

B-Bot Biped Bot

User Guide



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EDUCATION

60073 V0113

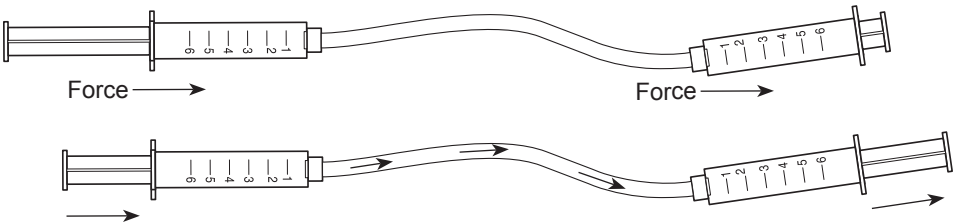
Cautionary and Warning Statements

- 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

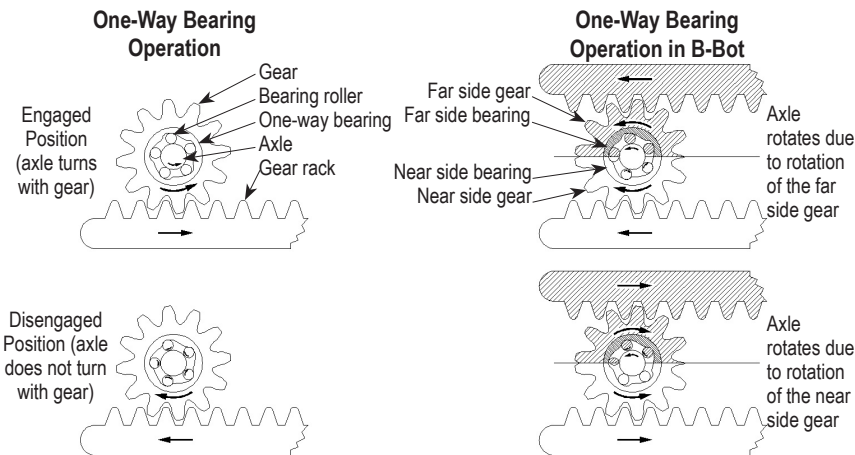
A hydraulic system is one that uses fluid as a force. The principle behind a hydraulic system is simple: Force applied at one point is transmitted to another point using a fluid.



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 B-Bot, 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 B-Bot 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 into rotary motion – the gears and hubs moving the legs – thanks to two one-way bearings and a rack-and-pinion gear train.



The gear train features a top and bottom rack on the axle with the one-way bearings, so the linear motion moves the B-Bot forward no matter which direction the syringe plunger goes.

Materials Included

- Bag of laser-cut parts
- 12 cc and 6 cc syringe
- Tubing
- Hub and bushing set
- Axle
- 2 one-way bearings
- 4 spacers
- 4 – 1" screws
- 2 – 1/2" screws
- 7 – 3/8" screws
- 2 bushings
- 2 – #6 flanged spacers
- 4 – #2 flanged spacers
- Piece of thread

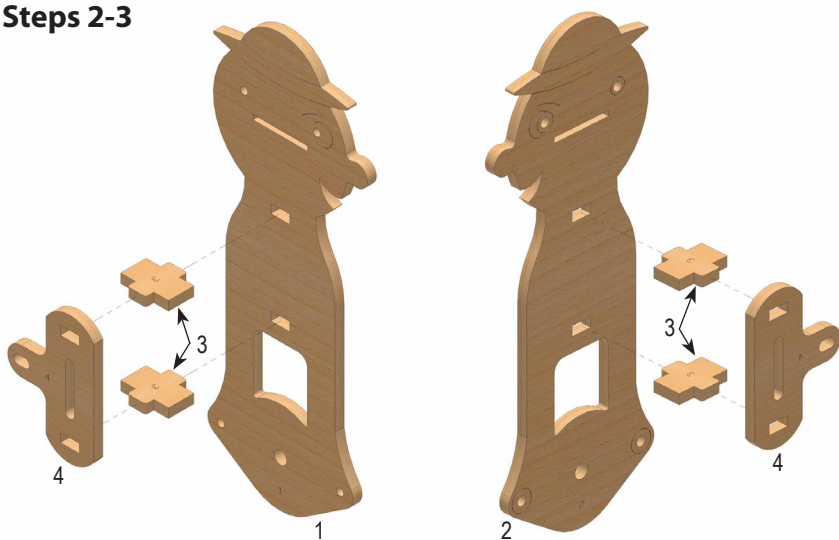
Items Required (not included)

- CA or white glue (such as HD Bond II)
- Small Phillips screwdriver
- File or emery sandpaper/cloth
- Wire cutters
- Small pliers (optional)

Building the B-Bot

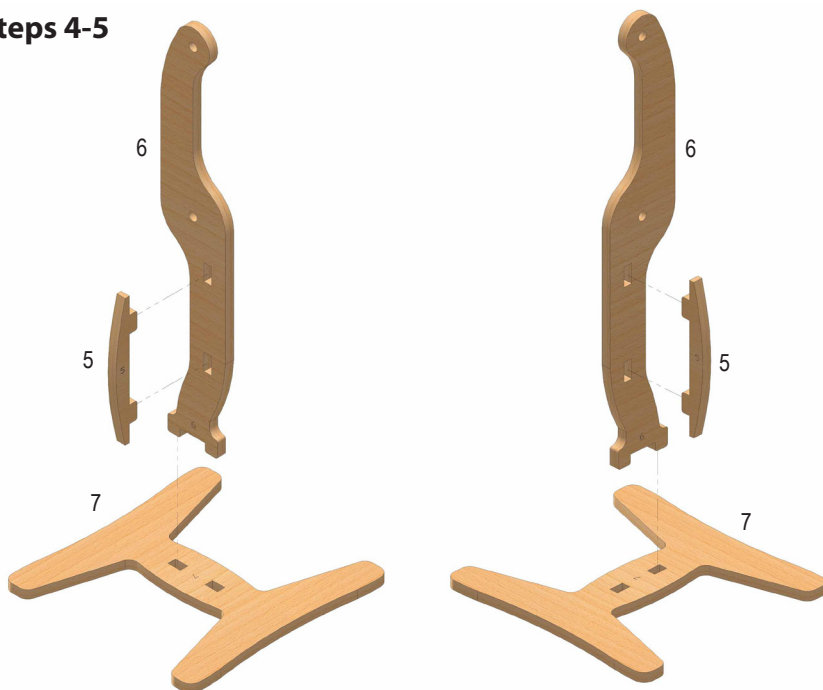
1. Open the bag of laser-cut parts. Pop out any interior pieces that need removed.
2. Lay Parts 1 and 2 flat with the number side facing up. Glue the Parts 3 into the center slots of 1 and 2 as shown.
3. Place a Part 4 on top of the 3s on each side. The “knob” should point toward the man’s back. Let dry.

Steps 2-3



4. Lay Parts 6 flat with the number side facing up. Glue a Part 5 lengthwise into each Part 6 in the two small slots.
5. Lay Parts 7 flat with the number side facing up. Glue the slotted end of each Part 6 into a 7. Making sure these stay straight, let dry. These are the legs.

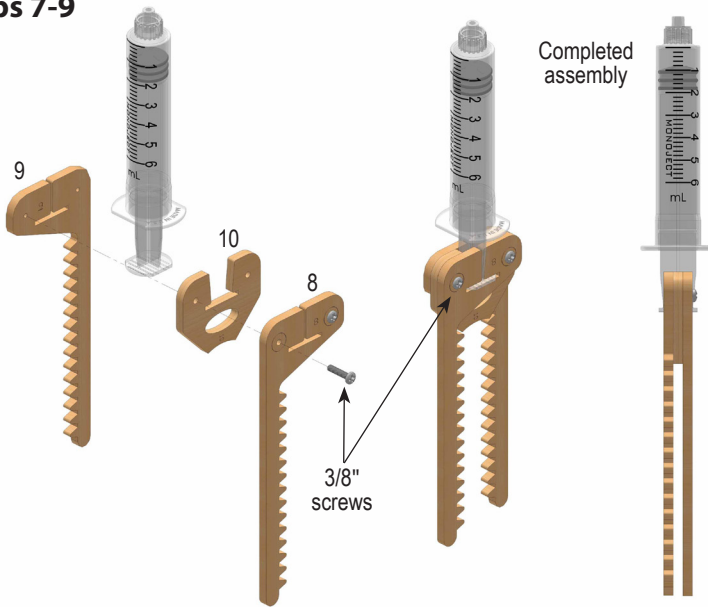
Steps 4-5



6. Using wire cutters, trim off two edges of the 6 CC syringe plunger as shown.
7. Place the syringe plunger into the slots of the Part 9 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.
8. Place Part 10 over the plunger.
9. Place Part 8 on top so the two saw edges of Parts 8 and 9 face each other. Insert two 3/8" screws from the side with the two circles. This is the gear train assembly.



Steps 7-9



10. Using a file or sandpaper, file off any rough edges on the ends of the axle. 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.

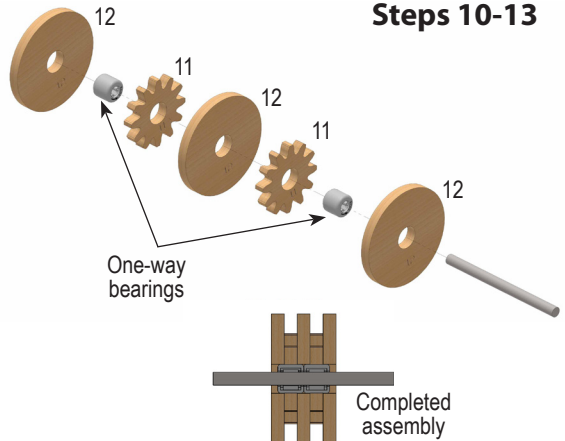
11. Lay the two Part 11s on a flat surface and center the bearings inside these so both bearings will spin in the same direction.

12. Place one Part 11 over a Part 12. Pick this up and place the other Part 11 on the other side so Part 12 is sandwiched between the other two pieces.

Make sure to keep the bearings spinning in the same direction.

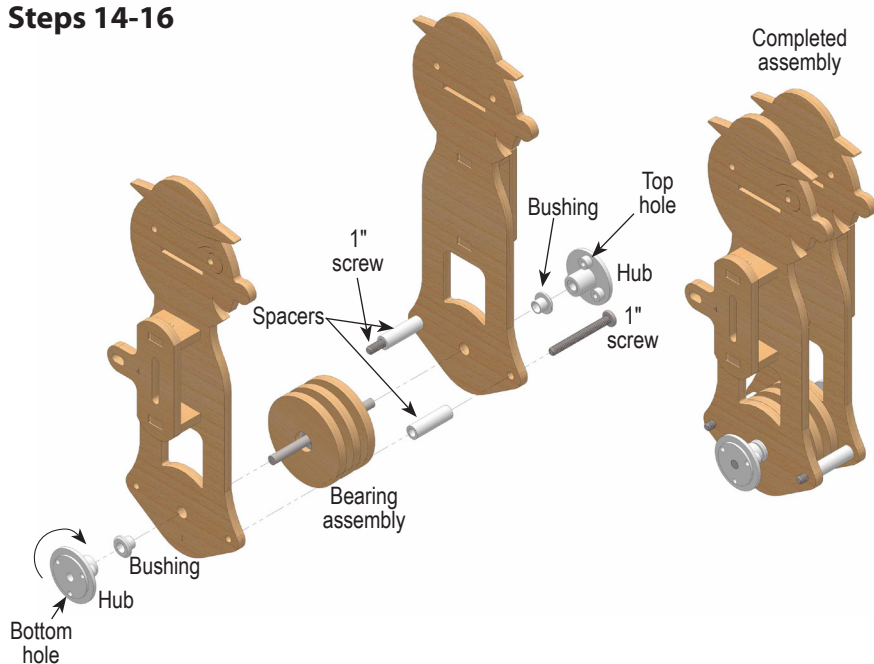
13. Insert an axle through the bearings and center it. Place a Part 12 on both sides of the bearing assembly.

Steps 10-13



14. Insert two bushings in the holes at the bottom of Parts 1 and 2. Place the bearing assembly between Parts 1 and 2, inserting the axle ends in the holes with the bushings.
15. Place two of the spacers between Parts 1 and 2 aligned with the two holes in the torso. Insert 1" screws from the side of Part 2 to secure. **Tip:** It may be easier to hold the spacers with the pliers to do this.

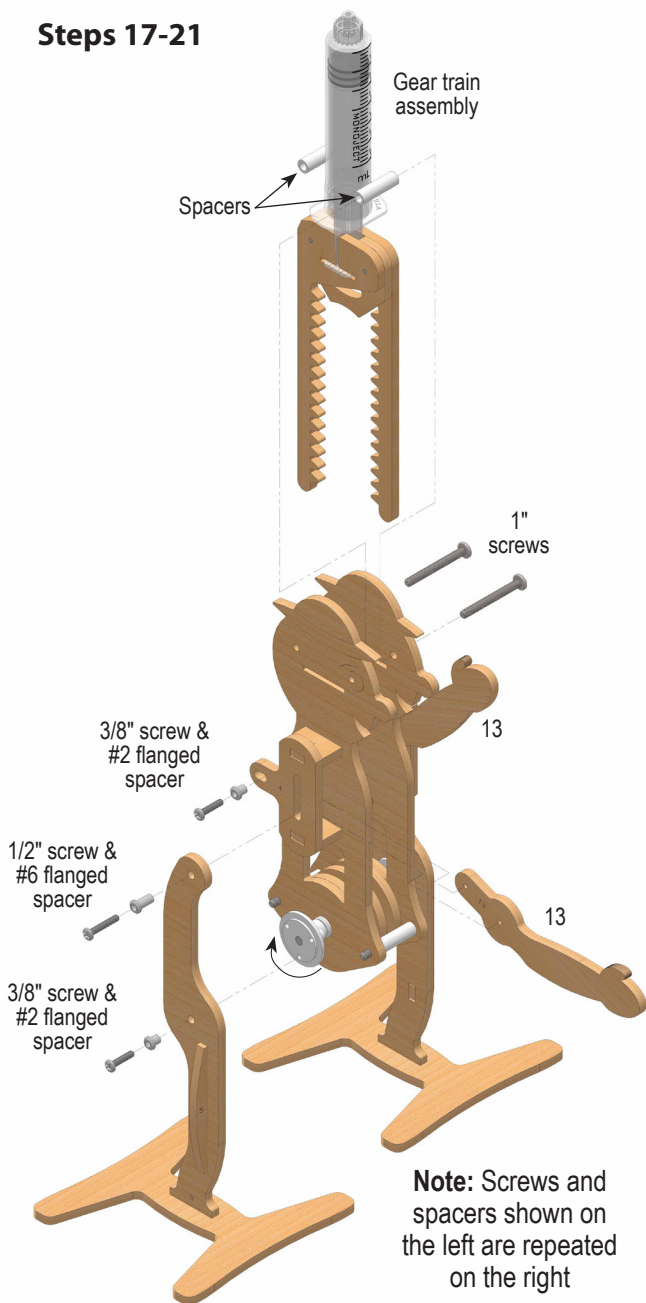
Steps 14-16



16. Note that each hub has three holes. Place a hub on each side of the axle so that one side has a hole at the top and the other has a hole at the bottom (see photo above). If the hubs feel loose on the axle, remove the hubs and insert a small piece of thread through the center hole on the hub and reattach.
17. Insert the gear train assembly, gear rack first, down into the man's torso as shown. Make sure each gear rack engages one gear (Part 11). Make sure the syringe lips are inserted into the slots on Parts 1 and 2.
18. Place the other two spacers between the holes in the head and secure them with the 1" screws as shown. Reach in and move the gear train up and down – the hubs should spin forward.

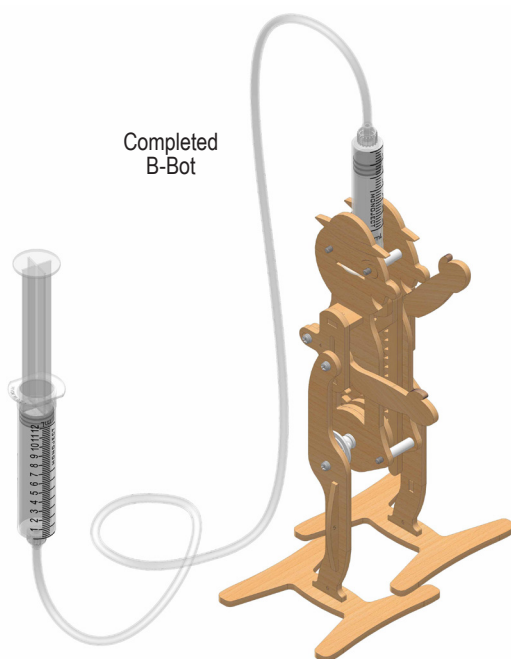
19. Through the middle hole, attach a leg to each hubs with 3/8" screws so that you are screwing into the top and bottom holes pointed out earlier. After doing this, make sure the holes still point in opposite directions. If they aren't, use the pliers to twist them in place.
20. Place Parts 13 (the arms) under the Parts 4 on each side of the torso. Using 1/2" screws, secure these through the holes at the top of the legs (three parts will be held together on each side). Be sure its snug but the arms can move.
21. With 3/8" screws, fasten each Part 13 arm to the hole on the Part 4 knobs.

Steps 17-21



Powering the B-Bot

1. Make sure the 6 cc syringe on the B-Bot 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 B-Bot. Remove the 12 cc syringe and refill it to the 10 cc mark. Attach it again to the tubing.
4. To operate the B-Bot, 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 B-Bot move forward.



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