



INSTRUCTIONS FOR BUILDING YOUR PARALLEL AXLE DERBY RACER!¹

This is the first year of the **Pumpkin Derby** at Pumpkinfest and no one knows quite what to expect! But the rules are really simple: build a Derby Racer with a small pumpkin by putting two axles through a pumpkin and attaching the wheels. While the pumpkin can be hollowed out, it must retain its pumpkin shape. **Total weight of the Derby Racer, including axles, wheels and any decorations, cannot exceed twenty (20) pounds.** There will be a weigh-in before each race to ensure compliance.

The **Pumpkin Derby** is comprised of three Divisions:

- Youth (12 and under);
- Teens (13-19); and
- Adults (20 & above) and Businesses

Teams can make and race a single racer in any Division. While Derby Racers do not have to be decorated, there will be prizes for several categories of decorated Derby Racers. For that reason, it is essential that parents let their youngsters decorate their Derby Racers themselves.

Throughout the event, racers will be examined by specially trained referees to ensure that there are no "cheater pumpkins" -- watermelons or other fruit masquerading as pumpkins; over weight racers; racers attempting to start before the race begins; etc.

For the **Pumpkin Derby**, the use of a solid base with affixed wheels is not permitted ...no skateboards, no roller skates, no Tonka trucks! The axles to which the wheels are affixed must penetrate the pumpkin and support it. The challenge is to build the fastest racing pumpkin with two independent axles.

And here is the secret to an undefeatable winner: for your Derby Racer to go straight down the track, **the axles have to be perfectly parallel.**

The race itself is simple. Put your Derby Racer in the starting block, and let 'er roll!

¹ Photos are supplied courtesy of Instructables.com

LIST OF MATERIALS

While in these Instructions we recommend use of five (5) inch rubber wheels with a 5/16" axle opening, any size wheel that will fit your racer may be used. Don't forget, being creative is just as important as speed.

Here's a list of recommended materials² to help you build your Derby Racer:

- (1) Medium pumpkin (14-18 pounds)
- (2) Eighteen inch long pieces of 5/16" threaded rod (The length of the axles will be determined by the size of the pumpkin racer...be sure to measure pumpkins before buying rods for axles. 36" threaded rods of various dimensions may be purchased at Damariscotta Hardware or Louis Doe's.)
- (4) Five inch rubber wheels, plain bearing (larger wheels may be also purchased locally, but the five-inch variety are only available online- see below)
- (20) Hex nuts 5/16"
- (8) Flat washers 5/16"
- (4) Fender washers 5/16"
- (4) Acorn nuts 5/16"
- (2) Wrenches 1/2"

Five-inch wheels with an axle diameter of 5/16" may be purchased online from the following vendors:

SES Caster 285 Circuit Street Building A, Unit 2 Hanover, MA 02339 (800) 215-8220 Sales@sescasters.com	Service Caster Corp. 9 First Street W. Reading, PA 19611 (616) 241-4519 Info@servicecaster.com	Advance Caster & Wheel Co. 839 Butterworth Street, SW Grand Rapids, MI 49504 (800) 451-8700 Sales@advancecaster.com
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Approximate Prices:

\$2.13/ 5" wheel	\$5.69/5" wheel	\$3.64/5" wheel
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Lawn mower wheels of various sizes may also be purchased at Home Depot and Lowe's.

² This list of materials assumes use of 5" wheels and/or axles using 5/16" diameter axles. If other axle diameters are used, associated hardware must be adjusted accordingly.

INSTRUCTIONS

Step 1- PUNCHING AXLE HOLES

The *Pumpkin Derby* Pit Crew will be manning a Pit Stop tent on Saturday, October 1st at Pinkham's Plantation during the pumpkin weigh-off to provide a tutorial on how to build a Derby Racer. The Pit Crew will also be at the First Bank on Main Street on Friday and Saturday, October 7th and 8th from 1:00-4:30 PM to assist participants in drilling and installing parallel axles on their derby racers using an axle punch jig.

Participants who would rather build their own pumpkin axle punch jigs will find instructions for doing so on the Internet at the following URL:

<http://www.instructables.com/id/PUMPKIN-AXLE-PUNCH-to-create-parallel-axle-holes-f/>



To drill parallel holes for the axles, place the pumpkin next to the jig. Hold the pumpkin firmly in place and punch the first axle hole by pushing the steel rod or drilling with a long 5/16" bit. Insert a 5/16" rod through the jig into the pumpkin to stabilize it in order to make a second axle hole and repeat the punching/drilling process.

TIP: It is easier to decorate your pumpkin prior to putting the wheels on. Just remember to keep the bottom part of the pumpkin free of any decorations. For example, if you're making a Mummy Derby Racer, don't wrap gauze around the part where you will punch the axle holes.

Step 2- INSERTING THE AXLES

Feed the axles through the path you have just created with the axle punch jig. If the threaded rod gets stuck, poke the steel rod through again to clear the path.



You need to be careful with the threaded rod. The threads can easily bend and then it will be impossible to get a hex nut to go on smoothly. Don't hammer the threaded rod through the pumpkin or knock it on the ground to help feed it through. It might seem like a good idea at the time, but you will regret it later. If you absolutely have to give the rods a tap, first screw an acorn nut on to the end.

Step 3- CENTERING THE PUMPKIN

After a few trips down the racetrack, you may find that your pumpkin will slip on the axle and become off center. This can happen during a crash, either with another pumpkin racer, someone's legs or the curb.

To avoid this problem, on each axle, thread one fender washer and one hex nut. The placement of the fender washers should be snug up against the pumpkin with the hex nut anchoring the washer in place on the axle as shown in the photo on the right.



While not absolutely necessary, it will help to keep your pumpkin centered and it can help get or keep your axles parallel. (This is discussed at length in step 8.) After reading this instruction, you can decide for yourself if you want to add fender washers.

TIP: After repeated use, axles can bend or warp, especially if your racer has crashed. Do a check of the axles to ensure they are straight before each race.

Step 4- ATTACHING THE WHEELS

Here is the order in which to place nuts and washers on the threaded rod: (2) hex nuts, (1) flat washer, (1) wheel, (1) flat washer, (2) hex nuts, (1) acorn nut.

Make sure that the acorn nut has enough room to be fully screwed onto the threaded rod. (The purpose for the acorn nut is solely to protect you from scratches and cuts from the ends of the threaded rods.) The sequence of washers, wheels and nuts is depicted in the photo below.



Repeat this step for the remaining three wheels. Now that you have all the pieces on the threaded rod, it is time to secure the hex nuts. You will need to create a LOCK NUT. If you skip this part, the hex nuts will continue to rotate on the threaded rod as your pumpkin goes down the track. This will cause your wheels to lock up. Your Derby Racer won't move, and you will lose.

LOCK NUTS

To create the LOCK NUT, simply rotate two hex nuts onto each other. This is the step where you will use the two 1/2 inch wrenches. You will have EIGHT points on the four axles where you will need to make LOCK NUTS; one on each side of each wheel.

Place one wrench over one hex nut and the other wrench over the second hex nut. You will essentially be rotating one hex nut to the right and the other to the left. This will give you a tight joint that you will not be able to move by hand.



Step 5- SECURING THE

It is important that after the lock nuts are tightened there is enough room for the wheels to rotate freely, but not so much room that they wobble. To avoid this problem, insert a fender washer between the wheel and lock nut as shown in the photo on the right.

Then rotate the two hex nuts back onto the flat washer and make the LOCK NUT joint. When you pull out the fender washer, you will have just enough room for the wheels to move unobstructed and without wobbling.



Step 7- TEST RUN & TROUBLESHOOTING

Make sure you do a test run of your Derby Racer. This is the only way to see what kind of adjustments you may need to make. A sloped driveway is a great place to practice. The following are common problems:

- **DERBY RACER RUBS ON THE GROUND:** If the pumpkin hangs too low and is rubbing on the ground, you will need to shave some off. Bumps and imperfections in the road may also cause a pumpkin to hit the ground as it races. Make sure you have good clearance.
- **DERBY RACER RUNS SLOW OR DOES NOT MOVE:** Check to make sure all wheels are spinning feely and not wobbling.
- **DERBY RACER VEERS OFF COURSE:** Your racer may tend to veer either left or right. This is comparable to a person on a skateboard. A person is able to tell where their center of gravity is to go straight and can lean left or right for a path correction. No such luck with a Derby Racer. You are going to have to make these adjustments for your racer by observation. For a racer that veers off course, determine the following:
 - Are all wheels spinning freely? Check to make sure that the wheels are spinning freely and equally. If a left side wheel is stuck, the rotation of the right side wheels will cause the pumpkin to sharply veer to the left.
 - Is the pumpkin centered on the axles? If your pumpkin appears to be heavier on one side, you may need to adjust its placement on the axles.
 - Are the axles really parallel? The most likely cause of veering is that your axles are not parallel. Stated another way, the distance between the left side wheels or axles is different from the distance between the right side

wheels or axles. If your axles are off by even 1/8 of an inch, your racer may not go straight. (In Step 8, SPECIALTY HARDWARE, there are some more ideas for getting your axles parallel, but when it comes to this problem, don't underestimate the value of a strategically placed piece of duct tape to pull your axles in slightly or push them out slightly.)

- You may also consider installing an OUTBOARD STABILIZER BAR to keep axles parallel. The bar can be made from two identical pieces of wood whose measurements are 2" wide by 3/4" thick. The length of the bar should be 2" longer than the distance between your axles. That dimension should be identical for both side of the pumpkin and if it's not, you have a problem because your axles are not parallel! Installing the stabilizer bar will cure that problem. If the measurements between axles are not identical on both sides of the pumpkin, choose one measurement to use in drilling the bar. Stack and clamp one bar on top on of the other and drill two 5/16" holes through the sides of both bars at a distance corresponding to the distance between the axles. Insert the axles through these holes and affix a lock nut between the bar and the pumpkin. Then attach the wheels outside the stabilizer bar as described in steps 4 and 5 above.

TIP: When you get all the bugs out, your Derby Racer will really pick up speed as it goes downhill. Depending upon how steep your track is you may want someone at the finish line to put on the brakes.

Step 8- SPECIALTY HARDWARE AND CUSTOM ADJUSTMENTS

Take a ride up to Damariscotta Hardware or Louis Doe's where you will find specialty nuts and washers for making fine adjustments to your pumpkin racer. Several useful techniques are described below.

An item called a FREE-SPINNING WASHERED NUT can be handy. This little item has the washer pre-attached to the nut. The washer is free-spinning. This particular nut may save you from some of these problems. Try it out and see how it works.

Another favorite is called a TEE NUTS PRONGED. This little nut has teeth to it and could be used to help stabilize an axle or keep an axle in parallel. Once you find the perfect position, just jam it in the pumpkin. There is also a nut called a MILLED EDGE COUPLING NUT. It's like a wedge. I also found washers with holes in them; however, it would be easy to recreate this for less money by simply drilling a hole through a fender washer. You can also use a screw through one of the holes to bring an axle into parallel.



A hole drilled through a fender washer can accomplish the same thing. The picture on the left shows how this is done. These enhanced washers can be used to fine-tune axles into perfect parallel alignment. First, secure the front axle with the custom fender washer. Then measure the pumpkin on both sides to achieve truly parallel axles. If measurements are not the same, adjust the front or back axle by pulling it forward until the distances on both sides are the same. When parallel, secure the fender washers.

FINAL THOUGHTS

Remember, you are working with a pumpkin, a product of nature that will not be perfect in terms of weight distribution or dimensions. Despite your best efforts, it may not go straight. Yes, it is challenging to get the axles on parallel, and it is precisely that fact that makes the race fun. On race day, pumpkins will zig and zag across the track. Some may end up on the curb. Some will zoom through the finish leaving everyone else in the dust. Some may never get off the starting line. But for everyone, the first annual *Pumpkin Derby* will be a unique event and one not to be missed while you're at the 2011 Pumpkinfest.



GOOD LUCK, WE'LL SEE YOU AT THE RACES!