

Sugar Glider Wheel Tutorial by tsugie

I made this tutorial for many reasons.

- 1) Sometimes people like or want to make things themselves. They prefer to be makers instead of consumers.
- 2) This one is or can be somewhat related to the first one. Because I realize some people are stubborn and I figure it's better to help instead of criticizing them and trying to convince them to buy a wheel.
- 3) They aren't in USA and don't have access to safe wheels. Or can't/don't want to pay the expensive shipping. (And don't know people who are interested in buying a safe wheel so they don't have anyone to divide the cost with.)
- 4) They don't want to wait weeks or, sometimes, months to get a wheel.
- 5) Some people just want to spend less. They want more bang for their buck.*

*If your only motivation for making a wheel yourself is saving money, I may have some bad news for you: It isn't always cheaper to make one yourself. Depending on where you live and the materials you use/find, it can easily cost you about \$40 or more to make one if you have to buy all the materials. And that's assuming you have all the necessary tools.

You can get a Fast Track wheel for about \$47, (USA) shipping included.

However, if you are planning on making two or more wheels and/or you have some of the materials and tools, then it most likely is worth it to make one or more yourself (economically speaking).

Look up the prices for the materials needed in your area and make a decision.

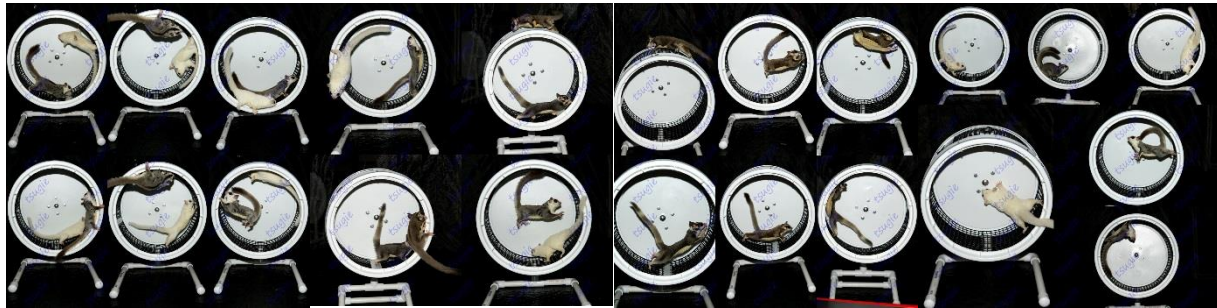
Even if you end up deciding to not make one or various wheels using this tutorial, please consider buying safe wheels for your sugar gliders. (I actually suggest buying at least one safe wheel before venturing on making your own so you can get a better feel for them.)

Wheels with bars/axles in the center, like the Wodent Wheel, have been known to injure backs and tails. Also, wheels with a solid track will get soiled very quickly with pee and poop. And your glider will be stepping on all of it.

In addition, sugar gliders often use the same wheel together, which increases the dangers of a center bar. Even the manufacturer of the often recommended Wodent Wheel strongly recommends against letting more than one glider use their wheel at the same time without supervision because of the potential dangers.

With a wheel per glider in each cage, my gliders will often use the same wheel at the same time. Plus, sugar gliders mostly jump/hop and with a center bar that is impossible and could be dangerous if they attempt to.

Here are photos of my gliders using wheels I've made.



Here are links to some of the safe wheels you can buy:

Stealth Wheels

<http://atticworx.com/1Stealth%20Wheels.htm>

Raptor Wheels

<http://www.mygliderwheelsandmore.com/>

Fast Track Wheels

<http://www.spinzoneglobal.com/>

Before I get into the details I have to clarify something: **I am not liable for anything that could possibly happen to your glider with this wheel.** I provide the tutorial but **YOU** are making it. And I'm certainly not forcing you to make it.

YOU are responsible for the safety of your pet. Which is why, **if you do not know how to properly use tools and/or follow instructions, PLEASE DO NOT make a wheel. If you are not comfortable in your ability to make it, ask somebody who is to make it for you or buy one, or however many you need, of the safe wheels.**

You do not have to use the same brands of tools and materials I used. However, results may vary if you use a different product (by choice or because you couldn't find the same one) for certain things, like the lids and bearings.

I have made various updates to this tutorial so there will be some older photos that don't show exactly how the wheel will look with the new instructions (like missing binding posts). I left them because I did not take step-by-step photos with all the new changes and the old photos still represent what I am instructing you to do. I hope that makes sense and doesn't cause any confusions. :)

Now onto the tutorial!

I tried to make it very specific. Please read the full tutorial before committing and buying the materials

Tools:

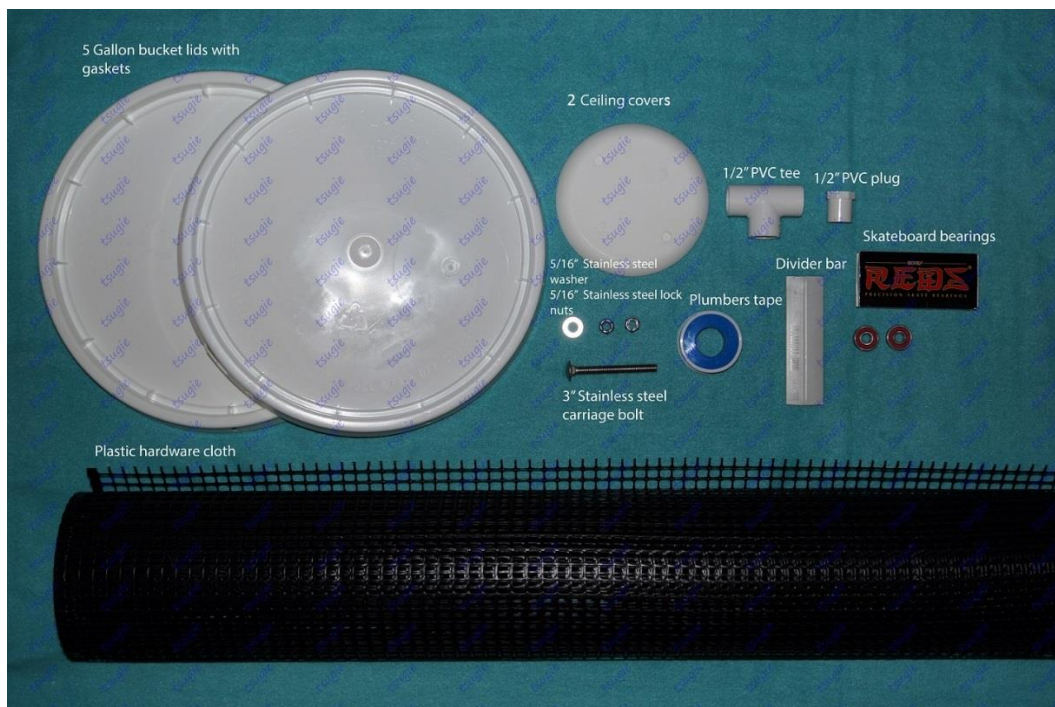
- 2 Ratchet wrenches <http://tinyurl.com/p6vgv7z> and <http://tinyurl.com/nourc2g>
- 2 Sockets 1/2" (1.27cm) <http://tinyurl.com/p6vgv7z>
- 1 Box cutter (or knife)
- 1 Pliers
- 1 Hammer
- 1 Flat metal object
- 1 Butter knife or flat head screw driver
- 1 PVC cutter <http://tinyurl.com/puzcgdk> or <http://tinyurl.com/oxss9rz>
- 1 Pair of scissors (not pictured)
- 1 Jigsaw <http://tinyurl.com/nhguxd3> or dremel <http://tinyurl.com/o35lsnu>
- 1 Drill <http://tinyurl.com/mtx9ft8>
- 1 Drill bit 5/16" (~.79cm)
- 1 Drill bit 7/32" (~.555cm) (not pictured)
- Wrench 1/2" (1.27cm) <http://tinyurl.com/oawukwz>
- Sand paper (grit 50 and/or 100) (not pictured)



MATERIALS: *I bought all the materials at Lowe's except for the scissors, divider bar and skateboard bearings. If you are in USA, you should be able to find everything locally.*

****IMPORTANT**** Make sure you get PVC pipes and fittings, not CPVC.

- 2 - 5 gallon bucket lids with gaskets (12-1/2" dia., 31.75cm dia.) <http://tinyurl.com/nvzmt47>
- 2 Plastic ceiling covers (Carlton) <http://tinyurl.com/nljb89v>
- 4 Binding posts 5/8" (~1.5875cm) (not pictured) <http://tinyurl.com/oqlcpnj>
- 1 Stainless steel washer 18-8 - 5/16" (~.79cm) <http://tinyurl.com/nkqy6yp> (the link is to a 5-count but you can buy singles in store for around a quarter each)
- 2 Stainless steel lock nuts 5/16" (~.79cm) <http://tinyurl.com/nvu9rug>
- 1 Stainless steel carriage bolt 5/16" x 3" (~.79cm x 7.62cm) <http://tinyurl.com/opnjt95>
- 1 Plumber's tape <http://tinyurl.com/o2plsoa>
- 1 PVC tee 1/2" (1.27cm) <http://tinyurl.com/o8os98y>
- 1 PVC plug 1/2" (1.27cm) <http://tinyurl.com/q9sojtv>
- 1 Divider bar/Divider molding <http://tinyurl.com/kms2gou> <http://tinyurl.com/lvqg7lk>
- 2 Skateboard bearings <http://tinyurl.com/nwqafn5> (8 pack, no spacers)
- 1 Plastic hardware cloth/mesh 1/2" (1.27cm) <http://tinyurl.com/lxc4qof> or plastic gutter guard <http://tinyurl.com/pkzoo7g>
- 1 Nut 5/16" (~.79cm) (not pictured) (optional) (stainless steel not necessary) <http://tinyurl.com/pl57b8p>
- 1 Fully threaded hex bolt 3" (7.62cm) (not pictured) (will need to be stainless steel if using on cage mount) <http://tinyurl.com/n2q4zq3>
- Sand paper (grit 50 and/or 100) (not pictured)



Materials for stand/mounts:

What you will need for this part will depend on the number and type of stands/mounts you make.

Floor stand:

- 1 PVC pipe 1/2" (1.27cm) (5' or 10' long) (152.4cm or 304.8cm)
- 2 PVC 90 degree elbows 1/2" (1.27cm)
- 2 PVC caps 1/2" (1.27cm)
- 1 PVC tee 1/2" (1.27cm)
- PVC cutter

Cage mount - Horizontal:

- 1 PVC pipe 1/2" (1.27cm) (2', 5' or 10' long) (60.96cm, 152.4cm or 304.8cm)
- 2 PVC 90 degree elbows 1/2" (1.27cm)
- 1 PVC tee 1/2" (1.27cm)
- 2 PVC plugs 1/2" (1.27cm)
- 2 Stainless steel hex bolts, 5/16" x 3" (~.79cm x 7.62cm)
- 2 Stainless steel wing nuts 5/16" (~.79cm)
- 2 Stainless steel washers 1-5/8" x 5/16" (4.127cm x ~.79cm) (might not need them depending on the cage)
- PVC cutter

Cage mount - Vertical:

- 1 PVC pipe 1/2" (2', 5' or 10' long) (60.96cm, 152.4cm or 304.8cm)
- 1 PVC 90 degree elbow 1/2" (1.27cm)
- 1 PVC Tee 1/2" (1.27cm)
- 2 PVC Plugs 1/2" (1.27cm)
- 2 Stainless steel hex bolts 5/16" x 3" (~.79cm x 7.62cm)
- 2 Stainless steel wing nuts 5/16" (~.79cm)
- 2 Stainless steel washers 1-5/8" x 5/16" (4.127cm x ~.79cm) (might not need them depending on the cage)
- PVC cutter

Procedure:

1. Assemble the bearing system.

These are the things you will need:

- 2 Ratchet wrenches
- 2 Sockets 1/2" (1.27cm) (two long ones or one long and one short one)
- 1 PVC tee 1/2" (1.27cm)
- 2 Skateboard bearings
- 1 Nut 5/16" (~.79cm)
- 1 Hex bolt 3" (7.62cm) (doesn't have to be stainless steel unless you plan on using it on the mount)
- 1 Hammer
- 1 Flat metal object



2. Place the bearing on top of one of the opening of the PVC tee as shown in the photo.

Then place the flat metal object on top of the bearing and hammer it in until it is flush against the edge. Do the same thing on the opposite end. *Alternatively, you can sand down the fitting enough so that the bearings slide in. You will not be able to use a PVC plug to close off the end but a Nylon Hole Plug might work (the size should be 7/8" (2.22cm)). You can skip to step 5 if you do this.*

* The metal object is used so that the bearing is not hit directly and it's not damaged when it's hammered in. The bearing might go flying out when hammering so press the metal object down hard to prevent it.*



3. Now, insert the hex bolt into the PVC tee and thread the nut. You can use a lock nut, but it's easier with a regular nut.



4. Tighten the nut using the ratchet wrenches and sockets. Do it until both bearings have reached the end and can't go any further. Then, remove the nut and bolt.



The PVC will expand, especially where the bearings are. This is normal.

5. Sand down the pegs of both ceiling covers until they are slightly shorter than the edge (so there's no gap between the ceiling cover and lid). *I first used a 50 grit sand paper to sand down the pegs. It does the job but it takes a long time. I prefer sanding them down with a dremel tool.*

Then, drill through the holes of the four pegs of both ceiling covers with a 7/32" drill bit to make them big enough for the binding posts. Drill a hole using the 5/16" drill bit on the center of one of the ceiling covers.

Remember the update using the acrylic sheet: <https://tsugielove.wordpress.com/2015/02/21/diy-sugar-glider-wheel-update>



Now align the ceiling covers, so that the pegs/holes match, and screw at least two binding posts through two holes to hold the ceiling covers in place. Now use the ceiling cover with the hole in the center to drill the center hole of the other ceiling cover. *The center holes have to match or the bolt won't go through or it will be diagonal. And you don't want that.*



6. Make a square on the ceiling cover that will be placed on the front of the lid. I use a soldering iron to make the general shape and then I shave off what's necessary with a box cutter. The bolt should have a snug fit. It shouldn't be loose. Slide the bolt through the ceiling cover.



7. Make a hole, using the 5/6" drill bit, on the center of one lid. Now, place the ceiling cover with the bolt over the front part of the lid. Drill a hole (using one of the holes on the ceiling cover as a guide) on the lid using the 7/32" bit. Place a binding post on the new hole. Then drill another small hole and put a binding post through it as well. Now drill the other two small holes.



Remove the two binding posts and slide the other ceiling cover through the bolt on the back of the lid. Align the four holes of each ceiling cover with each other and place the four binding posts. Then, slide the washer over the back ceiling cover and start tightening a lock nut. *Since the ceiling cover is a harder plastic, you can tighten the lock nut without worrying much about ruining the square on the front ceiling cover. You probably don't even need the pliers.*



Tighten it so that the lock nut is as close as possible to the ceiling cover. But do not over-tighten. You don't want the front ceiling cover warping inwards too much or at all.

8. Use the plumber's tape to coat the area of the bolt where the bearings will be. This will prevent metal on metal contact between the bolt and bearing, making the wheel more silent. If you are having problems finding where the bearings will be, put tape all over the bolt except for about 1/2" to 1/4" at the end.



9. Now, place the bearing system and screw the other lock nut using a ratchet wrench.

With the two ceiling covers and using a 3" bolt you won't have any room to play around to make the wheel spin easier or harder. You can use a longer bolt but you'll have part of the bolt protruding. If doing the acrylic sheet version, you will need to find the "sweet spot". You can make it tighter so that it's harder to spin or looser so that it spins easier. It's up to you.

Lastly, place the plug.



This is using the 3" bolt.

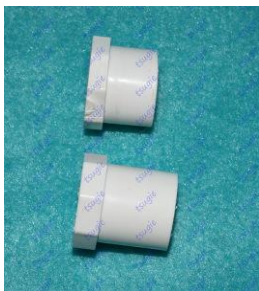


This is using a 3.5" bolt.

Because of the expanding of the tee, the plug might be too loose and come/slide off easily. I recommend checking the tee and plug before buying them to make sure that the fit is really tight so that when the tee expands the plug won't slide off. However, if using a cage mount, this probably will not be an issue since the back of the wheel will be pressed against the cage.

*Depending on the cage mount and version of the wheel, the plug and the bolt will be too long making the wheel slightly tilt forward. I had to cut the plug on some of my wheels. If you are using a floor stand, it is not necessary.

You can also grind or cut the bolt if it's too long. If you do this, you may be able to replace the plug with a Nylon Hole Plug. I haven't used them but I believe the size should be 7/8" (2.22cm). If checking with a tee without the bearings already in it, remember that the tee expands once the bearings are added.*



Cut vs uncut plug.

On the first photo below you can see more or less how long the bolt 3.5" extends if you don't cut it. On the middle photo the bolt and plug are cut. *I used the second cutter linked earlier to cut the plug. I have both cutters linked because of when I made my PVC cages. You don't need to get both. But if you want to cut the plug, the other one won't work.* The last photo is using the uncut plug.



10. For the second lid, if using the jigsaw, drill at least one hole on the edge with the drill. I drilled a lot to have an "outline" but you do not have to. Use the jigsaw to cut the opening.



If using a dremel, I recommend using a cutting guide. Place the guide like this and cut:



11. You might end up with flaky edges, especially if using the jigsaw, so sand them down. Make sure you don't leave any sharp edges.

12. Now, remove the gasket from both lids using the flat head screwdriver or butter knife. Make sure that whatever you use doesn't have a sharp edge so that it doesn't puncture/damage the gasket.

Pull the gasket carefully. Do not stretch the gasket.



13. Next, cut the hardware cloth or gutter guard and divider bar with a pair of scissors. The width of the hardware mesh will depend on how wide you want the track of the wheel to be. I prefer my wheels to have a track of about 5" (12.7cm) width so I cut the mesh about 6 1/2" (16.51cm) wide. The gutter guard is 6" (15.24cm) wide.

The hole spacing of the hardware mesh may not be suitable for very young/small joeys (think around 6 weeks OOP or less, depending on size). More comments on the final comments at the end.



The length should be about 36 3/4" (93.345cm) but it may vary depending on the lids and/or mesh you use, so measure it using your lids to be sure. You can easily do this by cutting it a little longer, about 38" (96.52cm), and placing it around the groove of the lid where the mesh will be and cutting however much you need to.



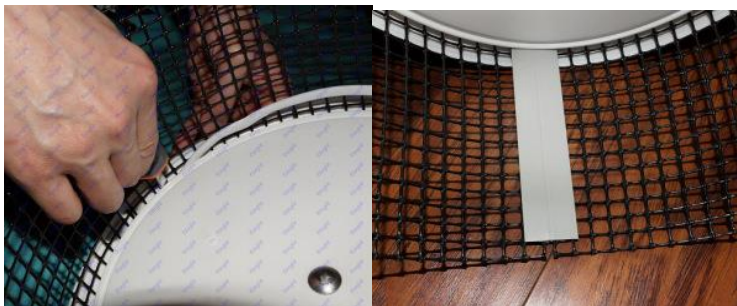
The space between both ends should be very small, as shown in the photo.



Since my mesh is 6 1/2" (16.51cm) wide, the divider bar has to be roughly 5 1/2" (13.97cm) long. Basically, the divider bar should be about 1" (2.54cm) less than the width of the mesh.

14. Now, with the mesh in place, insert the gasket inside one of the lids using the flat head screwdriver or whatever you are using. Make sure to insert the gasket surrounding the inner part of the mesh and that it is completely inside. Then place the divider bar between both ends. Lastly, place the other lid on the mesh and insert the gasket the same way as before.

I placed it first on the lid with the bearing system but you can do it on the other lid first. It doesn't make a difference.



When attaching both lids, make sure that the wheel does not pull apart easily. In other words, make sure that the gaskets have a tight and strong hold on the mesh and the wheel isn't going to fall apart.

*If, for some reason, you are afraid the wheel will fall apart because the mesh is being held just by the gaskets that come with the lid, you can replace them with 1/4" (outside diameter) polyethylene tubing or vinyl tubing.

I recently read that at least one of the Raptor Wheels uses a high quality polyethylene tubing, instead of gaskets, to hold the mesh. I'm sure it's the same for all but he specifically said that about the Velociraptor Type R. I wanted to try it out but, since I'm not familiar with the tubing and was in a hurry, I accidentally got vinyl tubing instead of the polyethylene.

I tried out the vinyl tubing anyway and it does provide a stronger hold than the gasket. So vinyl and polyethylene tubing are other options. The vinyl one is less than \$3 for 10 feet. The polyethylene costs about the same.*

15. Make a stand/mount for your wheel. And attach the wheel to it.

Unfortunately, I do not have photos of the process. But making stands/mounts is much more straightforward than the wheel.

Horizontal cage mount:

- Cut pieces of the PVC pipe the following sizes:
 - 1 of 1-1/2" (3.81cm)
 - 2 of around 3-1/2" (8.89cm)
 - 2 of 3/4" long (1.905cm)
- Insert the 1-1/2" long piece into the middle opening of the PVC tee.
- Insert the other two PVC pipe pieces into the other two side openings.
- Place the two PVC elbows on the ends of the two longer PVC pieces and insert the plugs into the elbows.
- Drill holes using the drill and 5/16" drill bit as seen on the photo.
Try to make it so that there is barely any, if any, space for the bolt to move around.
- Now, attach the mount on the cage. Placing the 3/4" PVC pipe pieces on the exposed bolts to cover them.

Photos after the Vertical Cage Mount.

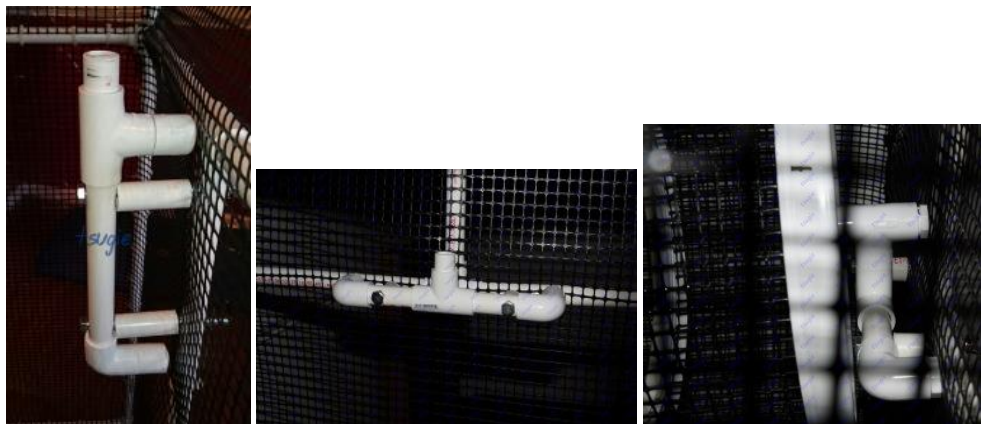
Vertical Cage Mount (using caps):

- Cut pieces of PVC pipe into the following sizes:
 - 1 of 9" (22.86cm)
 - 2 of 2" (5.08cm)
 - 2 of 1-1/2" (3.81cm)
- Insert a 1/2" elbow into one end.
- Insert a 1/2" tee into the other end.
- Insert one 1-1/2" piece into the elbow and one into the tee.
- Insert a cap into each 1-1/2" pipe piece.
- Drill holes using the drill and 5/16" drill bit as seen on the photo.
Try to make it so that there is barely any, if any, space for the bolt to move around.
- Attach the mount, placing the 2" PVC pieces on the exposed bolts to cover them.

I have PVC cages so I can only show how they will look on such cages.

This is how your mounts should look. *You don't have to use fully threaded hex bolts.*

Remember that you might need washers depending on your cage.



The bolts used for the horizontal and vertical mounts can be shorter or longer depending on your cage and desire. They don't have to be 3" long.

*Like I previously mentioned, the plug covering the bearings will be too long and could make the wheel slightly tilt forward on some mounts and a wheel version. It might not affect it negatively if you leave the plug long but I decided to cut it anyway.

Alternative 1: However, like I already said, you can grind/cut the bolt and/or cut the PVC plug.

Alternative 2: You could cut some 1-1/2" (3.81cm) PVC pipe pieces and use caps on the mount and/or tee. Remember, you will need longer bolts and pipe pieces to cover the bolt. Like I did with the Vertical Cage Mount.*

Here are some photos of Alternative 2 on the Horizontal Cage Mount:



Floor stand:

- Cut the PVC pipe into the following sizes:
 - 3 of 9" (22.86cm-25.4cm)
 - 2 of 5-1/2" (13.97cm)
- Insert one of the 9" PVC pipe into the middle opening of the PVC tee.
- Insert the one of the 5-1/2" pieces on each of the other two openings of the PVC tee.
- Insert two elbows on the ends of those two 5-1/2" pipe pieces.
- Insert the other two 9" pipe pieces on both elbows.
- Insert the caps on the ends of the 9" pipes.



16. Insert the wheel on the mount or stand and enjoy your wheel! (Well, your gliders will!)

On this wheel, the plug is intact. The front lid was cut using a jigsaw and the track is hardware cloth.



This wheel has the acrylic sheet on the back, instead of the two ceiling covers. The plug was cut and the track is plastic gutter guard.



I hope this tutorial has been helpful!

Final comments:

- I used to do a version with a single ceiling cover on the back and there's another tutorial recommending that. I do **NOT** recommend doing that anymore since the lid will probably crack around the bolt. It happened to the two wheels I left with just the ceiling cover on the back. I thought the first time was a one-time incident but I tried it out with another and it happened again. I recommend using two ceiling covers, one on the back and the other in front, or using the acrylic sheet (or similar material) on the back. And, although not necessary, I also recommend using the polyethylene or vinyl tubing, instead of the gaskets, because they provide a stronger hold and will most likely outlast the gaskets.

- It's possible the binding posts aren't necessary for the ceiling cover version. The tightness might be enough to prevent the ceiling covers from moving but I prefer to go the safe way and recommend them.

-The centimeter measurements are given so you have an idea of the size. Look for the closest materials to those measurements.

-I don't recommend using a lid without a gasket and using zip-ties to hold the wheel together. Zip ties can be chewed so you would have to be constantly checking the wheel to make sure it won't fall apart. Also, if the mesh has to be replaced, it will be more difficult and it would take longer since you would have to cut all those zip-ties and tie them again.

-According to some, the 1/2" (1.27cm) opening of the squares of the hardware mesh may be too big for young joeys.

The squares are around 13/32" x 13/32 (.406" x .406") (1.03cm x 1.03cm). However, diagonally the squares do, in fact, measure 1/2". I don't actually know if the openings truly are too big for when joeys first start using wheels. The youngest I have gotten a glider was 9 weeks OOP and he had no issues with

the mesh.

For older joeys and adults it's perfectly fine, but if you are concerned you could use plastic gutter guard mesh. I have only tried the Frost King brand, so I don't know how others will work.



-Some people have said that this wheel may not be safe because of the long slot on the lids and because of the bolt in the center. First, the slot is extremely unlikely to be a source of danger because of its small size. Also, on the time I made this tutorial, many safe wheels have a bolt in the middle. Including Fast Track Wheels and Stealth Wheels. So, in my opinion, it's just pure nitpicking.

Here's the slot. The biggest slot on the lids is 1/4" x 3/8" (0.635cm x .9525cm).



-Another option is using a cross tee instead of a tee. With this method the wheel and cage mount is all a single piece.

I haven't tried it but it should work the same as the one with the regular tee.

The bearing system is installed the same way as with the regular tee.

For the cage mount:

- Insert a 5" (12.7cm) PVC pipe on each of the other openings of the cross tee.
- Insert a 90 degree elbow on each end of the pipes.
- Insert plugs on the elbows to close them off.

Many of the comments/recommendations for the Horizontal and Vertical mounts apply to this one as well.

You can also use a floor stand. Just close the top opening.

I have not bothered using this method because it would require me to remove the bolts every time I cleaned the wheel. It's more work.