

Hyperloop Instructions

General

This is a proof of concept exercise. You will build a small, not very pretty version of a moving part to use in your city model. This is called a Proof of Concept or POC. It gives you experience in working with the materials. You also have parts to make a larger version. So, if you are clever you can get two moving parts for your city. The large coil of wire is for use in your model city, we will not use it today.

WARNING

The Neodymium magnets in your bag are very strong. They can pinch your fingers, they will fly across the table or through the air to bang against a piece of steel. They might break and/or break what ever they slam into. If one breaks or cracks throw it away. Read the warning in the plastic bag before starting.

All of the parts you need are in your team's brown bag or on the table. You have a small and large coil of wire. Use only the small coil today.

1. Assemble Coil

- Take the small coil of wire out of your bag
- One team member holds the coil so it doesn't unravel as you remove the masking tape from the wire coils
- Tape an end of the wire near the end of the dowel
- Rotate the dowel to wind all of the wire around the dowel. Do not let the wire overlap itself.
- Carefully slide the wire coil off the dowel on to the table

2. Build the battery-magnet assembly

- Hold the brass washer on the positive side of the battery.
- Carefully attach 2 or more of the Neodymium magnets to the positive side of the battery. Do not let the magnets jump out of your hand.
- The same pole must be on the battery side of the magnet stack on each end of the battery. Get a firm grip on the magnet stack for the negative side of the battery. Slowly bring it towards the stack already attached to the positive side of the battery. You will feel it either pull towards or push away. If it is pulling than that is the end of the stack that goes against the negative end of the battery. If it is pushing away than the other end goes against the negative side of the battery. See diagram.



3. Test the hyperloop

- Slide the battery-magnet assembly into the coil until it is all the way in. It will either:
 - Zip through the coil to the other end
 - Pop back out, in which case put the other end of the battery-magnet assembly in first
 - Not move or not go all they way through. This can happen if the coil is not smoothly round or too many of the coils are touching each other. To fix slide the wooden dowel back into the coils and adjust the winding. If your assembly has worked before and the coil looks smooth, the battery might be dead.
4. Fasten the coil to a piece of cardboard supplied in the bag using a strip of double sided tape (available at your work station). You should also have a tube to put your coil in for save travel.

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5. Other things to try:
 - a. Spacing of windings on coils
 - b. Number of magnets on the battery-magnet assembly
 - c. Going around gentle curves
 - d. Going uphill and downhill
 - e. Connecting more than one run of coil

References

Here are a few You Tube videos on similar projects.

<https://www.youtube.com/watch?v=BWW4kPid4yc>

<https://www.youtube.com/watch?v=tLMqYBVdQk>

If you Google Homopolar Motor, you will find some other projects that use the same electromagnetic principles.

Source for magnets

https://totalelement.com/products/totalelement-1-2-x-1-8-inch-neodymium-rare-earth-disc-magnets-n48-30-pack?utm_campaign=dsa&gclid=EAlaIqobChMI-5natrfH3AIVmISzCh1tBgAEEAEYAiAAEgJ9CvD_BwE

Parts List and Receipt for Parts

Description	Vendor	Unit Cost	Unit	POC	Model + Spares	Total per Team	Cost
1 of: Bare Copper Wire, Bright, 18 AWG, 0.04" Diameter, 195' Length (Pack of 1)	Amazon.com	\$0.09	foot	9	36	45	\$4.14
1/2x1/8 Inch Strong Neodymium Rare Earth Disc Magnets N438 (30 Pack)	totalelement.com	\$0.50	each	6	6	12	\$6.00
Brass Washers 1/2 Inch	Home Depot	\$0.12	each	1	2	3	\$0.35
Wooden Dowel 1/2 Inch x 4 feet	Home Depot	\$0.47	feet	1	0	1	\$0.47
Hyperloop Total							\$10.96

Batteries Not included

You will need to include the cost of these materials if used in your model and any batteries used on your expense form for the competition