at first) and your shifters may need to be re-tuned after several miles of use.

If you use the Lightfoot Technical Manual to assemble and adjust your cycle, you will have learned in a few hours the basics of what you need to know to keep it running efficiently and safely for a lifetime. This chapter is designed to get you through reassembly so you can ride. The Lightfoot Tech manual is available online at http://www.lightfootcycles.com/tech_man.php.

Lightfoot vehicles are all designed to be accessible to any qualified bicycle mechanic. As you put miles and wear on the cycle, any bike shop should be able to troubleshoot and repair any mysterious behavior of components or damage. Proper assembly, maintenance and adjustments will make your cycle safer and more efficient to ride, and will avoid the potential frustration of trying to learn to ride on an improperly assembled cycle. If in doubt as to your own ability to properly assemble this vehicle or some component of it, please use a qualified bicycle mechanic.

If damage has occurred during shipping, notify the shipping company immediately. Then, if anything appears to be missing or damaged on a factory-direct shipment, please call or e-mail us. If at all possible photo document the damage.

For future reference: All Lightfoot cycles have a serial number stamped on the frame. On bicycles, the serial number is stamped on the left rear dropout. On trikes, it is stamped near the top of the upper separation plate between the front and rear frame. The serial number may be difficult to read under the powdercoating, but it is there.

TOOLS NEEDED

To adjust an assembled vehicle, you may need only a couple of tools. Bike shops will have all of these tools. Also, you can buy these tools by the individual piece, or as part of a "home bicycle mechanic" set. Certain vehicles or options may necessitate other tools. We recommend getting a portable bicyclist tool kit (you will have most of the tools from the list above) for carrying with your vehicle as well as a home-mechanic set for more extensive repairs.

1. Pliers to pull staples and cut wire ties.
2. Knife or scissors to cut tape.
3. Reversible hand held drill with a Phillips head driver bit for removing fork stabilizer.
4. Metric Allen wrench set. Specifically: an 8mm (crank arms), 6mm (shorty stem), 5mm (adjustable stem and accessories), 4mm (seat and braces) and a 2.5 mm (Grip shifters). A 3mm wrench has been supplied with your mirror. A Philips head screw driver is needed for some of the fender bolts.
5. 15mm pedal or open end box wrench for pedals on Bikes.
6. Grease for coating threads on pedals and freewheels, lubricating unsealed bearings, lubricating the steerer tube. Phil Wood waterproof grease is one good choice. White Lightning is a good coating for chains and cables.
7. Internal hub systems may require a wrench or small vise grip pliers, as well as a medium size flat screwdriver.
8. A tire pump may be needed.

UNPACKING A BIKE IN A CARTON:
1. Lift the front end of the cycle and install the fork. The head set pieces are on the stem in the order they go on the bike: bearings go round side into the cups on the head tube.
2. Install the stem and handlebars. Slide the stem on above the headset, place the steering stem cap on and tighten down tight enough so there is no slop in the headset but not so much that the steering is too tight or that when you turn the handlebars it feels "crunchy".
3. Remove frame from box and place it in a bike stand if you have one or on a carpet. Remove dropout protectors and unwrap the frame.
4. Install the rear derailleur: position the derailleur over 10mm hole on rear dropout. Rotate it clockwise so that the spring tension screw will clear the stop on the dropout as you tighten the derailleur in place with a 5mm hex wrench. Allow tension screw to settle against stop before tightening.
5. Install rear wheel: Insert the skewer into the wheel with the lever on the side opposite the brake rotor (right side). Slide the wheel axle between the chains and allow the upper chain to rest on the smallest sprocket. Position between dropouts and work into place as gently as possible so as not to damage the rotor or brake pads. Make sure the wheel is pushed into the dropouts solidly and tighten.
6. Install front wheel: install skewer into hub with tightening lever on the side opposite the brake rotor (right side of wheel). Position between dropouts and work into place as gently as possible so as not to damage the rotor or brake pads. Make sure the wheel is pushed into the dropouts solidly and tighten.
7. Install pedals: There is either an L or an R on each pedal. The right pedal is reverse threaded.
8. Install the seat: Adjust to fit. Your leg should be just less than fully extended when the pedal is in the most forward part of its stroke. Do not over tighten the clamp holding the seat to the frame, this will deform the clamp.
9. Sit on the cycle and adjust the handlebars to fit you. Align the handlebars, stem and fork. Tighten all bolts.
10. Unpack all optional components and be sure that there are none tucked away in packing materials.
11. Refer to the Lightfoot Technical Manual for further installation and maintenance instructions.

UNPACKING A TRIKE IN A CARTON:
1. Remove staples, wire ties and strapping from the outside of the carton. Tip the carton and lay it down on the side with the shipping label. This is the bottom of the trike. Remove the screws holding the fork in place on the top of the carton.
2. Lift/pull the top of the box off the base.
3. Remove staples/screws holding the cycle in place.
4. Lift/pull and roll the cycle CAREFULLY out of box. There is some stretch wrap on the rear wheels and the brakes may be on, so pull slowly and let the wheels slide.
5. Remove packing being careful not to scratch the paint or cut cables and housing.
6. Follow #6 above.

UNCRATING A CYCLE IN A WOODEN CRATE (THIS IS RARE)
1. Position the crate with the arrows up.
2. Remove the lid piece using a reversible drill with a Phillips screwdriver bit by removing the screws around the sides near the top.
3. Your cycle may be held in place by its fork. Generally, the easiest way to free it is to unscrew the screws holding the wood block to the crate, then remove the block from the cycle after it is out of the crate.
4. The handlebars and front wheel(s) have been removed from your cycle in order to make it more compact for shipping. In place of the handlebar stem we have placed a spacer to hold the fork stem
and bearings in position. Remove the black cap and spacer before installing the handlebar stem. Tighten the cap as directed in the initial assembly pamphlet.

For trikes and four wheelers: You may lift the cycle out of the crate or remove all the screws around the sides of the crate at the rear and at the bottom of the rear panel. Remove the panel at the rear end of the trike. This removes the corner braces of the crate so the cycle can be rolled out. Remove ties, internal bracing and all packed components. Be careful in cutting cords or tape that you do not scratch the paint or cut cables and housing.

Make sure the parking brake pin on the brake lever is released.
Cycle can now be lifted up in the front end and rolled out of the crate. Continue with #6 in section above.

For bikes: Begin to remove the ties that hold the components and bike in position. Lift the bike out of the crate.
Install the front fork, wheel(s), seat, handlebars and pedals.
Align handlebars and stem with the front wheel. Adjust to fit.
Refer to the Lightfoot Technical Manual for further installation and maintenance instructions.

FOR BOXED UNASSEMBLED TRIKES ONLY:
1. Bolt the frame together using 8mm frame bolts provided.
2. Lift the front end and install the fork; Follow #1 above
3. Install rear wheels: Insert the skewer into the wheel with the lever on the side opposite the brake rotor. Slide the wheel axle between the chains and allow the upper chain to rest on the smallest sprocket. Position between dropouts and work into place as gently as possible so as not to damage the rotor or brake pads. Make sure the wheel is pushed into the dropouts solidly and tighten. Check wheel alignment and reposition if needed.
4. Install front wheel; Follow #6 above.
5. Pedals: Follow directions from “Install pedals” above

Check your cycle every time you ride for brake function and secure wheels. Watch for loose fasteners. Clean the frame regularly and check for cracks. Keep bare metal lubricated.

Enjoy your Lightfoot!

Remember four secrets of first riding a recumbent:
1. Start with a power stroke
2. Lean back into the seat
3. Relax your arms when you ride!
4. Look where you WANT to go!
INITIAL ASSEMBLY

Modular frames should be bolted together firmly, as soon as possible. Do not fully tighten any bolts until all bolts are inserted and the nuts are on finger tight. Be careful not to put weight on the frame until all bolts are in and fully tightened; a partially bolted frame can be easily damaged. Our frames are fabricated with the frame sections bolted together and WILL go back together; however, the frame may need to be gently "tweaked" a bit to line up the holes.

In order to put the vehicle on its wheels, you may need to install the front forks. The sequence of cups, bearings, races and seals is illustrated in Figure 2.2. The headset cups will normally be already installed (pressed in) on most vehicles, and the bottom-most race (the "crown race") will be pressed on the fork (may not be on framesets).

Figure 2.1. Headset cup placement

Figure 2.2 Headset, stem, head tube and fork assembly. From Right to left: Cap bolt, headset cap, stem, upper cover, shim washer seal, compression ring, upper cartridge bearing, (cups are in the space between the 2 bearings) lower cartridge bearing, lower bearing race/dust seal, and fork.

From the right; steering stem cap with bolt, stem, upper cover, shim washer seal, compression ring, upper cartridge bearing, upper cup, head tube, lower cup, lower bearing, bearing race/dust seal, crown of fork. The bearings we now use are sealed and only need a light coat of grease to keep them from rusting.

Figures 2.3 and 2.4 show the installation. Slide the stem on above the headset upper cover, place the steering stem cap on and using a 5mm hex key, tighten down enough so there is no slop in the headset but not so much that the steering is stiff or that when you turn the handlebars it feels "crunchy" or tight. Sit on your cycle and align the handlebars, stem and front wheel. Use a 5 mm hex key to tighten the two bolts holding the stem on.
INSTALLING HANDLEBARS AND STEM

Standard tiller steering includes a stem, either telescoping or fixed-length. If telescoping, make sure that at least 2” are inserted at maximum extension.

If your vehicle is a bike or trike with the 12” hi-rise bars**, set them in the stem so that the handle grip section just barely reaches back and down. Trikes and four-wheelers with "swept" bars actually may have a curve to the bar; set these also so they reach back down.

If a brace for the hi-rise bars is included with your model, install it just below the curve of the handgrip area.

After the handlebar stem is put on the steerer tube (that turns the fork), use a 5mm hex key to adjust the bolt through the Star Fangled nut in the top of the head tube, to provide free movement of the fork without sloppiness. The Star Fangled nut is set inside the steerer tube with a special tool. The cap and bolt assembly thread into the Star Fangled nut and push down on the handlebar stem and the headset bearings, thus creating the pressure that holds the headset together. Tighten...
the handlebar stem bolts that grip the steerer tube only after the headset is adjusted and handlebars aligned.

Put three- or four-wheel vehicles on their wheels as soon as feasible to avoid damage to the components on the underside of the vehicle. If you are working on a two-wheeler, use a mechanics stand or work on carpet to avoid scraping the powdercoat finish.

We may have dropped your handlebars on the stem riser so that we could pull the stem riser out of the frame for shipping. Please raise the handlebars back up to the top of your stem riser when you make your final fitting adjustments.

**PARKING BRAKE**

Most Lightfoot trikes have a dual pull brake lever with a locking pin (see figure 2.5a). Some may also have an elastic band Parking Brake that holds the brake lever in the “on” position. Activate it by squeezing either the front or rear brake lever and slipping the elastic over the brake lever. The band stores on the grip when not in use. Use it when you are loading your trike or parking it on uneven ground.

**INSTALLING WHEELS**

Some wheel axles may be quite tight in their fit into the "dropouts" (the slot that holds the wheel axle) because of the very stiff nature of our frames, it may be difficult to get the axle between the dropouts if the fit is tight.

The disc brake rotor must be aligned with the brake caliper on the left side of the wheel. There is a manual for maintenance and operation of your brakes in your owner’s packet. Please familiarize yourself with their operation.

While holding the derailleur down and out of the way as shown, position the wheel into the base of the dropout, then, as gently as possible, work the axle up into the
dropout, and the rotor (“disc”) into the brake caliper, without damaging the rotor or brake pads. **DO NOT** handle brake rotors with bare hands; they are very sharp!

Wheels need to be centered before the quick-release lever is tightened. Usually the weight of the bike on the ground will center the wheels between the frame forks. If we have pre-assembled the bike, the brake rotor will be centered between the brake pads when the wheel is correctly aligned.

Some axles (narrower than our standard 135 mm length) come with spacers (flat washers) on them; these go to the inside of the dropout to fill gaps between the axle nut and the dropout. Knurled washers (if any, often found on internal hubs) go to the outside, under the axle nut; these help grip and hold the axle in the dropout.

Internally geared rear hubs that do not have derailleurs should have the chain installed over the sprockets and then be slid up the dropouts until the chain is drawn tight. All wheels should be "eye-balled" or measured to make sure they are straight before final tightening. It is possible to bend the axle if the wheel is not relatively straight or if the cycle is ridden with only one side tightened. Make sure axle nuts are tight.

Wheels with internal hubs will have "alignment washers". Make sure the right-angle flange of the alignment washer is positioned in the dropout slot; tightening the flange against the dropout could bend the washer or even the axle.

Most Lightfoot models are equipped with disc brakes. Use Gloves when handling brake rotor discs. Slide the wheels into place being careful to place the rotor between the brake pads.

**NEVER PUT HANDS NEAR BRAKES OR ROTORS WHEN WHEEL IS TURNING!**

To remove or install a wheel with V-brakes ("linear-pull" brakes); squeeze the end of the V-brake arms together, and release the curved aluminum tube which holds the brake cable from its slot. This allows the brakes to spring open and make room for the tire.

Wheels with the Nexus internal hub and roller-cam brake are more complicated to install; please follow the instruction under "Internal Hub" below for attaching cables. Once the internally-geared hub’s shifter cable is attached and the axle is in the dropout, the roller-cam brake’s arm will be bolted to a clip attached to the frame. The rear "brake cable-stop" slides into a slot on the brake "actuator arm"--the one dangling from the hub. The barrel adjuster slides into a slot on the brake arm once it is bolted to the frame. The barrel adjuster and the actuator arm are held in position by the tension of the "brake actuator return spring".
A word about maintenance: The hubs we use are not “sealed” but are “semi-sealed”. They come well lubed. The bottom bracket does not come apart; it is maintenance free. IF the threads start to "creak", back them out and grease them. They were well greased here. The hubs will need some maintenance. We suggest twice a year lubing them.

THE BOTTOM BRACKET, CRANKSET AND PEDALS

The bottom bracket bearing set may be already installed, but may not be on framesets. If not, a special bike tool is required to tighten it within the threaded "bottom bracket shell".

The crankset is held on the bottom bracket spindle with the included crankset bolts. Most cranksets are held on with socket-head bolt, tightened with an 8mm Allen wrench. Some types use a hex head bolt and a socket wrench is needed. These bolts should be slightly greased.

Wipe off any grease where the crank spindle slides into the crank arm--no more than a thin film of grease is needed to keep the cranks from seizing onto the spindle. The crank with the attached sprockets goes on the right side.

Pedals can be installed after the crank arms are on, so that the vehicle holds the arms--this makes installing the pedals a bit easier. The left pedal is reverse-threaded. An open-end pedal wrench is essential if you are going to remove and install the pedals frequently. Do not simply hand tighten the pedals, as they may work loose and ruin the crank arm.

Maintenance: The bottom bracket does not come apart, it is maintenance free. If you begin to feel a clunk or gritty spot, a bearing has gone out and it is time to replace the unit.
INSTALLATION AND ADJUSTMENT OF THE SEAT

**Installation:** Slide the two top pockets of the seat cover over the top posts on the seat frame. Slide the pocket of the seat bottom over the seat horn. Buckle the large strap around the seat supports and under the seat fabric. Pull quite tight. You don’t want the seat to bottom out on the frame.

Buckle the back straps starting at the top. The top three straps should be tightened as tight as they will go. The next two straps should be tightened incrementally looser so that the bottom strap follows the curve of the seat back. This allows for lumbar support and can be adjusted to suit your needs. See more on this below.

Place the pad on the seat using the velcro to hold it in place.

Place the seat on the square rail and adjust it for the rider. Screw the quick release bolt into the clamp while the lever is open until it snugs down when closed.

**For Bikes:** Attach the seat braces to the seat brace slotted tab on the rear frame of the bike. Place the seat brace to the outside of the tab with the nylon washer between the slotted tab and the seat brace. Tighten the nut and bolt so that the seat brace does not slip.

**For Trikes:** Attach the seat braces to the seat brace slotted tab on the rear frame of the bike. Place the seat brace to the inside of the slotted tab with the nylon washer between the slotted tab and the seat brace. Tighten the nut and bolt so that the seat brace does not slip.

**Adjustment:** Adjust the seat braces so that the seat bottom supports are roughly parallel to the ground. If the seat is tipped too far forward, the horn will not be effective and the rider will feel that she is falling out of the seat. Riding in a more recumbent position may require shortening the horn.

When sliding the seat, push or pull as much as possible in the center so the tabs won’t bind.
Release ALL 4 quick release bolts and/or pinch barrel bolts during adjustment, even if adjusting only one part of the seat.

For Greenways and RoadRunners: The lower quick release bolt on the seat clamp should have a small wing nut on the chain side (as shown in figure 2.12) and spacers to “shorten” the bolt on the left side of the trike. IF it doesn’t, in some positions, the nut will interfere with the cassette.

To adjust the contours of the mesh Performance seat, adjust the tension of the straps on the back of the seat and under the seat bottom. Most people will want the straps behind the small of the back (the lumbar region) to be tighter for more support, while the straps at the very bottom of the back will remain quite loose. The seat horn can be adjusted in two ways; reduce the contour that the horn creates by tightening the large strap under the seat, and increase the horn contour by substituting a longer piece of 5/8” dowel and/or loosening the large strap.

The rear edge of the seat pad cover has a Velcro closing that can be opened to allow the removal, modification or replacement of the seat pad.

All the nylon straps as well as the mesh itself will stretch a little during break-in. Readjust the straps as needed to keep the seat comfortable for you.

FENDERS  (FROM CHAPTER 6 OF TECH MANUAL)

Front Fenders  All of our front fenders require that the left stay have a 30 degree bend 3” behind the fork mount loop to clear the brake caliper. On 20” front fenders, we trim the backside so it will not scrape going over curbs and bumps. The front fenders have single stays instead of double stays.

INSTALLATION
1. Bolt the fender top tab to the FRONT of the fork using 6mm x 2” bolt, lock washer and nut. Center the fender over tire and tighten.
2. The left fender stay needs a 30 degree bend 3 inches behind the attachment loop to clear the front brake caliper. We usually do that for you. If you have to bend it, just make sure the bend is in line with the flat plane of the loop.
3. Attach stays to the 5mm threaded mounts in fork using 5 mm bolt and washer.
4. Adjust stays to center fender over the wheel by loosening the stay nuts and sliding the stays while centering the fender.
5. Tighten all nuts. Trim the ends of the stays with bolt cutters or hacksaw if you choose. File off sharp edges and replace end cap. A dab of finger nail polish or glue will hold them on well.

Rear Fenders on Bikes  Set up fender hardware as directed in instructions with this exception: the front mount on the rear fender should be installed by bolting from the inside of the fender
to the fender mount on the frame. Use two or more 1/4" nuts as spacers between fender and frame if needed.

**Rear Fenders on Trikes** 1. Place the fender on the rear wheel. Open the Stays to approximate width needed for mounting. 3. Bolt the stays to the frame loosely. 4. Position the front of the fender to the front of the outrigger above brake. Use 5mm screws with flat and lock washers from the inside of the fender to attach to fender mount. 6. Adjust and tighten bolts and screws all around when sure of fit. 6. After Stays are adjusted, they may be cut off with bolt cutters, filed and have caps placed on their ends—be careful of the sharp cut ends.
MOUNTING TIRES ON WHEELS
Install a rim strip or rim tape; this protects the tube from punctures caused by the tips of the spokes and the spoke nipples. Align the hole in the rim strip for the valve stem with the hole in the wheel rim.

Some tires have a certain rotating direction marked on their sidewall. Generally, any V in the tread pattern should open toward the rear of the direction of tire travel. On our trikes, we often mount the right rear wheel with the cassette mount on the inside, but it doesn’t really matter.

Mount one side of the tire on the rim, and then push the inner tube into the partially mounted tire. Make sure the tube is not folded or twisted. After the valve stem is situated, use the tire levers to force the second side of the tire onto the wheel rim. Take care not to pinch the inner tube as you go. Some tires may prove to be very tight and difficult to lever onto the rim; warming and thus softening the tires—as well as lubricating with soapy water—may help get them on.

Before inflating, rotate the tire and tube around the rim as needed until the valve stem sticks straight out of its hole. Inflate slightly and, before inflating further, check to make sure that the tire is seated evenly on the rim. Finally, inflate the tire to its highest recommended pressure.

Some of our vehicles utilize high pressure (80 to 110 psi) tires for lower rolling resistance on pavement. Many tire models on the market are rated for a maximum of 45 to 60 psi. Sometimes people choose to inflate these medium-pressure tires over the rated pressure so that they roll more easily. Be aware that over-inflation is not recommended by the tire manufacturer.

If the tire still does not want to seat correctly, then deflate to 15 or 20 PSI. Squirt some Windex or dish soap on the trouble spot making sure to work it in below the bead. Then re-inflate the tire to desired PSI. The lubrication should help the tire to seat itself.

For safety reasons, insert the quick release axle into the wheel so that the quick release handle is on the side opposite the disc brake if at all possible.
Our standard transmission for a single-seat three- or four-wheeler is illustrated below. The pedals are attached to a triple-sprocket crankset, which creates rotation (by means of a chain) of an 8-speed gear cluster on a jackshaft (thus turning the jackshaft). A single sprocket on the outer end of the jackshaft then creates rotation (by chain) of the 8-speed gear on the left rear wheel—the drive wheel.

Two-wheel drive is a custom option, wherein the jackshaft is extended to the right to drive the right rear wheel as well.

**Trike Compound Gears**

When all three gear clusters are in low, the resulting gearing is very "low", "slow" or "powerful". This means that one revolution of the pedals will produce only a small forward motion of the vehicle. The force required to turn the pedals in low gear is very little; thus pedaling is easy.

When all three gear clusters are in high, the resulting gearing is very "fast" or "high". One revolution of the pedals will produce a lot of forward motion. Unless the vehicle is already moving fast, the effort required to turn the cranks will be very great. The very highest gears are used only at high speeds on downhills, with the help of gravity.

The term "Gear Inches" is shorthand for describing the "size" of gear you are in. Being in a "90 gear-inch" gear is like pedaling an 1890’s high-wheeler with a 90" diameter wheel and fixed pedals; a single turn of the cranks and you go a long way forward. This is called a "tall" or "high" gear. Being in a "10-inch gear" is like pedaling a little kid’s trike with 10" diameter wheel (a "low" gear); you don't make much forward progress for each turn of the cranks, though pedaling is relatively easy. Being in a 26 gear-inch gear on a mountain bike with 26" diameter wheels means that for each turn of the pedals, the drive wheel goes around exactly once. In a 52" gear, the drive wheel goes around exactly twice for each revolution of the cranks.

As normally set up; the left hand shifts the front triple sprocket by means of a twist-grip shifter. The right hand shifts the middle 8-speed cluster, also using a twist-grip shifter. A third shifter (a thumb lever) is used to shift the rear 8-speed cluster. The rear cluster is shifted only occasionally, and is normally left in a position to give an appropriately low gear for the conditions in which you are riding.

Contrary to some assumptions; single-wheel-drive on a trike (as Lightfoot Cycles uses it) with appropriate tires almost always provides plenty of traction, even in snowy or gravelly conditions. Single-wheel-drive also does not create any difficulties with tracking (traveling straight ahead) on a properly laid-out long-wheelbase design, despite the fact that only one side of the vehicle has power. Electric assist and two-wheel-drive options create two different forms of very positive dual-wheel traction.
INSTALLING CASSETTES ON REAR WHEELS
Cassettes in the box are connected together in just the way they fit on the splined free-hub. There is a spacer between the third and second chain ring on some makes, including SRAM. That spacer has small half circle cut-outs on its outside circumference. These cut-outs drop over the rivets holding the six chain rings together. The final (smallest) chain ring is held on with the threaded outer cap/ring. After you have the cassette slipped on the free-hub, check to see that the spacing between the chain rings is even. SHIMANO cassettes do not have a spacer, and fit together simply. On trikes, the right rear wheel (the non-drive wheel) does not get a cassette, even though the wheel is of the type that will accept one.

INSTALLING CONTROLS ON HANDLEBARS
Install the brake levers first and then the grip shifters. The friction-type or SIS thumb-shifter used on trikes and quadricycles can be mounted on either the right or left; usually it will have flexible clamps and so can be mounted last. A 1mm-friction ring is used with the Gripshift shifters, placed between the grip and the shifter to minimize binding between the two.

The foam-rubber grips are mounted after the shifters and brake levers are installed. Do not pull on the grip of the shifter unit when you are installing the grip extension, as you may pull the thing apart.

Water squirted lightly inside the grip will lubricate it for easy mounting, and will then dry over 24 hours. The manufacturer does not
recommend hairspray or any solvents that might damage the gel grip. You may have to trim the grips; they may be a bit too long to fit on some handlebars with certain components.

Standard placement of the shifters connects the left grip shifter to the front triple chainring. The right grip shift controls the rear derailleur on bikes, or the mid-frame derailleur on trikes and quadracycles. On trikes and quadracycles, the thumb shifter controls the rear derailleur.

If an internal hub gearing system is used, then the right grip shift will control the internal hub in the rear drive wheel, and the thumb shifter will control the mid-frame derailleur. This allows the most commonly shifted gears (the internal gear hub) to be those most easily shifted, and leaves the rarely-shifted “ranges” to be controlled by the more awkward thumb shifter.

The derailleur shifted by the thumb shifter is generally shifted only infrequently and is used to set a "range" of operation such as low range, medium or high range.

**ROUTING THE CABLES**

Try to keep the length of the cable housing as short as possible, however; do not make tight bends in the housing. Zip ties can be used to tie loose sections of cable to the frame.

The cable "saddle" is used to activate both rear brakes as shown in Figure 3.5. Place it about 3 inches in front of the mid-frame cable saddles. Before installing it, place a patch of frame protector in the spot it will sit. This will protect the frame from scratching and noise.

![Figure 3.6. Trike shift cable arrangement](image)

Technical Manual
Vehicles with two front wheels will have a similar dual-brake system up front. The brake pair shares a single unbroken cable. The saddle hooks over the exposed middle section of this cable and pulls it (both sides at once) when the brake lever is squeezed.

**Figure 3.7. Trike brake cable arrangement**

DERAILLEURS
The derailleur is the component that shifts ("de-rails") the chain; there is a front derailleur and (usually) a rear derailleur. On cargo vehicles with a jackshaft, a third "mid-frame" derailleur (identical to the rear derailleur), is used to shift the 8-speed sprocket on the jackshaft.

The front derailleur should not be adjusted unless the rear derailleur is already working properly, because front derailleur adjustments are affected by the position of the rear derailleur, and you will need to access all of the rear gears to adjust the front derailleur correctly.

On trikes and four-wheelers the mid-frame derailleur should be attached to the derailleur hanger after the jackshaft is in place and the freewheels are attached.

**Figure 3.8. Mid-frame derailleur on trike**
On tandem bicycles, the mid-derailleur hanger is removable. When installed, the derailleur plate (the flat piece with the threaded hole) should clear the freewheel by 3/16".

With both mid-frame and rear derailleurs, **be careful not to strip the threads of the derailleur hanger.** Make sure the derailleur spring tension screw (Figure 3.9) is backed all the way out so that the derailleur can thread all the way into the hanger. Make sure the hanger bolt is correctly lined up with the threaded hole on the frame. Gently thread the derailleur bolt into the threaded hole in the dropout. Move the spring tension screw back to a central position before tightening the derailleur all the way.

Do not force the derailleur bolt, as this may damage the threads. If the threads on the dropout are damaged, you may need to use a thin 10mm nut behind the dropout to hold the derailleur on. You can alternatively use a "dropout saver" available from most bike shops.

If your derailleur bolt interferes with the chain shifting onto the smallest cog of the freewheel, you may need to use a washer as a spacer between the derailleur and the dropout in order to reduce the amount of bolt that protrudes through the hole.

**Note:** Internal hub systems may use a "Singleator" or a modified derailleur as an idler or an idler wheel with bracket.

"Index-shift" systems require close adjustment for proper functioning. When they work, they work very well; a simple "click" of the shift lever and you are in the next gear (you have to be pedaling and the wheel has to be moving). When they don't work, however, they can make operation of the vehicle difficult and very frustrating. We highly recommend that if your vehicle has a SIS or index system, you familiarize yourself with the adjustment process before you get stranded somewhere.

**Front Derailleurs:** (adapted from Sheldon Brown
http://www.sheldonbrown.com/derailleurs-adjustment.html)

The front derailleur simply consists of a cage made of sheet metal that can move back and forth from side to side. As it does so, it pushes the chain sideways until it can't run on the chain wheel it has been riding on, then the chain falls off and lands on the next chain wheel closest one to its new location.

Figure 3.9. Rear derailleur spring tension screw

Figure 3.10. Rear derailleur limiter screws for Shimano. Sram screws reversed.
Front derailleur adjustment is not an exact science. It requires a good eye and a bit of patience to get it right. When you apply power to the pedals, the power is transmitted to the rear sprockets by the upper run of the chain. The lower run of the chain is just the return path, and the only tension on the lower run is that applied by the spring in the rear derailleur. Since the front derailleur does its shifting with the upper, power-transmitting, section of chain, it has a harder task to perform. In general, you should not expect a front derailleur to shift well while you are pedaling hard, even if the rear derailleur does so.

The Three Front Derailleur Adjustments

Clamp Position

The most critical adjustment of a front derailleur is its attachment to the bicycle frame. This must be set correctly before you attempt to adjust the limit stops. There are two variables, angle and height. The front derailleur comes with a small piece of plastic holding it into the extended (high-gear) position. A small piece of clear plastic stuck to the side shows where the teeth of the sprockets should meet the shifter when in high gear; this tells how high to mount the derailleur. As you tighten the clamp, watch to make sure the derailleur cage remains parallel with the sprockets. Remove the plastic spacer after the derailleur is firmly clamped to the frame.

Angle of the front derailleur is judged by looking down on the cage from above. Modern front derailleurs have very subtly shaped cages, so it is not always easy to tell when the ideal adjustment has been made. In general, the centerline of the cage should be parallel to the centerline of the frame. Rotating the derailleur so that the back of the cage is farther out will sometimes improve shifting to the small ring of a triple by preventing overshifting, but may cause increased need for trimming on the larger rings. It may also cause the crank to strike the cage. Rotating the derailleur so that the front of the cage is farther out will help reduce the need for trimming on the large chainwheel, and will provide crisper downshifting, but with a greater tendency to overshift on the inside. This may be appropriate on bicycles equipped with an antiderailment device.

Height of the front derailleur is a principal factor in how well it will shift. Manufacturers commonly recommend 2mm clearance between the bottom of the outer cage plate and the teeth of the large chainwheel. This is a bit of an oversimplification. Best performance will result from the very lowest position that still just barely keeps the cage from hitting the chainwheel teeth. The lower you can get it, the better it will shift, and the less you will need to trim the front derailleur.

Derailleur Chain wheel Mismatch

To get the front derailleur as low as possible, the curvature of the outer cage plate has to match the curvature of the largest chainwheel. If you use a larger chainring than the derailleur was designed for, the rear of the cage will hit the teeth of the big chainring before the front of the cage gets low enough to provide crisp shifting without the need for trimming. If you use a smaller chainring than the derailleur was designed for, it will shift OK, but you'll have to do a fair amount of trimming, due to the rear of the cage being higher than it should be, so that the chain crosses through it farther back.

Lately I’ve started modifying front derailleurs for improved shifting with larger rings. I have an RSX on a bike with 50/38/28 Biopace (the sweep of a 50 Biopace is comparable to that of a 52 round.) The RSX front derailleur works great on its intended 46/36/26 setup, but the cage doesn’t match the curve of the larger chainring. In a couple of minutes with a grinding wheel, I removed a good bit of metal from the bottom rear of the outer cage plate, and a bit from the bridge section where
the inner and outer cage plates connect at the back. This made the derailleur match the curvature of the larger chainwheel, and allowed me to set it low enough to provide good chain control. This setup now works fine with an STI rig that doesn’t permit “trimming” the front derailleur.

**Low-gear limit stop.**

The low-gear limit stop stops the derailleur from shifting past the smallest chainwheel and throwing the chain onto the bottom bracket shell. If it is too loose, the chain will fall off when you try to downshift to the small chainwheel. If it is too tight, you it will be difficult or impossible to shift down to the low chainweel.

On older front derailleur, the low-gear stop is the one closer to the frame. Many newer designs reverse this position for reasons relating to the mechanism used.

The basic adjustment for the low-gear stop is to set it so that the chain just barely clears the inner plate of the cage when the lowest gear (small front, large rear) is selected. This will usually be the best position for double-chainwheel setups, and will permit the use of most or all of the rear sprockets with a minimum of trimming.

For triple chainwheels, it will sometimes be necessary to adjust the low-gear stop a bit looser, so that the outer plate of the derailleur can travel far enough to knock the chain off of the middle ring.

**Anti-derailment devices**

In some instances, you may find that one adjustment of the low-gear stop causes the chain to derail past the small chainring, but a tighter setting results in slow downshifting to the small ring. In such cases, a good, if inelegant, solution is sometimes to install an anti-derailment device that clamps to the seat tube. These products, such as the 3rd Eye Chain Watcher ® and the N-Gear Jump Stop ® set up a barrier preventing the chain from overshooting the small ring, no matter how loose the low-gear stop is set. This allows the low-gear stop to be set to allow the derailleur to move farther inboard for faster, more precise shifting, even under some load. These devices can often save the day when extra-wide range gearing is used on a mountain bike or tandem.

**High-gear limit stop**

The high-gear limit stop is pretty straightforward. It should be set so that the chain almost rubs on the outside plate of the front derailer cage when the bicycle is in its highest gear (large front/small rear). This will reduce the need for trimming as you shift the rear derailer.

If the shift to the large chainwheel is slow, make sure that you aren’t pedaling too hard, front upshifting requires being ready to have the cranks slow down when the shift takes place. If the shift is unreliable even when you are pedaling lightly, you may be able to improve it by loosening the high-gear stop a bit. If you do so, check to make sure that the derailer cage is not moving so far out that it can be struck by the crank as it goes by. Sometimes front upshifting may be improved by rebending the front edge of the inner cage plate outward a bit. This may be done with an adjustable wrench. This is rarely necessary on modern front derailers, but used to be a very common trick on older, cruder designs.

**Front Derailleur Trimming**

As you shift the rear derailleur one way or another, the direction from which the chain runs from back to front changes a bit. As a result, sometimes it is necessary to "trim" the adjustment of the front shifter after changing gears with the rear, even if you are staying on the same front chainring.
Trimming means using the shifter to move the front derailleur cage sideways just a little bit, enough to stop the chain from rubbing, but not enough to make it shift to a different chainring.

Older front derailleurs designed for friction shifters used to require trimming as a matter of course, but newer indexed systems can often be set up so that no trimming is necessary.

For a "trimless" front indexing, you will usually need to be using the particular chainwheel sizes for which the front derailleur was designed, and the chainwheels must not be bent even a little bit. The lower down the cage is mounted, the less trimming will be needed.

If your system requires trimming, it is essential that you do it. If you ride with the chain rubbing against the front derailleur cage, you will wear a groove in the side of the cage and it will never shift properly.

Adjusting derailleur systems is most easily done with the drive wheel elevated into the air so it can turn freely. Make the initial "rough" adjustment without the chain installed. Fine-tune and test with the chain in place.

Rough Adjustment: Start by letting the spring-loaded derailleur relax to its highest position (lowest position if it is the front derailleur). The shifter cable should be either disconnected or the shift lever at the handlebars should be in the position in which it is taking up the least amount of cable. (Note: the shift lever should be complementary to the derailleur in model or type.)

Then screw in or out the little "high/low limiting screw" that restricts the movement of the derailleur in and out; this establishes how far the derailleur can move, so that it does not shift the chain entirely off the sprocket cluster. There are two of these, usually marked with an H for high (small sprocket) and an L for low (large sprocket). Move the screw until the derailleur jockey wheels line up with the outermost cassette sprocket. Manually, push the derailleur to its other extreme and adjust the other limiting screw until the derailleur lines up with that sprocket or chain ring (front). The instructions that come with your front derailleur give metric settings for making this adjustment. Return the derailleurs to their relaxed position. Above smallest chainring and sprocket.

Now, Install the chain and connect the cables. Make sure that the housing (the tube in which the cable is housed) is socketed into the mechanism or cable stops at each end by stretching the cable under the midframe after everything is connected. Disconnect, take up the slack and reconnect.

When the shift lever is now rotated (while pedaling), the derailleur should shift the chain from one sprocket to the next. When the derailleur reaches the farthest sprocket, re-adjust the "low" limiter screw to permit the chain enough movement to shift onto the sprocket, but not so much that it goes off the far side.

If the system is an index system (as most LFC vehicles are), fine-adjustment to exactly position the rear derailleur for accurate shifts is generally made with a "barrel-adjuster" bolt, either where the cable enters the derailleur or where the cable exits the shift lever. If your chain hesitates to shift up (to the smaller sprocket), twist the barrel adjuster inward, thus taking some of the tension off of the cable. If the chain does not shift down (to the larger sprocket), twist the barrel adjuster outward, adding tension to the cable so that it pulls the derailleur further over toward the larger sprocket.
Indicator marks for the front derailleur (even on index systems) do not accurately indicate what gear the front triple sprocket is in. This is not a problem, but you can take the time to adjust it as close as you wish.

The shifter for the rear-most derailleur on a trike or Tandem is a "friction shifter". The limits to derailleur movement are adjusted in the same way as for the index shifter, but there is no need to fine tune the operation of the shifter lever. Shifting is done by sound, sight, and feel. After a learning period, this can be done fairly accurately without looking. The screw or "D-ring" on top of the shifter can be tightened to adjust the tension of the thumb lever; it should not be so tight that it is difficult to shift, but not so loose that the derailleur spring pulls the cable back out of gear.

You will be able to shift those "range" gears if you are climbing steep hills, starting heavy loads or flying down a hill and need more gears. Generally, leave it in a center gear unless you are experiencing one of those conditions.

It's a tight squeeze on that shifter to get all 8 gears. Most of the time it can be set up to get all 8, but occasionally only 7 are available. Don't get too excited if only 7 are available. You will still have 168 gear combinations. If it ever needs to be adjusted, you can have it set up for whichever end you need the gears most, High or low.

**JACK-SHAFT**

The Jack-Shaft transfers power from the centerline to the outside drive wheel on trikes and some quads. **PROPER CARE AND MAINTENANCE IS CRITICAL FOR GOOD FUNCTION AND REPLACEMENT EASE.** Remove, clean and grease the parts every 1000 miles or each year. Remove any burrs that develop around bolt holes with a round file or sandpaper. Check the bolts holding the freewheel and cassette mounts frequently to make sure they are tight. Sloppy bolts create burrs which will make removal of the jackshaft almost impossible.
Figure 3.11. Jackshaft arrangement showing track cog or single speed freewheel on left and cassette and mid frame derailleur on right
If one of the 1/4" x 1 1/2" bolts is lost or damaged, replace it with a hard grade-8 bolt (hardware store personnel can get you one).

If a bearing goes out or becomes hard to turn: remove the bolt that fastens the threaded mount onto which either the multi-speed freewheel or cassette is threaded, pull the shaft out of the bearings and tube. If the shaft is rusty and resistant to being pulled out, or if the metal around the bolt holes is distorted, sand the hole area lightly, and then tap the shaft out with a rubber mallet or block of wood. Then, insert a long 3/4" dowel or other object through the bearing center, reach all the way through the length of the tube and gently tap each bearing (they are only pressed in, not threaded) from behind until it falls out of its tube.

Figure 3.12. Jackshaft breakout: freewheel mount on left, cassette mount and cassette body on right
Bearings are 3/4" i.d., 1 5/8" o.d. "flanged tube bearings", and are available from Lightfoot Cycles or from many industrial suppliers. (Vehicles older than March 2000 use a 5/8" i.d. bearing with a 1 3/8
o.d. Transition vehicles made in the first quarter of 2000 use a 3/4" i.d., 1 3/8 o.d. bearing, this is also the bearing to use if retrofitting an old vehicle with the newer 3/4" jackshaft system.

When assembling the jackshaft, the entire length of the jackshaft should be greased, and additional grease should be applied inside the jackshaft mounts. The threads of the mount and Track cog or freewheel should be greased. Failing to grease these could make disassembly extremely difficult after the cycle has been exposed to moisture for a length of time.

Cycles built after 2004 use a different style of mount at the middle cluster to mount a cassette, rather than a freewheel. These include a cassette hub body held on with a hollow bolt. The bolt is loosened using a 10mm hex wrench.

**CHAIN**

After the derailleurs are installed and roughly adjusted, the chain can be put on and the adjustments can be tested with the chain in place. This is best done with the cycle on a stand or, if a trike or fourwheeler, with the rear frame corner propped on something so that the wheel does not touch the ground.

You may receive raw lengths of chain in need of "breaking", or chains already cut to length, with a connecting master link.

Chain tools act by driving the pin out of the chain link, so that the chain can be separated. Do not drive the pin all the way out if you will be rejoining the chain at the same link; the increased last bit of resistance signals that the slightly flared end of the pin has arrived at the outer plate.

To reassemble chain, simply reverse the chain tool and its orientation to the pin and push the pin back in. The chain will "click" together and
hold itself against light pressure; be gentle while starting the pin when reassembling. Push the pin back in until the same amount is protruding on either side of the chain.

When the chain is rejoined, often the rejoined link will be stiff. This stiffness will interfere with proper chain travel and shifting. Remove the stiffness at the reconnected link by bending the chain sideways to its normal direction of flex, back and forth until its action becomes smooth again.

The correct chain length: The rule is: when the chain is on the smallest chaining front and rear, the rear derailleur arm should be just below level and not interfering with the rear cassette. Care needs to be taken not to get the chain so short that it is too tight in your forbidden cross chain position (Large - Large). Before you shorten anything, check that cross chain position. Occasionally, one forgets, and cross chains. It is nice if that isn't a catastrophic event. Cross chaining is to be avoided.

At maximum, use only enough chain to allow the transmission to shift the chain into the largest front sprocket and the largest rear sprocket at the same time while not binding the derailleur. Figure 3.16 shows the maximum extension of the derailleur. Normally, the transmission will never be shifted into this gear combination, and will not need this much chain. This amount of chain, however, will allow inexperienced persons to use the transmission without damaging it, though it will also create an undue amount of slack. If the persons using the vehicle are limited to experienced riders, you can remove several links from the chain, for a tidier appearance, less droop in the chain and more positive shifting.
A chain idler as shown in Figure 3.17 can help manage the extra chain length. Chain tubes have much the same function as idlers.

A lubricant like "White Lightning" should be applied frequently to your chain, to keep it from wearing, and to keep transmission friction low.

**INTERNAL HUB**

Internal hubs will normally come pre-adjusted on fully assembled or disassembled units. Do not change the cable-stop settings unnecessarily. To understand the following directions you will need to be looking at the hub.

On most assembled Lightfoot Cycles that utilize an internal hub, the "cable-stop" on the end of the shifter cable is preset and should not be loosened. It only needs to be hooked in the spring-loaded shifter plate on the hub. If, for some reason, you need to loosen the cable-stop, mark its position on the cable with a magic marker before moving it.

To install a wheel with the Nexus 7-speed hub, the end of the cable that holds the cable-stop should be wound around the rear of the hub and up to the C-shaped notch on the spring-loaded flange. The cable should run along the outside of the flange closest to the sprocket on the hub; if routed wrong it may bind and not move freely. The cable-stop should be inserted into the C-shaped notch, with the cable-threaded side of the cable-stop to the inside surface (in line with the rest of the cable) of the plate in which the C-shaped notch is found. The black nut on the cable-stop will be toward the outside.

It may be easier to install the cable-stop with the wheel out of the drop-outs. The spring-loaded flange is hard to hold with fingers; you may need to use a glove on that hand or use a needle-nose vise grip or pliers to hold the flange in a compressed position. The flat-sided cable-stop has to be rotated to slide into the C-shaped notch.

For correct shifting; the two red marks on the top of the hub flanges (visible when looking down at the right side of the hub) should be aligned when the shifter on the handlebars indicates fourth gear and the cable-stop is in place. Coarse adjustment of this setting is made by loosening the cable-nut and sliding it along the cable. Fine adjustment is made by screwing in or out the "barrel-bolt" adjuster. Some systems may have no barrel bolts, some may have one, some will have one at each end of the cable housing.

The push-button type shifters sometimes supplied with the Nexus hub are inconsistent in their ability to shift and are worse with the long cable runs, and if slow to shift may require that you use your thumb to downshift the indicator tab. You may wish to upgrade to a grip shifter; doing so may require installation of a different style handlebar.
LINKAGE STEERING
Lightfoot’s Linkage Steering System consists of these parts:
1. Handlebar and stem
2. Stem extension
3. Linkage Steerer Tube (inserts into bike frame)
4. Linkage Rod
5. Fork Steerer Tube Clamp/Cap
6. Steering Assembly Standoff
7. 2) 5/16” tie rod ball ends
8. 2) 5/16” Fine Thread Nuts

Adjust the steering columns so that they align with the front wheel. The Steering Assembly Standoff should be in line with the long axis of the cycle. The tab on the Steering Assembly Standoff and the Fork Steerer Tube Clamp should be parallel to each other and perpendicular to the long axis of the cycle. The handlebars should be perpendicular to the long axis of the cycle and especially the front wheel. Tighten all bolts when everything is aligned.

DUAL WHEEL ALIGNMENT
The steering linkages on the front of the four-wheel vehicles will in most cases come pre-adjusted if the vehicle is assembled. Some may not be adjusted; you can tell this if there is excessive “toe-in”, or if the front tires obviously “scrub” as you make a tight turn.

Figure 4-1. Linkage Steering
Figure 4-2. Four wheeler front end
You may also want to make adjustments to the "quickness" of the steering. You may need to read the following paragraphs a couple times to make sense of these instructions. Adjustment is made in one of three ways. Fine toe-in adjustment is made by unbolting one end of the tie-rods and screwing the tie-rod-ends in or out. Ackerman adjustment can be made by rotating the head stems on the steering tube of the front fork.

**Ackerman Steering**
Ackerman steering is the design of the vehicle that allows the inside wheel to turn more sharply than the outside wheel in a turn, thus avoiding "scrubbing" of the front tires and losing speed during turns. It is adjusted by changing the angle of the stem that holds the outer tie rod bolt, in its relationship to the front wheel. The amount of angle depends upon the wheelbase (length) and track (width) of the vehicle. A short vehicle will have a wide Ackerman angle, with the outer stem and tie-rod end angled 20 to 30 degrees from the long axis of the cycle. A very long wheelbase vehicle may have only a 10 or 15 degree Ackerman angle. When correctly adjusted, sharply turned front axles should aim at the same point just below level on an imaginary line drawn through the rear axle(s) at right angles to the long axis of the cycle.

**Toe-in**
Toe-in measures the amount that the wheels are out of parallel with each other. The front wheels should be 1/8" closer together at their front than at their rear (when pointing ahead). The rear wheels should be parallel to each other. Make sure that the nuts that hold on the tie rods are TIGHT.

**Quickness of Steering**
Steering "quickness" can be adjusted if you find the vehicle handling to be TOO quick. By turning the direction that the outer tie-rod bolts are facing so that they reach forward, you can reduce by a small percent the "quickness" or amount that the wheels turn with a movement of the handlebars. For a dramatic reduction in steering quickness, you can replace the center stem that holds the center tie-rod bolt with a comparable, but shorter stem.
OPTIONS AND ACCESSORIES

CANOPIES
You will need a drill with 3/16" bit, screwdriver, 3/8" wrench and (8+) 1 1/2" #10 bolts and locknuts. Attach the Canopy pedestal to the fender platform with 1 1/2" x ¼" bolts and lock nuts. Position it on its center 17 1/2" forward from the back of the vehicle. They should be on top of the fender panel, to the outside of the fender panel frame.

The footman-loops of the canopy top may be fastened as close as possible to the outside corners of the fender platform or the cargo box with #10 bolts. They are secured the same way, with bolts or rivets.

Assemble the bows as you put them into the canopy. The shortest bow belongs in the center. The front and back bows are the same length. Attach the front and back bows to the swivel plate using 1 ¼" x ¼" bolts and lock nuts. Attach the center bow to the swivel plate and the pedestal with the 2" x ¼" bolt in this order: bow, plate, 4 washers, pedestal, lock nut. This will take two people or a support for the other side. The bows have spring in them to give a curve to the top of the canopy. Tying a piece of twine around the uprights of the center bow will keep them from springing out as you work on them.

Attach the straps to the canopy as follows: the shortest strap goes around the front and back bows and through the footman loops. The other two straps go through the front and back footman loops on the bows then down to the footman loop on the platform. Snug these down so that the canopy top is level. Adjust the straps to get the proper attitude and tautness. Attach the canopy sides to the velcro around the top of the cargo box.

On four wheeled cycles, you may have a front strap which attaches to the front frame cross member. It should not interfere with steering at any point.

The fabric can be cleaned without being removed from the frame. Brush off any loose dirt, hose down and clean with a mild soap in lukewarm water (no more than 100 degrees).

CARGO HAMMOCK

Align the cargo hammock in the opening. Fasten the nylon straps snugly around the framework between the wheels. There are 4 or 5 straps per side. Near the brake rotors and derailiers, be sure to tuck the ends of the straps into the loop made around the frame to keep strap ends out of the rotors and gears.

Cargo Hammocks can be hand washed or wiped with a cloth to keep clean. Do not wash in a washing machine or dry in a dryer.
CHAIN TUBES

Chain Tubes function to keep the chain cleaner, keep the rider cleaner and support the chain on large trikes, bikes and four wheelers.

**Chain Tube Mounting**  Mount chain tubes as shown in Figure 6.2. Keep bolts loose enough to allow the tube and bracket mount to swivel with different chain positions, but not so loose that the frame mount will twist out of alignment.

Bikes: Mount clamp on mid frame brace using “p-clamp”(figure 6.2).

RoadRunner trike: Mount clamp on bottom tube 3-¼ inches in front of the mid-frame brace.

Align clamp with axis of cycle. Break chain below and behind the crank with chain tool and run the chain through the tubes, threading correctly through the front derailleur. Reconnect chain and be sure to work out any tight spot on the chain by flexing the chain back and forth from side to side.

If necessary, loosen the tube clamps and reposition the tubes so that they are at least 1-½ inches from either sprocket. **It is important not to pedal backwards when chain tubes are on the cycle. If poorly adjusted, they may foul in the sprockets.**

CHAINRING GUARD

The Lightfoot Chainring guard is made to install on the Truvativ Blaze Crankset. Slip the guard over the crankarm and install the bolts closest to the crank arm first. Use #4x ½” or M3x 16mm bolts, use an 5mm nylon locknut between the guard and the outer chainring as a spacer and tighten using locktite or peen the tip of the bolt to insure the nut stays on.
DECALS
Apply decals at 68 – 75 degrees F. Clean the frame and your fingers with alcohol. Peel back off the decal keeping fingers off the adhesive; use tweezers if you have no fingernails. Position decal. Lay on frame. Use a credit card to “burnish” or set the decal working from center to outside, pushing any air bubbles as you go.

Remove top cover by peeling back along the frame. Lifting may lift the decal especially if cold. If you have trouble, allow the decal to sit for 24 hours with the cover on then remove cover.

Do not use citrus-based cleaners on decals; they will smear. Alcohol or ammonia based window cleaners are OK.

ELECTRIC ASSIST
The electric assist system battery pack rides in the cargo hammock of our trikes, and can ride on top of almost any rear rack that is mounted on our bikes. A red and a black wire from the motor pass through an opening in the front of the cargo hammock (or cargo box), and attach to a similar pair coming out of the front of the battery pack; this connector clicks together and apart easily. A grey cable from the motor attaches to the throttle. Unzip the battery pack to see the pair of 12 volt sealed batteries wired in series inside. A silver metal connector lies beside the batteries; this connects to the battery charger. The battery charger can be carried in the cargo hammock (rough usage can be hard on the electronics of the charger), or it can be left at the charging station. The battery pack rests on a platform that serves to spread their weight across the fabric bottom of the hammock. If you wish to put a piece of foam rubber under the platform, it will help reduce road shock to the batteries (and charger if you carry it). Push the battery pack forward as far as possible to keep cargo room available.
When shifting, ease off of the throttle, so that the shift is smooth. If you have the assist in too high of a gear when starting up, it will surge or stall.

**FAIRING**
The fairing mounts with T-Block clamps with arms on the handlebars. The lower mounts are P-clamps and twist tabs on the fork legs. The fairing can be adjusted up in cold weather so that the wind flow is directed over your head. In hot weather, you may want the air shed off the top of the fairing to flow toward your face.

Place the lower mount clamp on the left fork leg, just above the brake mount. Align as shown in figure 6.4. Place the right clamp on the rt fork leg even with the left. Insert foam tape between mount and fairing.

**Fairing Mount for Linkage steering**

Linkage steering requires a customl “rhyno” steer tube clamp mount that holds a 24” T-stem of 1-1/4”x.058” AL tubing. Standard Zzipper 8” block clamps attach to the .875 x .058 cross T-bar to attach to the upper fairing mount holes.
FENDERS

Front Fenders  All of our front fenders require that the left stay have a 30 degree bend 3” behind the fork mount loop to clear the brake caliper.  On 20” front fenders, we trim the backside so it will not scrape going over curbs and bumps.  The front fenders have single stays instead of double stays.

INSTALLATION
1. Bolt the fender top tab to the FRONT of the fork using 6mm x 2” bolt.  Center over tire and tighten.
2. The left fender stay needs a 30 degree bend 3 inches behind the attachment loop to clear the front brake caliper.  We usually do that for you.  If you have to bend it, just make sure the bend is in line with the flat plane of the loop.
3. Attach stays to the 5mm threaded mounts in fork using 5 mm bolt and washer.
4. Adjust stays to center fender over the wheel by loosening the stay nuts and sliding the stays while centering the fender.
5. Tighten all nuts.  Trim the ends of the stays with bolt cutters or hacksaw if you choose.  File off sharp edges and replace end cap.  A touch of finger nail polish or glue will hold them on well.

Rear Fenders on Bikes  Set up fender hardware as directed in instructions with this exception: the front mount on the rear fender should be installed by bolting from the inside of the fender to the fender mount on the frame.  Use two or more 1/4” nuts as spacers between fender and frame if needed.  Use a ¼” or 6mm washer and lock washer between the bolt head and the fender slot to secure the mount.

Rear Fenders on Trikes  1. Place the fender on the rear wheel.  Open the Stays to approximate width needed for mounting.  3. Bolt the stays to the frame loosely.  4. Position the front of the fender to the front of the outrigger above brake.  Use 5mm screws with flat and lock washers from the inside of the fender to attach to fender mount.  6. Adjust and tighten bolts and screws all around when sure of fit.  6. After Stays are adjusted, they may be cut off with bolt cutters, filed and have caps placed on their ends—be careful of the sharp cut ends.
KICKSTANDS

Lightfoot cycles accept standard kickstands with a slight modification. Protect the frame with vinyl tape and install as shown in the photos below.

Figure 1  Seat brace tab forward

SAFETY FLAG

Place frame protection tape on frame where you want the flag (the left rear side of the frame is a good visible spot).

Attach the flag mount using the #10 bolts and lock nuts provided. Sandwich the frame between the flag mount and the flat tab, straighten and tighten. Do not over tighten or the mount may bend making insertion of the flagpole impossible.

Figure 6.9  Safety Flag mount
HANDCRANK ASSEMBLY

Tools needed: Metric hex set: 5mm, 7/16” open end wrench, ½” open end wrench

Lift out of box TAKE CARE NOT TO CRIMP THE CABLES OR CABLE HOUSING!
Unwrap lower portion, do not unwrap the crank yet. Plug lower stem into derailleur tube of trike with chain tubes on the right. Tighten the derailleur tube collar clamp. Unwrap and slide fork stem clamp onto fork stem with tab to left and bolts to the back of the trike. Tighten the headset down using the headset top cap. Do not tighten the clamp yet.
Connect the tie rod loosely to the linkage steering tab. Now you can unwrap the top. MAKE SURE TO PUSH THE CABLE HOUSING INTO THE BARREL ADJUSTERS ON THE BRAKES AND SHIFTERS; DON’T CRIMP CABLES!

Here comes the 4-hand part:
Get some strong, mechanical help.
Holding the front wheel in alignment, align the linkage steering system and tighten the bolts on the linkage steering tab and fork stem clamp.
Insert the chain into the chain tubes. Loop around foot crank and pin the chain back together. Check to make sure the link moves freely.
Align the hand crank and pedals as shown in Figure 1. Hand crank perpendicular to ground/foot crank perpendicular to line between cranks. This is the timing that allows the hand crank to not interfere with your knees.
Loosen the bolt on the Linkage steering stem tube clamp. This is tricky. Lift up hard on the hand crank, keeping it in its vertical position, align with the front fork and have someone else tighten the collar clamp to hold in place. The bottom bracket in the center of the hand crank should be at your shoulder height when everything is tightened in place.
Attach the large cable tie to the spring, tighten enough to hold in place but not too much to crimp tube and trim flush. Figure 2.
When all that is done to your satisfaction, connect the new cables to your brakes and derailleurs.
Run the housing between the frame and the linkage rod.
HEEL PLATES

Install Heel Plates by unbolting or popping rear pedal reflector off with a flat screwdriver. Bolt heel plate onto pedal using reflector holes, L opening down. Place foot on pedal as normal. Slide heel cup up to heel. Mark the underside with a marker and tighten the bolts holding the plates together using the mark to keep the proper length. Some pedals may have 5mm holes. If so, use 5mm bolts supplied.
Our standard brakes are cable-actuated disc brakes. Disc brakes have a “burn-in” period and the braking force gradually increases as the “burn-in” period progresses. The calipers and rotors heat up when used. Do not touch them or try to adjust them when hot. Be extremely careful with fingers around rotating brake disks.

We use "linear-pull" or "vee-brakes" on cycles with internal hubs. The brake arms are held onto the brake bosses with a button-cap hex bolt. The brake shoe should be adjusted until the shoe lines up with the wheel rim. Springs control the "return" of the brakes (pulling back from the rim when the lever is not being squeezed); these need to be set evenly, so that neither side drags. These springs are generally adjusted with the small outside screws on most models of brake.

We have included the Avid Brake Manual with your cycle. Please read it and familiarize yourself with the operating and adjustment instructions. Avid has instructions on adjusting and maintaining the ball bearing disc brake BB-5 and BB-7 on this web site:

**PARKING BRAKE**
Lightfoot trikes have 2 simple parking brake systems. The first is the brake loop; a very simple low tech braking solution that comes with every cycle. Slip it over the grip, squeeze the brake lever. Pull the shock cord loop over the brake lever.

The second is a factory add-on option. It is a locking brake lever. If your trike has a parking brake: squeeze the left (front) brake lever to see a ¼” hole into which the parking brake pin fits snugly. Use it when you are loading your trike or parking it on sloping ground.

**BRAKE HOUSING**
On long cable runs, lubricate the cable where it goes through the housing by applying a few drops of White Lightning or other lubricant. The very long runs create drag that the return springs on brakes may not be able to easily overcome; lubrication helps brake levers and calipers return to their fully open position.

**ADJUSTING BRAKES**

**Disc Brakes**
- Before each ride: 1) check cables for wear or fraying. 2) Squeeze the brake lever firmly and check for proper brake function. Adjust for pad wear if necessary. 3) Check pads for wear and replace if necessary. 4) Make sure the rotors are free of foreign substances and oils.
• Spring tension adjustment: turn the spring tension adjustment screw with a 2.5 mm hex wrench. Turning the screw clockwise increases spring tension, which equals a harder lever pull.

• Cable slack adjustment: use the barrel adjuster on the brake lever to remove cable slack. Turn the adjuster out until there is no free play in the lever, but not so far that the torque arm on the caliper is advanced. The torque arm should return completely when the brake lever is released.

• Pad wear adjustment: turn both inboard and outboard red adjusting knobs clockwise 1 or 2 clicks as needed to restore your brake to optimum settings. **DO NOT USE your barrel adjuster to compensate for pad wear.**

• Pad Wear: a pad should be replaced when its total thickness is less than 3 mm. To remove the pads, back both red adjuster knobs all the way out (counter clockwise) then squeeze the pad tabs together and pull both pads straight out of the caliper. Reverse the process for installation of the new pads. Squeeze the brake pad/spring clip assembly together then press firmly into the caliper until it clicks into place.

• Care and cleaning: Extreme care must be taken when cleaning both the cycle and the disc brakes. Under normal use the pads and caliper rotor will not need to be cleaned. If necessary, use only water and dish detergent. Be sure to thoroughly rinse all soap residues from the rotor. Dry with a clean paper towel.

**BALANCING BRAKE PAIRS**

All-wheel braking on three-wheelers or four-wheelers requires not only that each brake be symmetrically adjusted, but that each front or rear opposite pair is balanced. Both left and right pairs that are controlled by a single brake lever should have approximately equal amount of spring tension so that each pulls back from the rim in equal amount when that brake lever is released.

When brakes are adjusted properly, you should be able to squeeze the brake lever as hard as possible (under full braking) without the brake lever contacting the handlebar. As well, the brake lever should move only a little (as your hand tightens upon it) before the brake begins to activate.
RIDING YOUR CYCLE

Any of our cycles will feel odd to the first-time recumbent rider. Two-wheel models will seem hard to balance at first, and clumsy to push or move around. Trikes and trucks will seem strange in every respect. If you are a long-time upright bike rider, it may even be worse than if you haven’t ridden in 10 years. Have patience. With practice almost anyone will be able to ride straight and efficiently and turn predictably. Pushing and maneuvering the bike will become second nature. However, it may take some time.

When learning to ride a recumbent two-wheeler, begin in a level, paved parking lot, with lots of room to maneuver and no traffic. Do not begin on a crowded street, or on gravel, or on a hill. Do not use toe clips on your first ride. A little bit of speed will help your balance on a bike; don’t try to ride slow. Start in a medium-low gear. Some people will have their balance in 20 seconds; some will take 20 minutes.

Three secrets to learning to ride a recumbent:
1. Start with a power stroke (pedal straight up)
2. Lean back into the seat
3. Relax your arms when you ride.

Many of our vehicles use “tiller” steering. Practice swinging the handlebars back and forth to get a feel for the motion of steering, and practice on level terrain before you steer down a hill and around a corner.

SMOOTH SHIFTING
Derailleur systems require that the rear wheel and pedals be turning when you shift. Also, you must ease off on the pressure to the pedals as you shift. **Index shifters must be adjusted correctly, or they will not shift consistently and may not stay in gear.** If you cannot get your gears to shift consistently using the information printed in this owner’s manual, have an experienced bike mechanic help on this critical adjustment.

The wheel and pedals do NOT need to be turning when you shift an internal hub. The internal hub systems can also shift under pressure; however, it will shift better and the internal components will last longer if you ease off when shifting.

EFFECTIVE BRAKING
When braking a two-wheeler, keep in mind which lever controls the rear brake; it is almost always the lever on the right. Use the rear brake for most of your braking. On gravel, snow, or slick surfaces, use the rear brake and be cautious with using the front brake. If the front locks up, you will lose your ability to steer. Experienced riders can skid the rear wheel in gravel without losing control.

On dry pavement, use the front brake strongly, in combination with the rear brake for fast stops.

USING A MIRROR
If your cycle did not come with a mirror, or if you do not have a good helmet mirror, get a mirror. Immediately. You will be, and will feel, much safer.
Learn to use the mirror without turning your head. Make frequent checks of overtaking traffic by glancing at the mirror, moving only your eyes. Don't stare at it, just check and go. This continuously updated consciousness of what is behind you will make you much safer if you should need to make an emergency maneuver.

If you are unavoidably on a narrow street with high-speed traffic and no shoulder; use the mirror to check on overtaking vehicles as you see or hear them coming up behind you. You may spend more time looking in the mirror than looking ahead of you, since the greatest threat to your safety on such a street is from overtaking vehicles. If the overtaking vehicle is not getting over, you may decide to hit the ditch. Do not passively hope that everyone will watch out for you on a shoulder-less road; some may not see you, especially if they are tailgating another overtaking vehicle.

A Mirrycle ™ is a good choice; other handlebar-end mirrors may work well. Pedicabs or tall-box cargo vehicles may need a handlebar extension (such as those cow horn looking-things that bolt on the end of mountain bike bars) to elevate the handlebar-mounted mirror.

**COMFORT, CADENCE AND POSITION**

The most likely complaint about the recumbent position will be about knee soreness. This complaint will come from those who push too hard on the pedals at low rpm’s or have the seat adjusted too far forward.

On a recumbent, you can’t stand up to protect your knees if in too high of a gear, like you can on an upright bike. So, don't mash on the pedals. Spin. Try to keep your pedaling cadence above 70-80 r.p.m. This may seem very fast, but it works to sustain your energy and protect your knees. Long distance riding may be most efficient and sustainable at 90-100 r.p.m.

If you are stuck in a high gear when stopped on a hill or when starting a heavy load, pedal slowly and gently until you have an opportunity to shift down to a gear that you can spin at a 90 r.p.m. cadence. Pedicab drivers take note: a few days of heaving on the pedals in a recumbent position can put you in pain and temporarily out of commission.

Your knees should almost straighten out as you pedal forward. Adjust the seat until they feel comfortable. It has been said that if the front of your knee hurts, you are pushing too hard with your seat too close to the pedals; if the back of your knee hurts, you are pushing too hard with your seat too far back.

Use your ankles; don't lock the feet in one position. Try to use your toes to push and pull the pedal around its orbit. Use toe clips or "clip-less pedals" to help your ankle motion and to keep your feet securely on the pedal. Clip-less pedals and matching shoes with cleats are necessary to efficiently ride bike or trike models with a high bottom bracket position; they reduce the constant effort of trying to keep your feet on the pedals.

Shoulders can become tense and tight if your seat is not adjusted correctly. Try putting your weight onto the seat back, and consciously loosening your grip on the handlebars. If your handlebar simply will not adjust back far enough or high enough for you, we can supply lengthened custom handlebar stems.
Our mesh seat has an oversized pocket for the foam pad that allows additional padding if you wish it. If you want additional lumbar or shoulder support, moveable strap-on pads are available from LFC.

**STABILITY**

*Our trikes CAN tip over.* Practice in a level parking lot to learn their limits. It is fairly easy to put the trike up on two wheels by turning sharply with some speed. If you get a wheel up, bring it back down by steering back in your original direction of travel. After you have the feel for the limits of stability of the trike, you will be able to anticipate the need to lean into sharp, fast corners. When cargo trikes are loaded, they will be more stable than when unloaded.

Enjoy your Lightfoot!

Remember four tips for riding a recumbent:

1. Start with a power stroke
2. Lean back into the seat
3. Relax your arms when you ride!
4. Look where you WANT to go!
HOW TO RIDE SAFELY ON THE ROAD WITH CARS

You can greatly reduce your chances of being in a bicycle accident by following some basic rules; rules which a majority of bicyclists break all too frequently.

COMMONSENSE RULES OF THE ROAD
To avoid the most common accidents in bicycling, follow some simple safety rules:

**Rule: You are a vehicle, act like one.**
Stop at stop signs (failure of bike riders to do so is the #3 cause of urban car/bike accidents).
- Go with the flow of traffic (riding against traffic is the #4 cause of car/bike accidents).
- Do not ride on the sidewalks.
- Do not pass cars (except those in a left turn lane) on the right, unless you have a free lane or wide shoulder on which to do so.

**Rule: The closer your speed is to the speed of automobile traffic, the more you should take your place in traffic.**
- If you are traveling much slower, keep out of the traffic lane--as far to the right as practicable.
- If you are traveling almost as fast, position yourself on the edge of the traffic stream.
- If you are traveling as fast as the cars, take your place in the lane.
- Do NOT ride fast near the curb.
- Do NOT ride closer than 5 feet from parked cars that may open doors in front of you, forcing you suddenly into traffic.
- Do NOT squeeze yourself on to the very margin of the pavement; drivers tend to give you room in rough proportion to the amount of room you take for yourself.

**Rule: Position yourself in an intersection so that it is obvious what your intentions are.**
- If turning right, move toward the right edge of the roadway.
- If continuing ahead, stay as close to--or in--the traffic lane as your relative speed allows; this makes you more visible to drivers coming towards you. This is critical because the #1 cause of urban car/bike crashes is left-turning cars cutting off an on-coming bike. This also makes you more noticeable to drivers who are waiting to pull out from side streets. This also is important because the #2 cause of urban car/bike accidents is motorists who fail to yield at stop signs. Thirdly, this also discourages right-turning motorists from accelerating past you and cutting you off with a sudden turn.
- If you are going straight through an intersection, position yourself to the right edge of the through lane.

**Rule: Act like a car to merge safely with slow or moderately fast traffic.**
- Learn to merge--look back, assess when it is clear and signal your intentions just as other vehicles do.
- Do not attempt to negotiate and merge with high-speed traffic.

**Rule: Ride a straight line.**
- If you have to leave your path to avoid an obstacle, signal.
- Do NOT ride in the parking lane weaving in and out around parked cars.

**Rule: Ride at night only with very good lights.**
- Do NOT ride on busy narrow high-speed roads at night; only the most radically bright lighting systems are visible through the confusion of headlights and taillights. Statistically speaking; at night you are 8 times as likely to have a fatal accident as in daylight.
- Ride defensively; assume the automobiles may not see you.
- If you plan to ride a night a lot, make your cycle GLOW, using plenty of illumination lights, clearance lights, blinking tail lights, and reflective materials.

**Rule:** Ride only on a well-maintained vehicle with fully functional and powerful brakes.

**Rule:** Wear a helmet.

*We, at Lightfoot Cycles, want you to enjoy your cycle for a very long time. If you have any sort of problem that you or your local bike shop cannot fix, please let us know.*

*Have fun; and remember to SIT BACK and RELAX*