NEMA 17 Cycloidal Drive

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VIEW IN BROWSER

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Summary

Cycloidal drive box for a NEMA 17 stepper motor. 20:1 reduction ratio

Hobby & Makers > RC & Robotics

Tags: gearbox cycloidal cycloid

A Cycloidal Gearbox with a 20:1 reduction ratio, for driving just about anything. I haven't tested the force output yet, but it nearly broke my finger when trying to hold the output. Feel free to modify the motor bolt pattern for your motor, as well as the output bearing housing to fit your mount. I've provided a modified output bearing housing with additional mounting lugs, that I'm using on a project.

I printed on a Bambu P1S, with various brands of PLA. I always drill my holes to exact size, but I couldn't hold the small bearing washers/spacers, so I printed them with a +0.1mm hole compensation. The output bolts could be replaced with M6 screws, but I don't have any laying around. If you use M6, you'll still want to include a spacer on the small bearings, so the outer race isn't clamped.

Hardware:

1. NEMA 17 Stepper Motor
2. 4ea - M3x12mm Countersunk Screws

3. 2ea - M3x25mm Socket or Button head screws
4. 6ea - M5x30mm Socket or Button head screws
5. 6ea - M5x40mm Socket or Button head screws
6. 1ea - M3 Grub Screw
7. 12ea - M5 Nuts
8. 4ea - 15x21x4mm Inner Bearings - Amazon
9. 6ea - 6x10x3mm Drive Bearings - Amazon
10. 1ea - 50x65x7 Output Bearing - Amazon

Printed Parts:

1. 1ea - Motor Plate
2. 1ea - Housing
3. 2ea - Cycloidal Disc
4. 1ea - Output Disc
5. 1ea - Output Bearing Housing
6. 1ea - Output Bearing Retainer
7. 6ea - 8x5x0.5mm Spacer
8. 6ea - 8x5x2.5mm Spacer
9. 2ea - 18x15x1mm Spacer
10. 1ea - 21x18x1mm Spacer
11. 1ea - Hub - Motor
12. 1ea - Hub - Disc 1
13. 1ea - Hub - Disc 2
14. 1ea - Hub - Output
15. 1ea - Hub - Retainer Cap

Print Details:

- PLA
- Outer Walls: 3
- Infill: Grid, 25% grid
- Supports: None
- Spacers are 100% infill, and concentric top layer
- Hub pieces have concentric top layer only on surfaces that meet the bearing
- Applicable holes include a 0.2mm enclosed face to bridge the hole without support. This will need to be removed with post processing.

Assembly:

It'll be helpful to review the assembly model before assembling this unit. You can view or clone my OnShape project here (https://cad.onshape.com/documents/4b07bd2e442b10c296f7d831/w/a34ad588bf1ec8029485032e/e/fda2a676b041003d86762a85?

renderMode=0&leftPanel=false&uiState=65dba8739a3c5b362868aaa3). Open the Exploded View in the Drive Assembly tab.

All bearings are press fit on the OD, and flush to the mating surface, except for the output disc hub bearing, details below.

The two holes in the Motor Hub piece are for self threading the M3 screws. You won't have access to this piece when inserting the screws, so you'll want to drill the holes to size if they're too small. The screws act as additional shear support, since the flat on the motor shaft can strip out separately. The screw threads don't need to be very tight, they're just to hold the screws from coming out on their own.

Output Subassembly:

1. Press the Output Bearing into the Output Housing
2. Press 1 Inner Bearing into the Output Disc. Insert the Output Disc Hub piece into the bearing to help press it in deeper. The Output Bearing Hub surface should protrude 0.5mm above the Output Disc surface.
3. Insert the Output Disc into the Output Bearing, and fasten with 6 M5x40 screws and nuts

Motor Mount:

1. Press 1 Inner Bearing into the Motor Plate, opposite the side of the motor, until flush with the surface.
2. Insert the 21x18x1mm Spacer into the plate from the motor side, until it meets the bearing.
3. Mount the Motor Plate to the motor with the 4 M3x12mm Screws

Disc Assembly: (must be assembled to the motor shaft)

1. Slide the Motor Hub piece onto the motor shaft until inserted into the Inner Bearing.
2. Press 1 Inner Bearing into each of the Discs
3. Insert the Disc 2 Hub into the 1 of the Disc bearings. The larger diameter of the Hub should be on the same side of the disc as the disc groove.
4. Push a 18x15x1mm Spacer onto the hub, on the opposite side of the disc. The spacer should fit snug to the hub and sit flush with the hub surface.
5. Slide the Disc/Hub assembly onto the motor shaft.
6. Slide the Disc 1 Hub onto the motor shaft and secure with the M3 Grub Screw.

7. Place Disc 2 and Bearing onto the hub, then place a 18x15x1mm Spacer on top. The spacer should fit snug to the hub and sit flush with the hub surface.
8. Place the Output Disc Hub on the top of the motor shaft. There will be very little left of the shaft to register the flat. Just make sure the flat and the screws holes are aligned.

Final Assembly:

1. Slide the Housing over the Discs. Rotate the discs until the teeth align, and the Housing meets the Motor Plate.
2. Place the Output Subassembly onto the Housing. Rotate the Output Disc until the Drive Bearings align inside of the Disc holes.
3. Fasten the assembly together using 6 M5x30mm screws and nuts.
4. Place the Hub Retainer Cap onto the Hub
5. Insert the 2 M3x25 screws into the hub and tighten. Everything is going to want to turn when tightening these screws. I used my finger as a wedge against the screwdriver to help keep it from turning. I'm open to suggestions to make this easier and less painful.

Model files

motor-plate.step

housing.step

cycloidal-disc.step

output-disc.step

output-bearing-housing.step

output-bearing-retainer.step

8x5x05mm-spacer.step

8x5x25mm-spacer.step

18x15x1mm-spacer.step

21x18x1mm-spacer.step

hub-motor.step

hub-disc-1.step

hub-disc-2.step

hub-output.step

hub-retainer-cap.step

example-drive-mount-motor-plate.step

cycloidal-drive-v4.3mf

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