

## Frame and Fixtures

The frame of the human powered vehicle is designed for two riders of maximum individual height of 5'10" and a maximum combined weight of 350 lbs. Fixtures for seating, restraints, suspension, etc. are to be fixed to the frame specified in their respective sections.

Bottom bracket tubes can be adjusted to accommodate larger riders by providing more clearance for pedaling. The instructions for adjustments are as follows:

1. Remove wire snap pin from bottom bracket tube.
2. Remove chain tension via tensioner.
3. Adjust bottom bracket tube accordingly and fasten wire snap pin.
4. Add chain links and/or tension chain as per new adjustment.

## Seating and Restraints

The seating for the vehicle consists of 2 Greenline Saddles measuring 11 inches at their widest, with an adjustable height seat back that has a range of 5 inches to adjust for lumbar support. The seats will be secured similarly to that of a traditional bicycle, by having a seat post be welded to the frame of the vehicle the saddles secure on top of the post.

The restraints for the vehicle consist of 2, 2-Point retractable lap belts with chrome lift latches. The belt at its longest is 77 inches (6.4 ft) with the two portions of the belt connected, with one side being fully retractable and the other being adjustable to ensure riders are secured in the vehicle. The restraints will be attached to the rover frame and the belts should attach (click) over the riders lap.

## Wheels

All four wheels on the rover are easy to detach and reattach quickly. Hardware required for attachment and detachment include 2: ¼"-20 1" bolts, 2: ¼"-20 nuts, and a 7/16 socket wrench.

Front Wheel assembly: Each front wheel consists of an inner and outer aluminum plate, 4 circular pieces of foam, a rubber sheet cut to size, and 10 aluminum cleats. The inner and outer plate only align in one orientation.

Rear Wheel assembly: Each rear wheel consists of an inner, middle and outer aluminum plate, 6 circular pieces of foam, a rubber sheet cut to size, and 10 aluminum cleats. The rear left wheel has two additional shaft bushings on each side and the rear right wheel has a custom hub fixed to the wheel. The inner and outer rim are orientated the same way and the middle rim only fits in one orientation.

Front Wheel mounting: To mount each front wheel first a front shaft is fitted through each of the front bearings with the longest end facing away from the frame. Then the assembled front wheel is slid onto the exposed shaft. A ¼"-20 bolt is placed and firmly tightened into the exposed hole at the center of the outside part of the wheel.

Rear Drive Wheel mounting: The rear left wheel is the driven wheel. This wheel assembly lacks an internal hub. The two bushing fixed to the wheel are keyed and match the rear axle. Align and place these keys, then ca the end with a ¼"-20 nut.

Rear Free Wheel mounting: The rear right wheel slides onto the reduced portion of the axel. Then firmly tighten a 1/4"-20 nut to the end of the shaft. Orientation is not important.

### **Steering**

The steering consists of a go-kart rack and pinion kit. The end to end length range is 9.75 inches to 12.5 inches. The end to end length range after the tie rod is connected with the steering rack is from 33 inches to 35 inches. The diameter for the steering wheel is 11.8 inches and the holes' distance are 1.42 inches. The functions of the rack and pinion system are as follows.

#### Tie rod

This component connects to each end of the rack. It translates motion from the rack and pinion to the wheel.

#### Gearset

The gearset converts the rotational motion of the steering wheel into the linear motion needed to turn the wheels; and it provides gear reduction, which makes it easier to turn the wheels.

#### Steering shaft

This component, in conjunction with the pinion which is attached to the end of the steering shaft, takes the motion from the steering wheel to then move the rack.

#### Steering Wheel

This component is attached to the top of the steering shaft and provides control of motion for the movement of the rack and pinion.

### **Drivetrain**

The drivetrain consists of common and accessible bicycle components; replacements and upgrades are readily available, and they are, in most cases, immediately compatible. The drivetrain consists of two single-speed inputs from each respective rider powering a common axle shaft. Information on the components, how to replace or upgrade them, and their function is as follows.

Bottom Brackets: The bottom bracket shell is a 73 mm standard English thread. Take clearances into account if the bottom brackets, cranksets, or pedals are replaced or upgraded. Additionally, many bottom brackets will have a specific tool depending on the manufacturer for installation.

Crankset and Chain: The crankset and chain are single speed components to mitigate chances of derailing. The crankset, chain, and freewheel is (for) a 1/8" chain.

Tensioner: The tensioner consists of two idler pulleys that guide the chain and provide tension. Loosen the translating pulley with a 5mm hex key and adjust pulley position to achieve desired tension. NOTE: Release chain tension prior to adjusting bottom bracket position.

Freewheel and Adapter: The 20 tooth freewheel has an inner thread of 1.375" x 20TPI; this is standard english thread for bicycle components. The freewheel is to be threaded onto the adapter and oriented in a position on the axle shaft that transmits torque to propel the vehicle forward; additionally, freewheel must be aligned with the crankset as well as the keyed slot on the axle shaft. Fix the freewheel and adapter onto the axle shaft using the key and the two set screws per freewheel. Mirror the assembly for the other side of the drivetrain.

The entire assembly allows for both riders to pedal and contribute a torque to the common axle shaft; riders can also idle due to the ratcheting freewheel. Both riders will be able to apply torque at low rpms especially at a stall. However, it is likely that one rider may pedal faster than the other at higher rpms which will result in only one contribution of torque.

## **Braking**

Braking consists of a combination of easily accessible parts, and custom made parts that are tailored to the design of the vehicle. Double output braking force will be applied on the rear axle of the vehicle. The braking force will be applied with the use of a single input - double output brake lever. The components of the braking system and their functions are described below.

Single Input - Double Output Brake Lever: The brake lever allows the pilot to apply the braking force with one hand, while also enabling the pilot to maintain contact with the steering wheel with the other hand. The lever pulls a set of braking cables that run to the brake calipers

Brake Shaft: The brake shaft is 0.75" in diameter. The shaft is welded from the frame of the body and runs up in between the pilots. The brake lever is attached to the shaft, allowing for a comfortable braking action.

Braking Cables: The braking cables run underneath the frame of the rover from the brake lever to the brake calipers.

Brake Calipers: The brake calipers are an accessible part that are compatible with 160mm brake discs. The brake calipers are mounted to the frame of the vehicle with the use of custom made mounting brackets. The brake calipers are pulled by the brake cable, allowing the calipers to apply the braking force onto the discs.

Brake Discs: The discs are 160mm in outside diameter. The discs are very common and are easily accessible for replacement.

Brake Disc Adapter/Adapter Key: The brake disc adapter is a custom made part screwed onto the brake disc. The adapter has three threaded holes that allows the adapter key to be screwed onto it. The adapter key has just enough clearance for the rear axle to run through it, and is tightly secured to the axle with the use of a key and set screw.