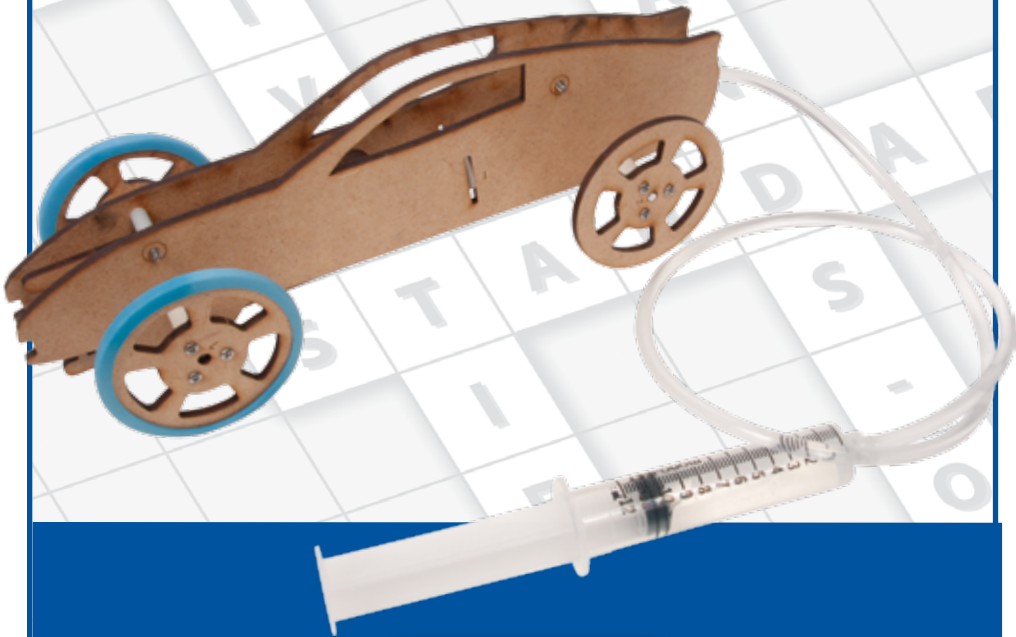


Fluid Power Car

User Guide



PITSCO
EDUCATION

60070 V0113

Cautionary and Warning Statements

- This kit is designed and intended for educational purposes only.
- Use only under the direct supervision of an adult who has read and understood the instructions provided in this user guide.
- Read warnings on packaging and in manual carefully.
- Always exercise caution when using sharp tools.

Principles at Work

Hydraulics

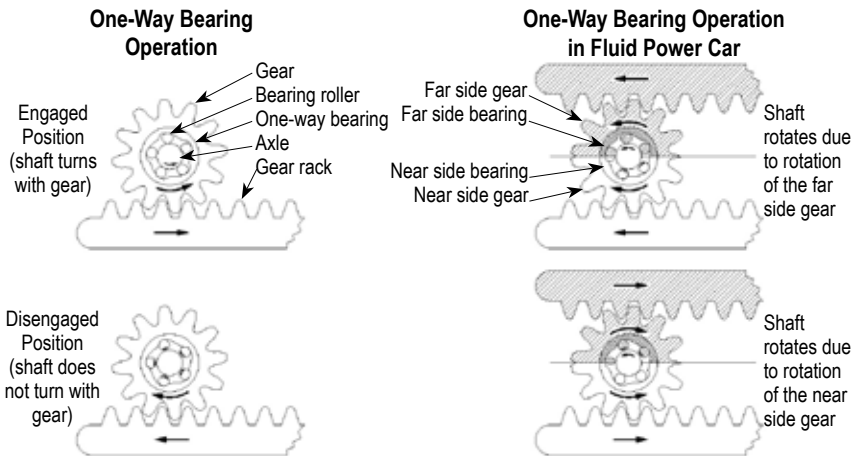
A hydraulic system is one that uses fluid as a force. The principle behind a hydraulic system is simple: Force applied at one point is transmitted to another point using a fluid.



Pushing on one end of a syringe filled with water (a hydraulic system) creates an equal and opposite reaction on the other syringe. On the Fluid Power Car, a syringe is connected by a tube filled with water to a mechanical part of the robot. Force is what causes the part to move.

Linear to Rotational Motion

The Fluid Power Car is an example of reciprocal linear motion being converted into rotary motion. The syringe being pulled back and forth – the reciprocal linear motion – is converted to rotary motion – the wheels – thanks to two one-way bearings and a rack-and-pinion gear train. The car's gear train features a top and bottom rack on the axle with the one-way bearings, so the linear motion moves in one direction no matter which direction the syringe plunger goes.



Materials Included

- Bag of laser-cut parts
- CD Hub & Bearing Set (only hubs and screws will be used)
- 2 metal one-way bearings
- 4 – 1/4" x 1/2" nylon spacers
- 4 – 3/8" x 5/8" nylon spacers
- 4 – 1" screws
- 2 – 3/8" screws
- 1" wooden dowel
- 4 nylon axle bushings
- 2 axles
- 2 wide rubber bands
- 12 cc syringe
- 6 cc syringe
- Flexible tubing
- Piece of thread

Items Required (not included)

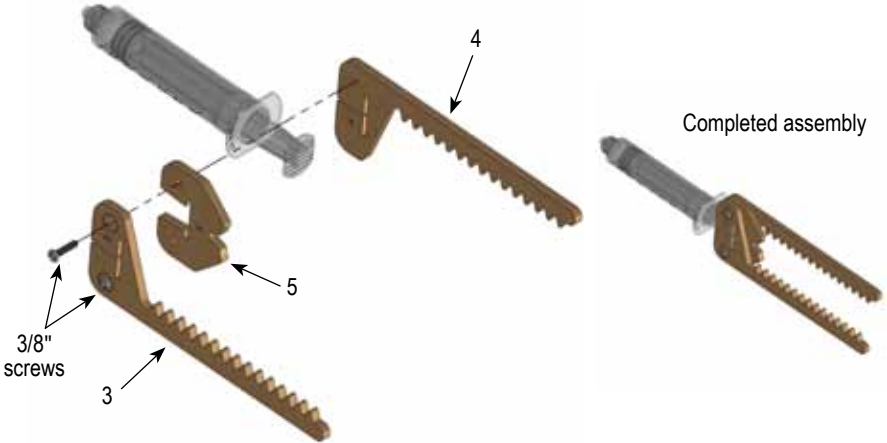
- Small Phillips screwdriver
- Sturdy scissors or wire cutters
- White glue (such as HD Bond II) or CA glue
- File or emery sandpaper/cloth
- Small pliers (optional)
- Cup of water

Building the Car

1. Open the bag of laser-cut parts. Pop out any interior pieces that need removed.
2. Using wire cutters trim off two edges of the 6 cc syringe plunger as shown.
3. Place the syringe plunger into the slots of the Part 4 with the two circles on it (they should face away from the plunger). Make sure the trimmed edges of the plunger are facing up and down, not side to side.

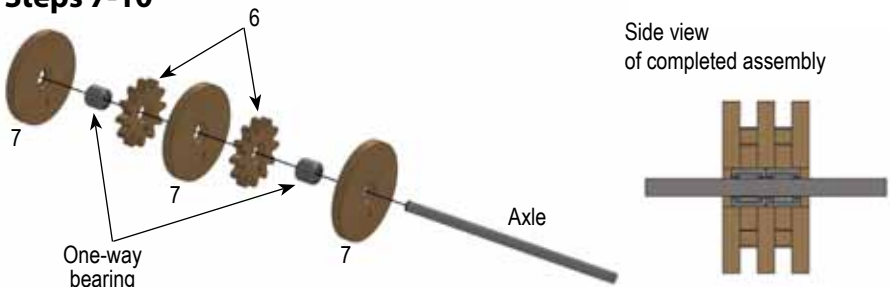


Steps 3-5



4. Place Part 5 over the plunger.
5. Place Part 3 on top of that so the two saw edges of Parts 3 and 4 face each other. Insert the 3/8" screws from the side with the two circles. This is the gear train assembly.
6. Using sandpaper or a file, file off any rough edges on the ends of the axles.
7. Place a one-way bearing on the axle and notice how it will spin in only one direction and that a tiny arrow on the side indicates this. Remove the bearing.

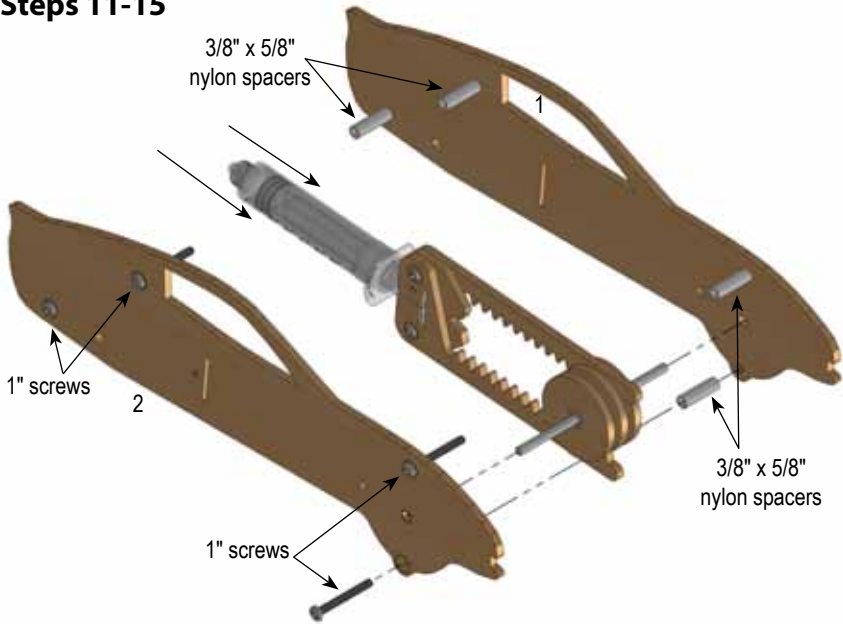
Steps 7-10



8. Lay the two Part 6s on a flat surface and center the bearings inside these. Make sure both bearings spin in the same direction.
9. Place one Part 7 over a Part 6. Pick this up and place the other Part 6 on the other side so Part 7 is sandwiched between the other two pieces. Make sure to keep the bearings spinning in the same direction.
10. Insert an axle through the bearings and center it. Place a Part 7 on each side of the bearing assembly.

11. Take Part 1 and insert the front axle bearing assembly into the large hole toward the nose of the car. Be sure the bearings are positioned so that they spin forward.
12. Place Part 2 on the other side of the axle as shown.

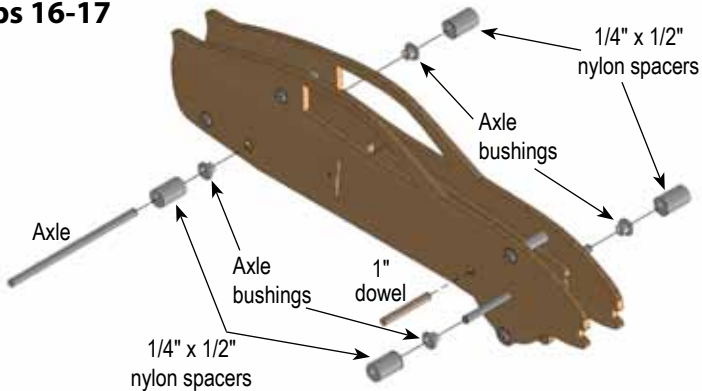
Steps 11-15



13. Holding the parts together, insert a 5/8" nylon spacer between the holes under and above the front axle. Tighten these with a 1" screw, making sure to put them in from the Part 1 with the circles. **Tip:** This may be easier to do if you hold the spacer with a small pair of pliers.
14. Take the gear train assembly and place it into the car body so the top gear rack is over one gear (Part 6) and the bottom gear rack is under the other gear. Make sure the syringe lips are inserted into the slots on the Parts 1 and 2.
15. Insert the remaining two 5/8" nylon spacers into the remaining circled holes of the Part 1. Secure them with the 1" screws.

16. Insert the nylon axle bushings on both sides of each axle hole. Insert the second axle into the back hole.

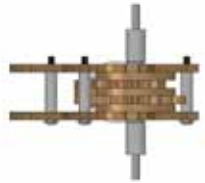
Steps 16-17



Top view of completed assembly



Side view of completed assembly



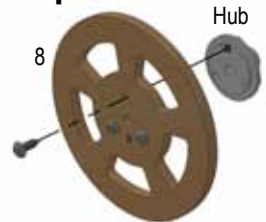
17. Insert the small dowel in the hole behind the front wheel. Glue this in place on only one side of the car body. Place a 1/2" nylon spacer on each end of the axles.

18. Find the four Part 8s – these are the wheels. Remove the hubs from the plastic front. Holding a hub on one side of a wheel, screw in three of the hub/bearing set screws to hold them together. Repeat with the other three hubs and wheels.

Note: For extra traction, carefully stretch the two big rubber bands over the edges of the front wheels before attaching them.

19. Carefully press a wheel on each axle end. If the hubs feel loose on the axle, remove the wheels and insert a small piece of thread through the hub and reattach.

Step 18



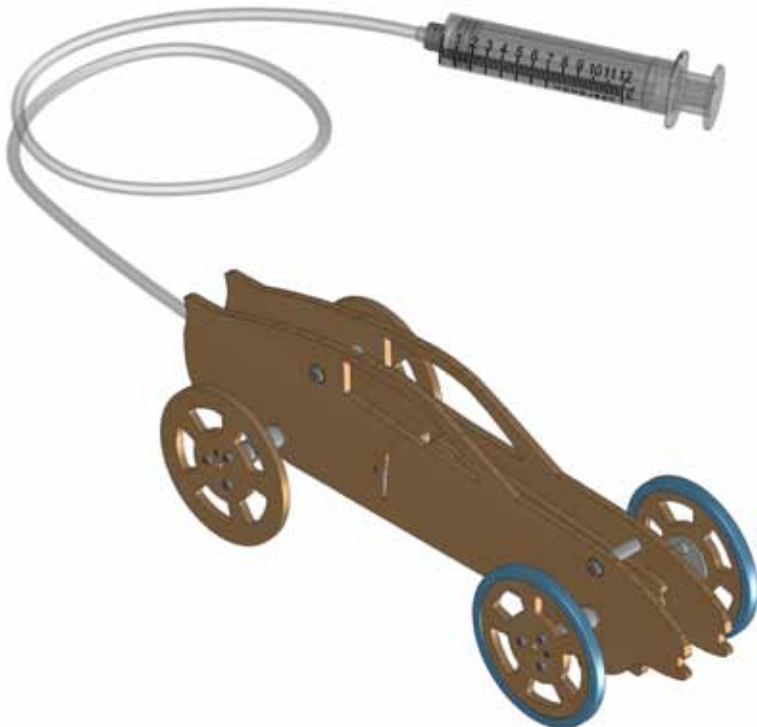
Powering the Car

1. Make sure the 6 cc syringe on the car is completely depressed.
2. With the 12 cc syringe depressed, insert its tip into the cup of water and pull back the plunger to fill the syringe. Attach the tubing to the end and depress the syringe to fill the tubing with water.
3. Attach the other end of the tubing to the syringe on the car body. Remove the 12 cc syringe and refill it to the 10 cc line. Attach it again to the tubing.
4. To operate the car, set it on a flat surface such as the floor, counter, or tabletop. Depress the 12 cc syringe plunger and then pull it back out – continue to do this to make the car move forward.

Step 2



Completed Car



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E D U C A T I O N

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