

## LESSON 1

### **Assembling the Gearbox**

These are the first steps to enjoying your new Pi-Bot kit. Follow the directions and you'll be ready to program it in no time! The first lesson covers the building of the gearbox which will power your Pi-Bot.

#### Identification of the Gearbox Parts

1. Your Pi-Bot comes in a specially-designed package. Locate and open the box for the Double Gearbox kit. You should have three bags of parts and a gearbox housing, as shown in figure 1.1.



*Figure 1.1*

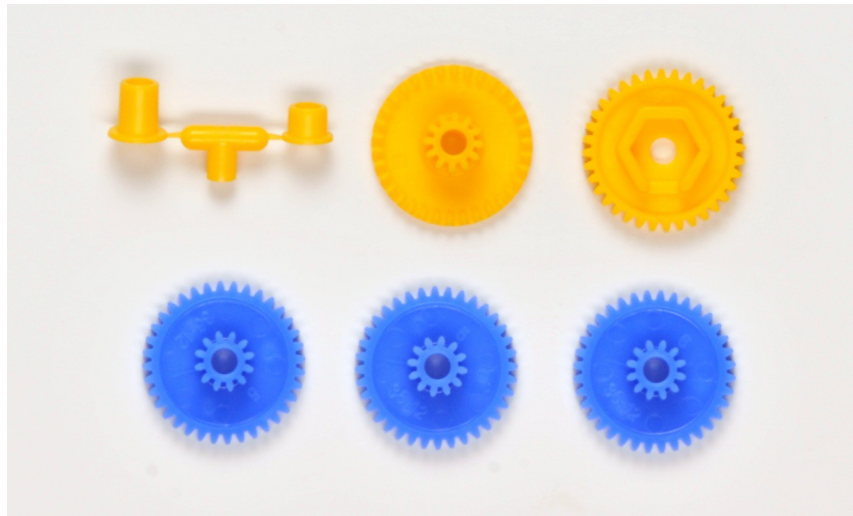
2. Open the bag of hardware, as shown in figure 1.2, and verify its contents.



*Figure 1.2*

- Two (2) electric motors (wires may already be attached)
- Two (2) hex shafts approximately 15mm in length
- Two (2) smooth shafts approximately 28mm in length
- Two (2) brass gear hubs 7mm in length
- Two (2) 4mm spacers
- One (1) hex wrench
- One (1) tube of grease
- One (1) package containing:
  - Six (6) self-tapping screws approximately 17mm in length
  - Two (2) tapping screws approximately 8mm in length
  - Two (2) screws and nuts
  - Nine (9) brass eyelets
  - Three (3) grub screws (set screws)
  - Two (2) motor purple pinion gears

3. Open one of the bag of gears, as shown in figure 1.3, and verify its contents.

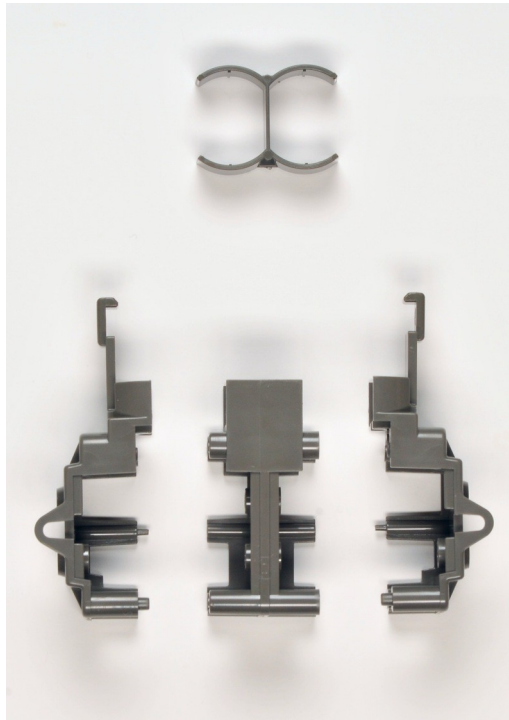


*Figure 1.3*

- One (1) yellow crown gear
- Three (3) blue 2-step gears
- One (1) yellow final gear
- Two (1) yellow long spacers and two short spacers (may be attached)

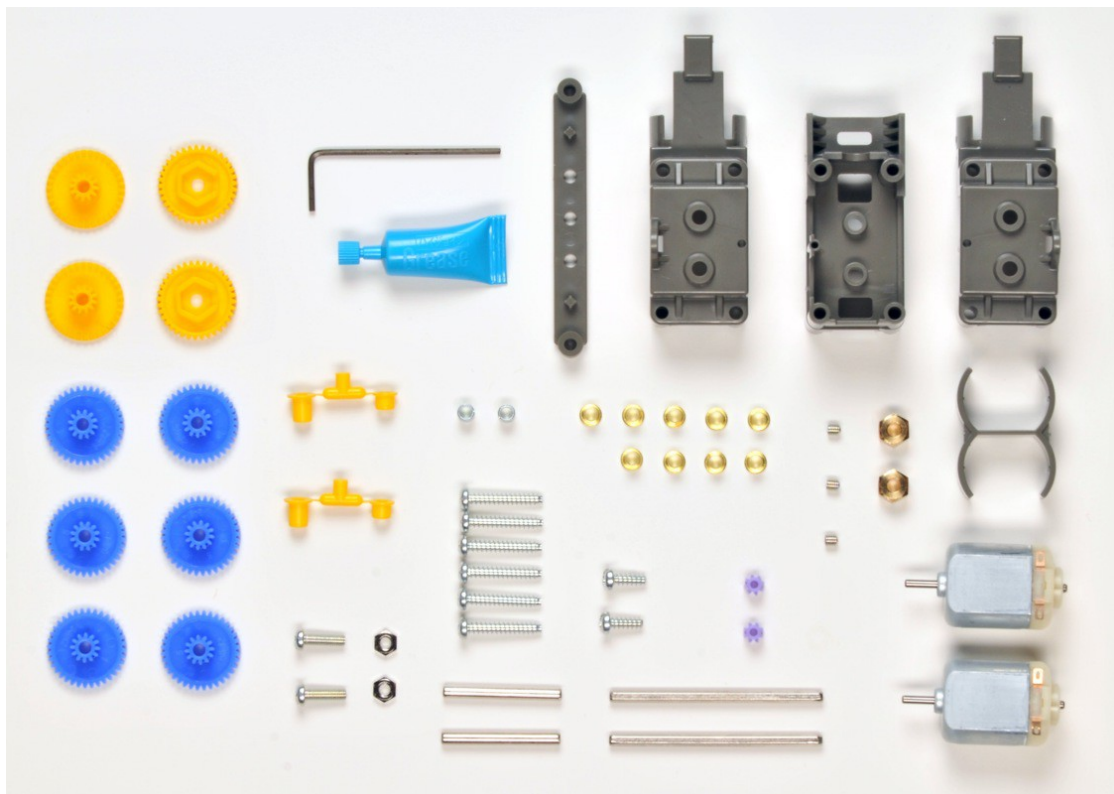
4. Open the second bag of gears and again verify its contents.

5. Identify the gearbox housing, as shown in figure 1.4.



*Figure 1.4*

6. Organize the parts for ease of assembly. Identify that all parts are present, as shown in figure 1.5.



*Figure 1.5*

7. Use figure 1.6 to help you recognize the different types of gears included.

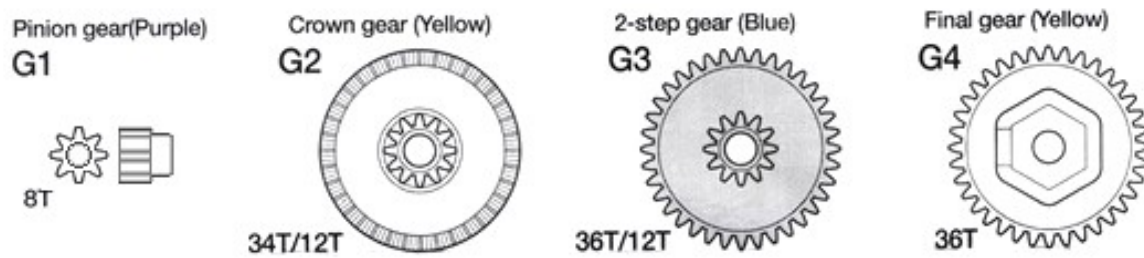


Figure 1.6

### Assembly of the Gearbox

1. Press a yellow bushing onto each the smooth shafts, as shown in figures 1.7 and 1.8. There should be 3mm of exposed shaft from the flanged side of each bushing. Set aside temporarily.

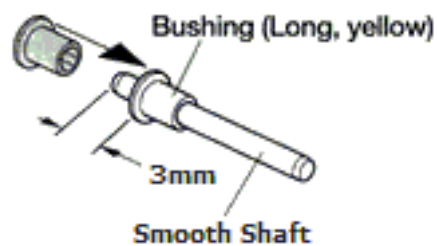


Figure 1.7

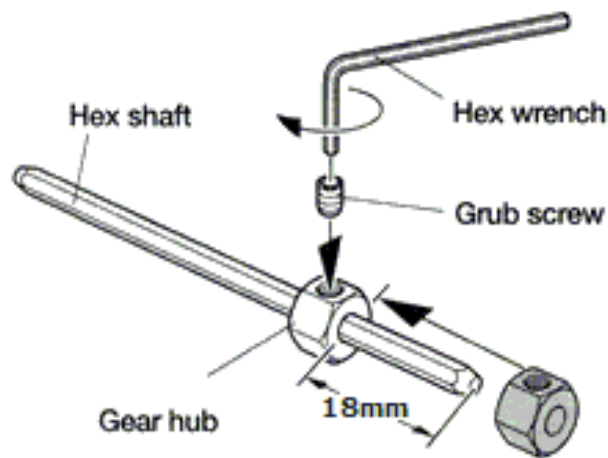


Figure 1.8

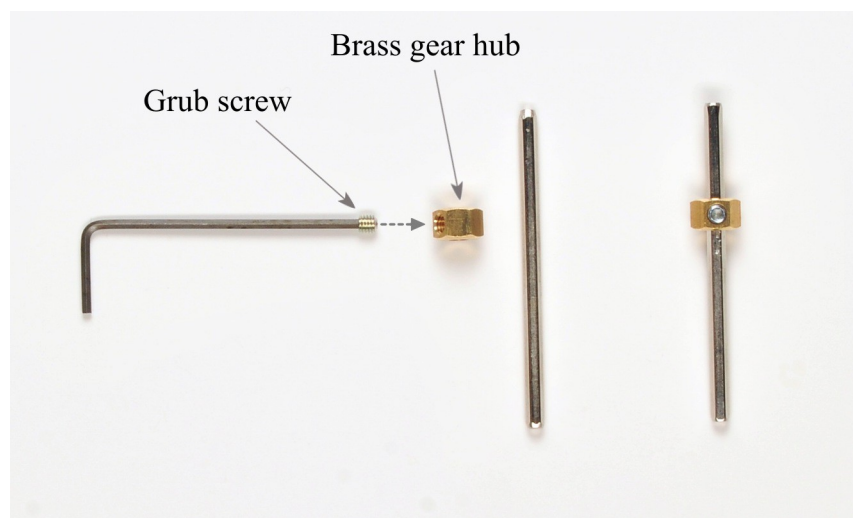
2. Locate the right side of the housing.



3. Place a gear hub on each of the hex shafts approximately 18mm from the end and secure with a Grub screw. Do not over-tighten as actual position will be adjusted later. See figures 1.9 and 1.10.



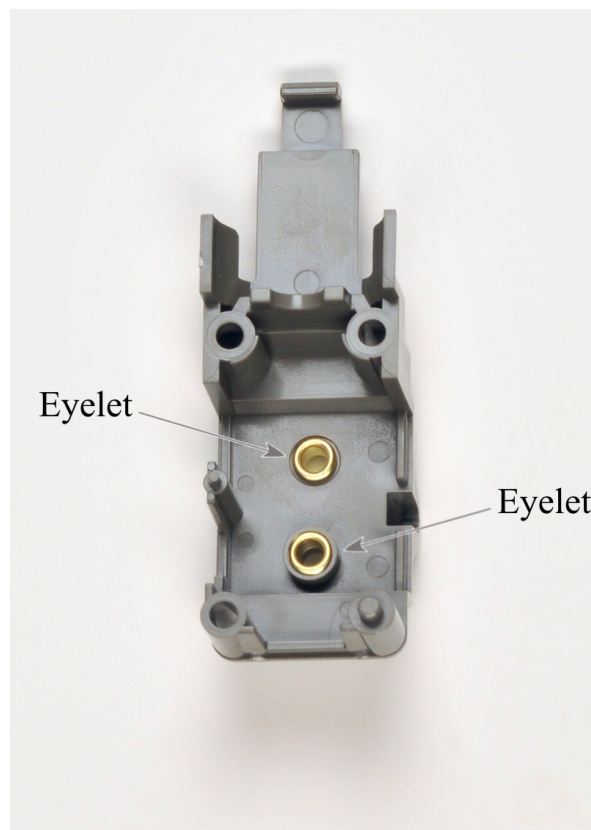
*Figure 1.9*



*Figure 1.10*

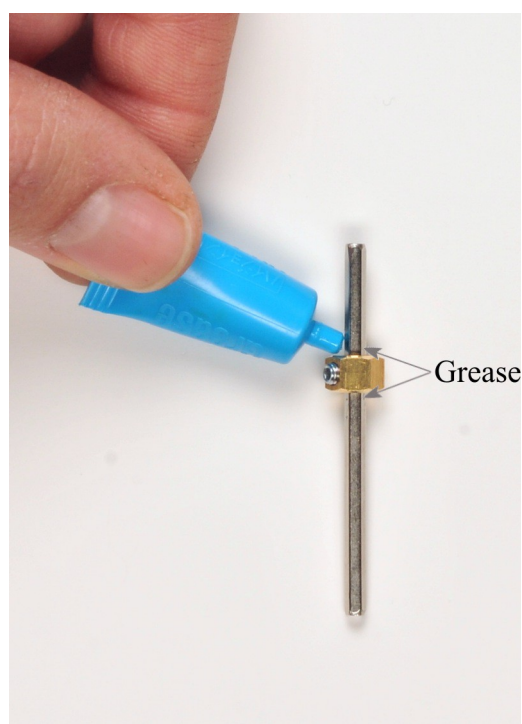
4. Twist off the top of the tube of grease. Save the top as it can be used to seal the tube.

5. Place two eyelets into the inside center holes of the right side of the gear housing, as shown in figure 1.11.



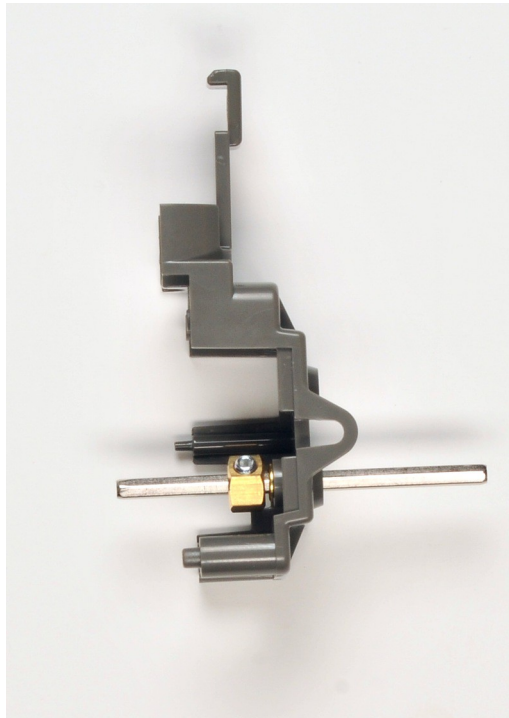
*Figure 1.11*

6. Carefully apply a small amount of grease to the hex shaft next to both sides of the gear hub, as shown in figure 1.12.



*Figure 1.12*

7. Insert the 26mm (longer) end of hex shaft into the rear eyelet, as shown in figure 1.13.



*Figure 1.13*

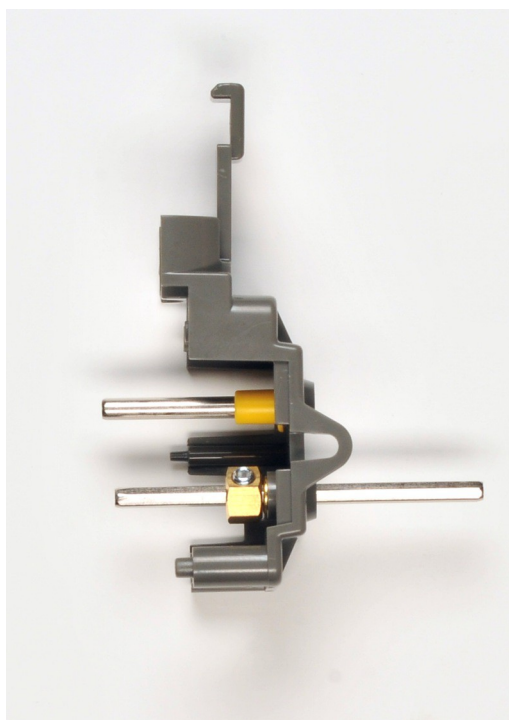
8. Locate the smooth shaft assembly and apply a small amount grease to the 3mm end, as shown in figure 1.14.



*Figure 1.14*



9. Insert the 3mm (shorter) end into the remaining eyelet on the gearbox housing, as shown in figure 1.15.

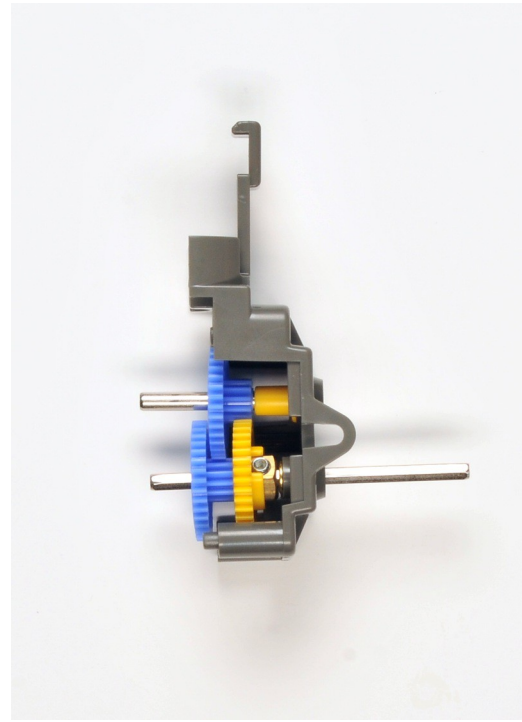


*Figure 1.15*

10. Insert a yellow final gear onto the hex shaft such that the hub of the gear encloses the gear hub. See figure 1.16.
11. Apply a small amount of grease to both of the exposed shafts on the inside part of the gearbox housing, as shown in figure 1.16.  
  
Note: Do not apply grease to the outside portion of the hex shaft where the wheel will be attached.
12. Place a blue 2-step gear onto the smooth shaft such that the small diameter gear mates with the yellow final gear.
13. Place second 2-step gear on the hex shaft such that the smaller diameter mates with the larger diameter gear from the first 2-step gear, as shown in figure 1.17.

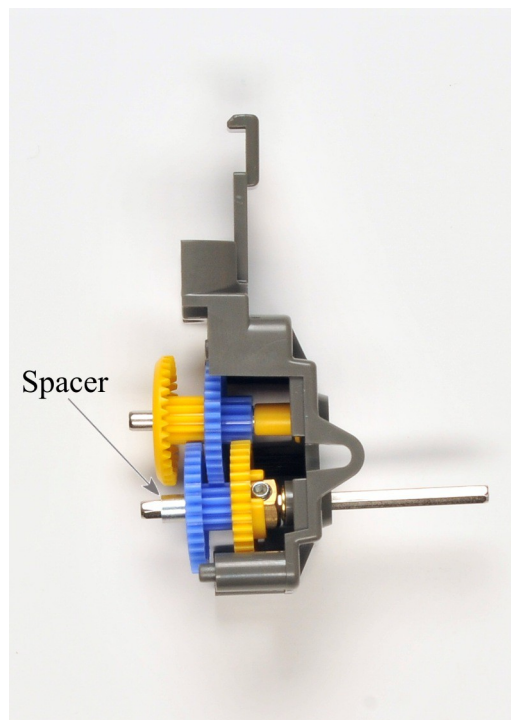


*Figure 1.16*



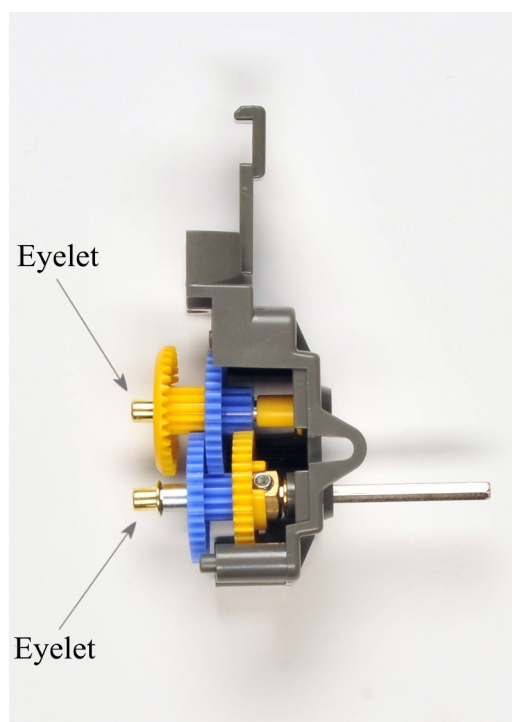
*Figure 1.17*

14. Place the crown gear on the smooth shaft such that the small diameter gear mates with the larger diameter gear of the second 2-step gear, as shown in figure 1.18.
15. Place one 4mm spacer onto the hex shaft, as shown in figure 1.18.



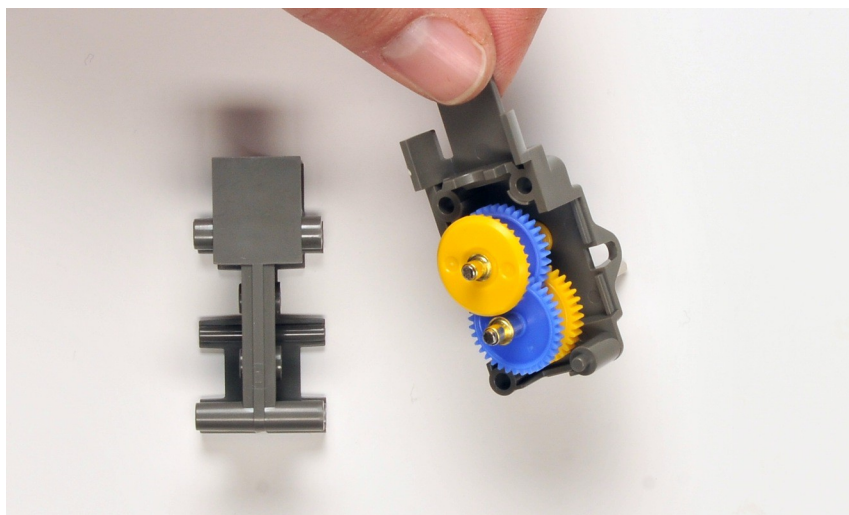
*Figure 1.18*

16. Place an eyelet onto both the smooth and hex shaft, as shown in figure 1.19.

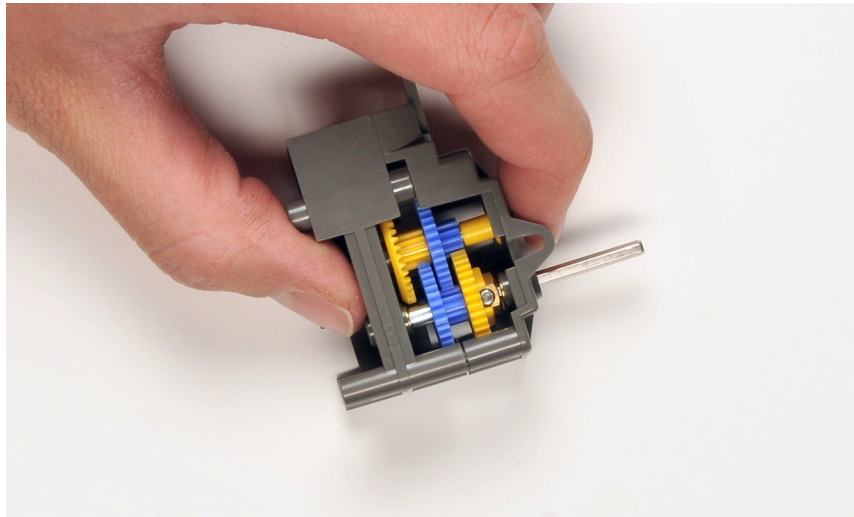


*Figure 1.19*

17. Holding the gear assembly so the shafts are vertical, attach the center section of the gearbox housing to the gear assembly, as shown in figures 1.20 and 1.21.



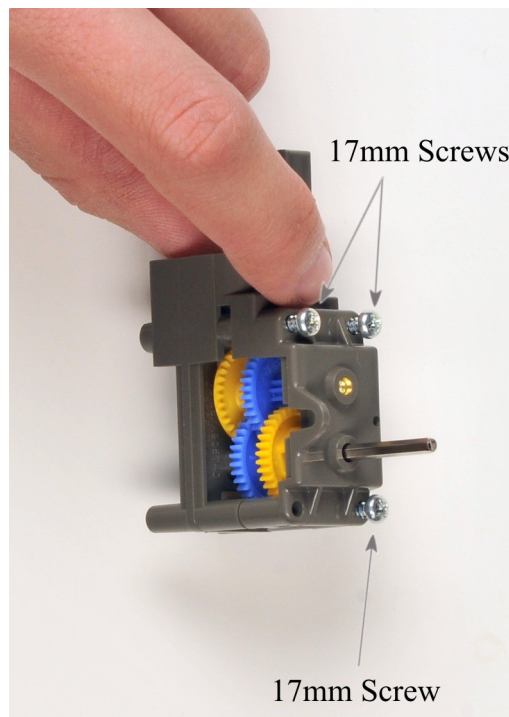
*Figure 1.20*



*Figure 1.21*

18. After ensuring that the gearbox housing parts are mated correctly, locate and insert three 17mm self-tapping screws to hold the assembly together, as shown in figure 1.22. The screws should be tightened and snug.

**CAUTION – Do not over-tighten the screws!**



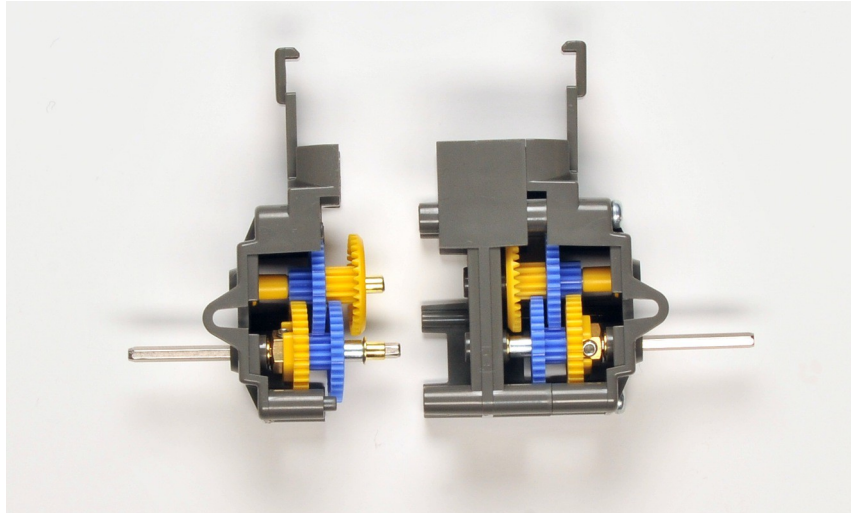
*Figure 1.22*

**CAUTION –** There appear to be four screw holes, but only three are used. The rear upper hole is for alignment only. Inserting a screw into this location will damage the housing.



19. The right side of your gear housing is now finished!

20. Repeat steps 2-18 for the left side of the housing. The completed left side of the gear assembly is shown in figure 1.23

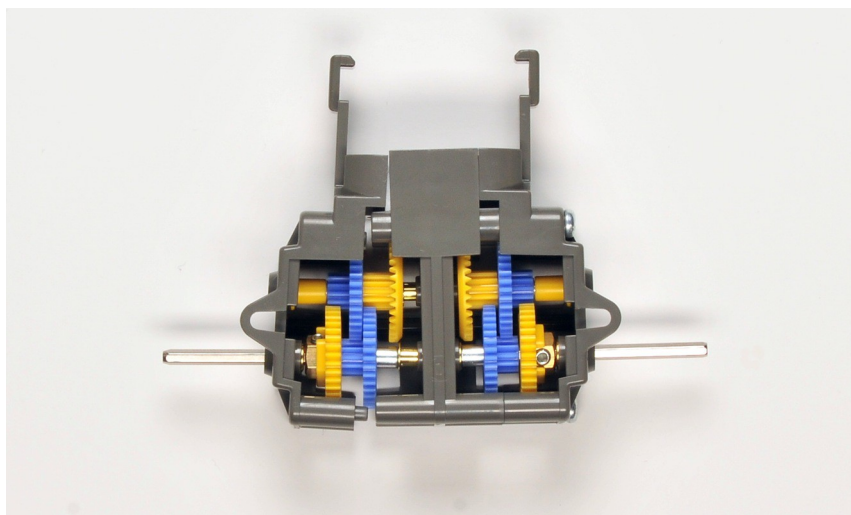


*Figure 1.23*

21. Verify that both sides of the housing are mated to the center correctly.

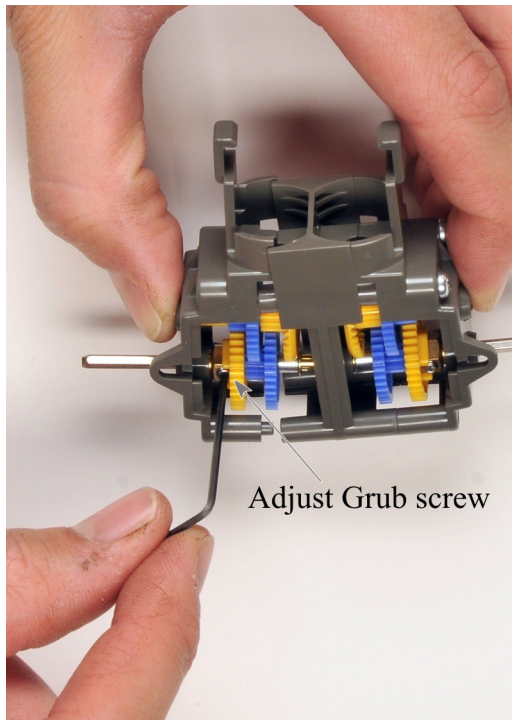
**CAUTION – Do not force both halves of the housing together.**

22. The left side of the housing may not close correctly, as shown in figure 1.24. Do not force together. Instead, while holding the two parts together, use the hex wrench to loosen the left side Grub screw. See figures 1.25 and 1.26. This will allow the two parts to mate properly. Continue to hold the two housing part together. Tighten both Grub screws.

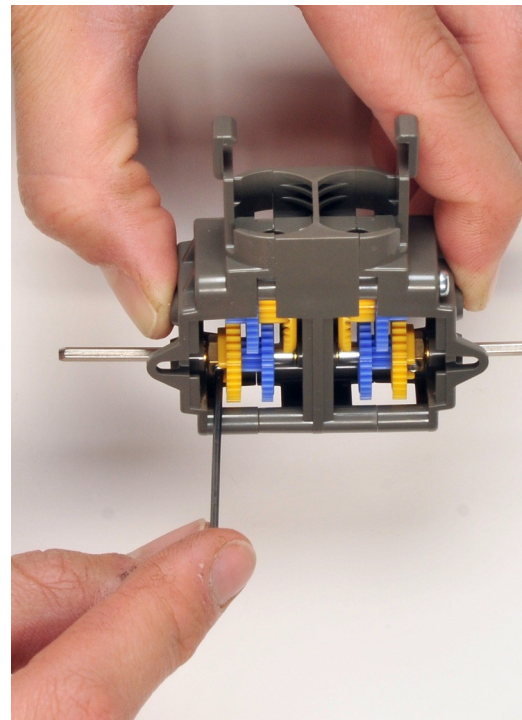


*Figure 1.24*



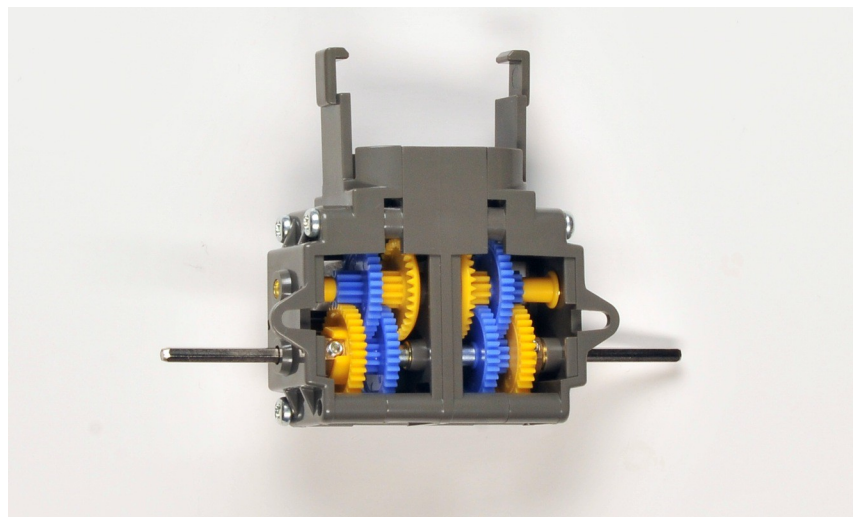


*Figure 1.25*



*Figure 1.26*

23. The completed both sides of the gearbox housing is shown in figure 1.27



*Figure 1.27*

24. Attach a purple pinion gear on to each of the two motor shafts, as shown in figure 1.28. Do not push on the motor body. Support the opposite end of the shaft, as shown in figure 1.29.



Figure 1.28

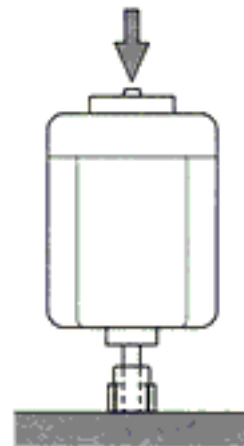


Figure 1.29

25. Install the motors into the front of the gear assembly making sure that the electrical contacts face outward. See figures 1.30 and 1.31.

Note: If wires are already attached to motors, place the motor with orange wires to the left side of the gearbox and the motor with brown wires to the right side.

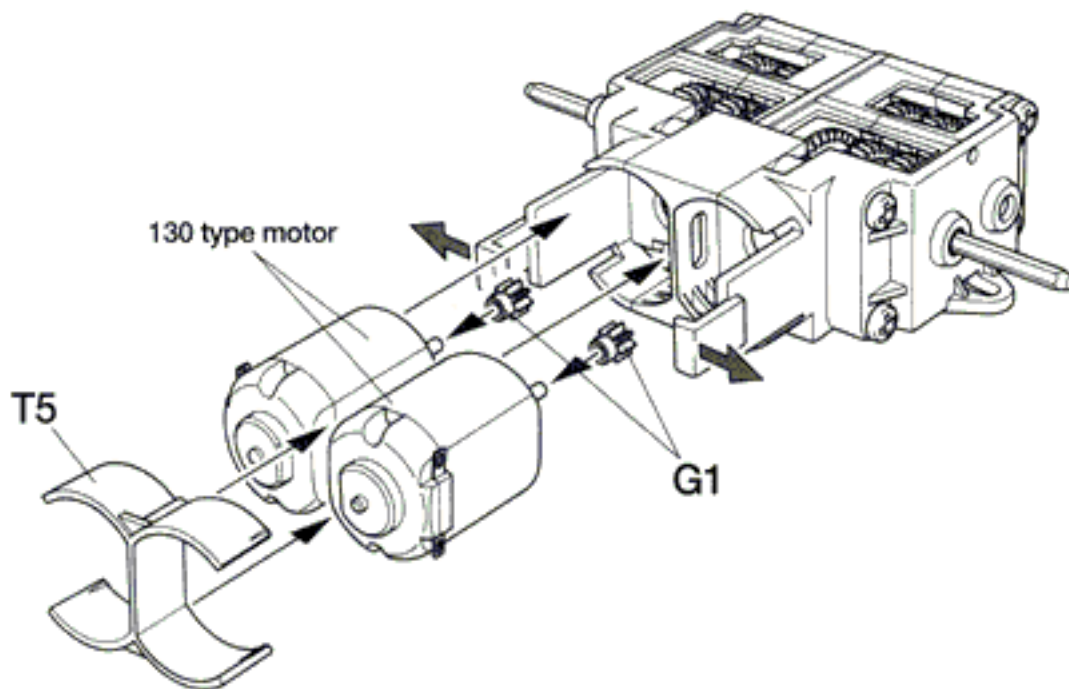
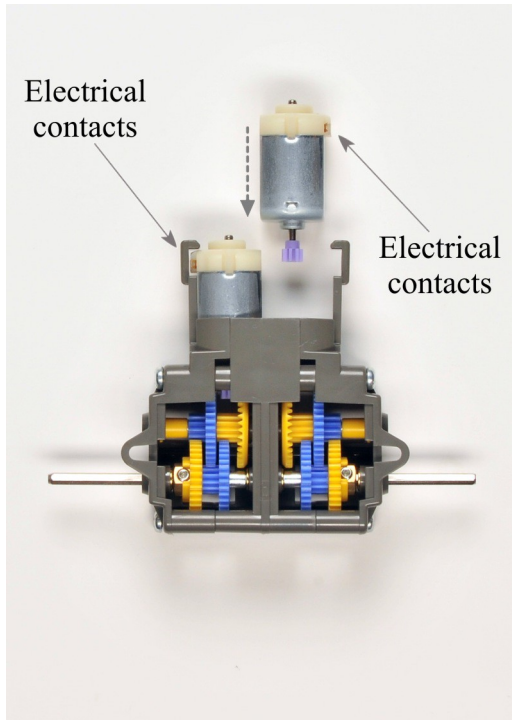
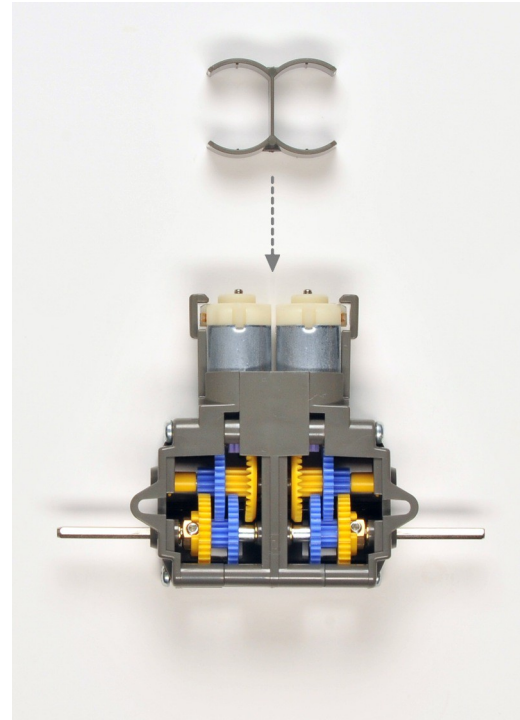


Figure 1.30



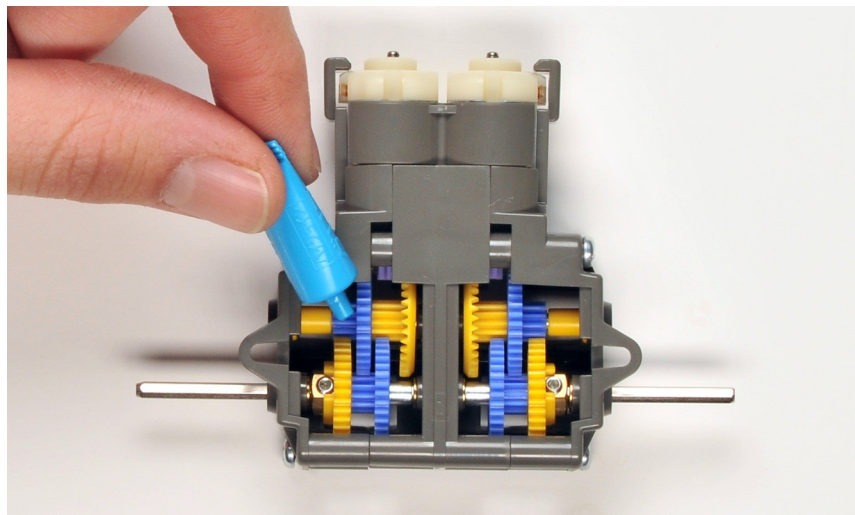
*Figure 1.31*



*Figure 1.32*

26. Slip on the motor retaining band (T5) in between the motors, as shown in figures 1.30 and 1.32.

27. Lastly, apply grease to all of the gears, as shown in figure 1.33



*Figure 1.33*

CONGRATULATIONS, your gearbox assembly is complete! You may test your completed gearbox with a 3-volt power source.

Note: You should have some leftover parts even though the gearbox is complete. These spare parts may be saved for future projects.