SWYFT Ascend V2 Elevator: Assembly Guide

This guide covers building the SWYFT Ascend FRC Telescoping Elevator V2. The steps show the two-stage build. The one-stage build uses the same parts minus the inner tube and ropes. Notes marked **One-stage build** tell you what to skip, and the One-stage build section at the end sums it up.

SKU	`SR-ASCEND-V2`
Stages	Ships with parts for two stages. Build it as one or two stages.
Collapsed length	8 in to 47 in, set by how you cut the tubes
Drive	1/2 in hex axle. Motor and gearbox not included.



Two-stage, retracted Two-stage, extended One-stage, retracted One-stage, extended

One-stage or two-stage?

- **One-stage:** a pure rack-and-pinion elevator with no rope to deal with. Choose it when you need a higher load and don't need as much extension.
- **Two-stage:** adds the inner tube and two ropes. Choose it when you need a lot more extension.

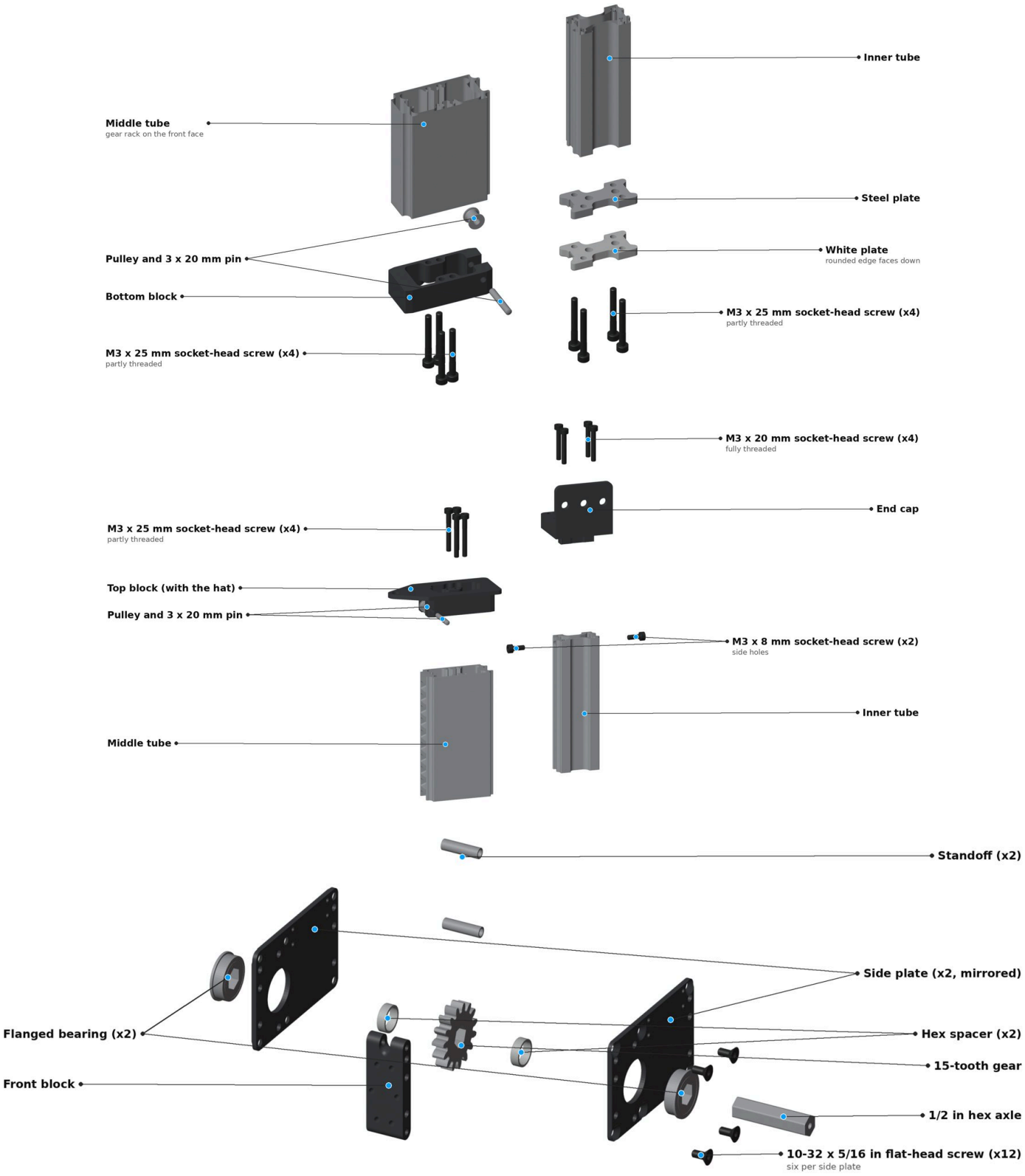
Tools and supplies

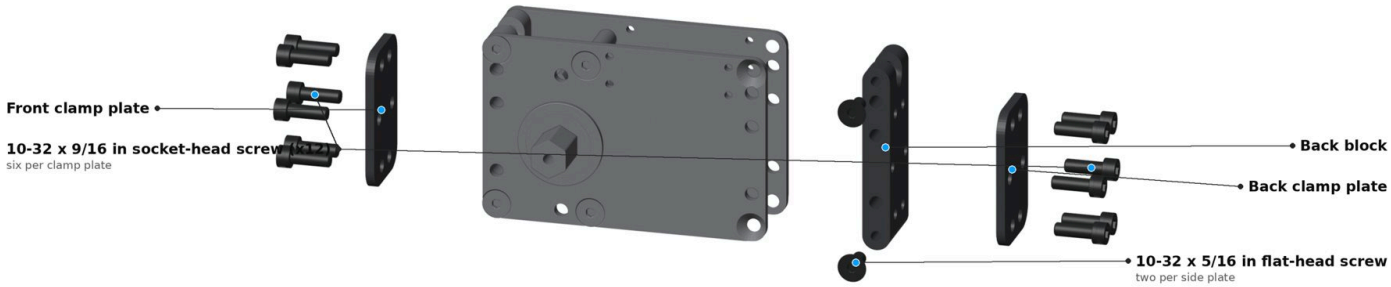
Item	Notes
1/8 in Allen key, 5/32 in Allen key, 2.5 mm Allen key, 2.5 mm driver bit	Included
Drill or driver	For the M3 and 10-32 screws. Use a low clutch setting.
Saw for aluminum	A chop saw works well for cutting the tubes
Tape measure and marker	For marking the tubes and ropes
Pliers	For pulling the rope through small holes
Blue Loctite	For the screws noted in the steps
Grease	For the ball channels in step 20. White lithium grease works well.
Small mallet	Only if a bearing won't go in by hand (step 11)

Before you start

- **Pick your lengths first.** Use the Extension Lengths Calculator on the product page. It gives the cut length for each tube and the total extended length, which sets the rope length.
- **Watch the assembly video.** It's on the product page.
- **Front and back.** The **front** is the side with the gear and the gear rack. The **back** is the opposite side.
- **Steel balls.** The balls come in numbered bags, and each slot takes one full bag. There are extra bags in case you drop some.
- **Keep loaded stages upright.** Once the balls are in, tipping a stage over dumps them out. They're held in for good once the gearbox screws go in (step 15).

Parts


Inner tube
Middle tube
gear rack on the front face
Steel plate
White plate
rounded edge faces down
Pulley and 3 x 20 mm pin
Bottom block
M3 x 25 mm socket-head screw (x4)
partly threaded
M3 x 25 mm socket-head screw (x4)
partly threaded
M3 x 20 mm socket-head screw (x4)
fully threaded
End cap
M3 x 25 mm socket-head screw (x4)
partly threaded
Top block (with the hat)
Pulley and 3 x 20 mm pin
M3 x 8 mm socket-head screw (x2)
side holes
Inner tube
Middle tube
Standoff (x2)
Side plate (x2, mirrored)
Flanged bearing (x2)
Hex spacer (x2)
15-tooth gear
Front block
1/2 in hex axle
10-32 x 5/16 in flat-head screw (x12)
six per side plate

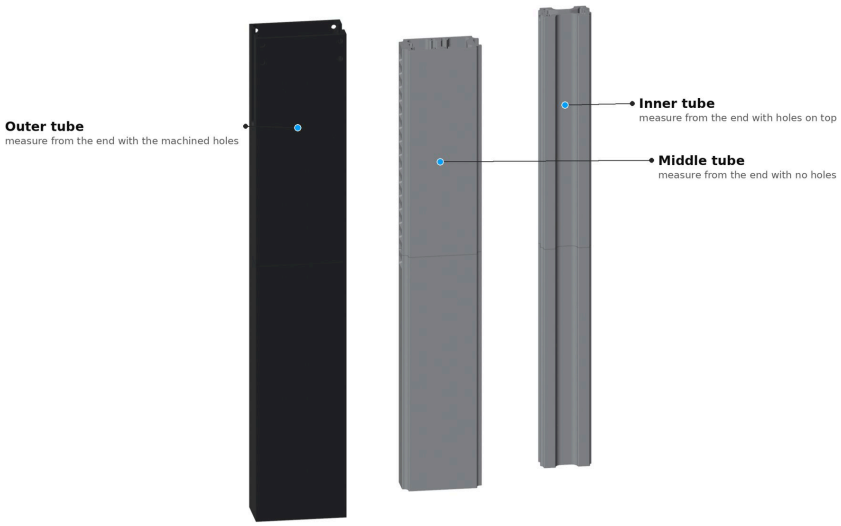


The kit also has the outer tube (black), two ropes, the steel balls, and M3 × 5 mm and M3 × 8 mm screws that hold the gearbox on the tube (step 15).

In the step pictures, **blue = parts you add in that step**, grey = parts already in place, and the orange arrow shows which way a part moves. The **lift rope** is pink and the **return rope** is green.

Cut the tubes and ropes

Step 1. Cut the tubes



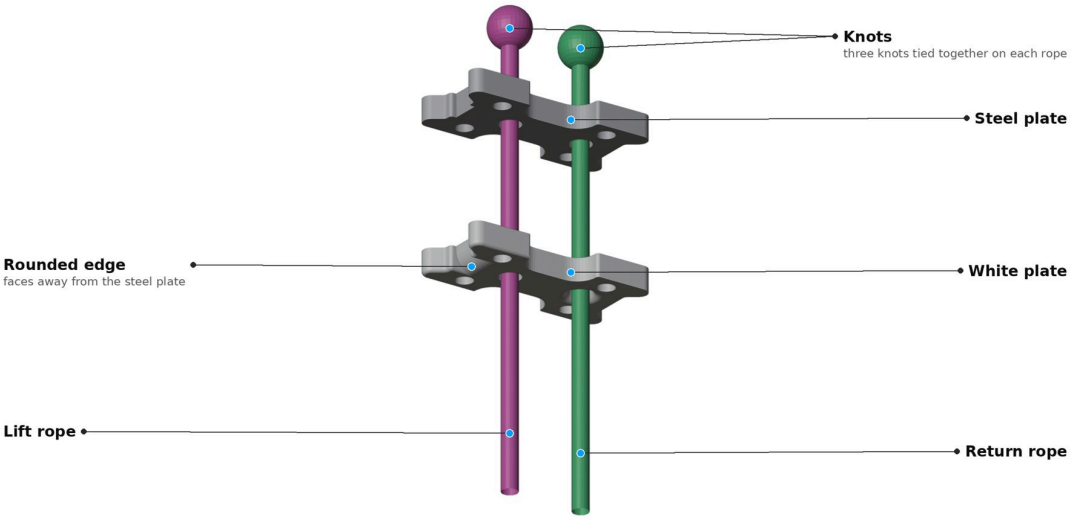
Mark each tube at the length from the calculator, then cut it.

- **Outer tube (black):** measure from the end with the machined holes.
- **Middle tube:** measure from the end with no holes.
- **Inner tube:** measure from the end with holes on top.

Within about 1/8 in is fine.

One-stage build: cut only the outer and middle tubes.

Step 2. Thread the ropes through the plates

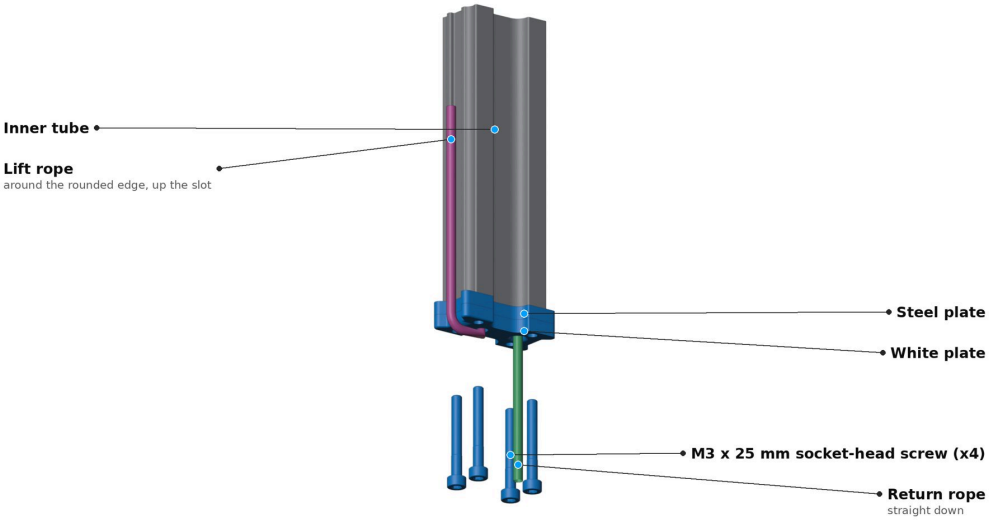


1. Cut two pieces of rope, each as long as the total extended length from the calculator.
2. Push one rope through each of the two rope holes in the **white plate**. To start a rope, lay its end over the hole and press it in with an Allen key, then pull it through with pliers.
3. Find the rounded edge on the white plate. Thread both ropes through the **steel plate** on the side away from the rounded edge, the same way.
4. Push the plates together.
5. On each rope, next to the steel plate, tie a knot three times in a row so the knots form one big knot.

The rope in the hole next to the rounded edge is the **lift rope** (pink). The other one is the **return rope** (green).

One-stage build: skip steps 2 and 3.

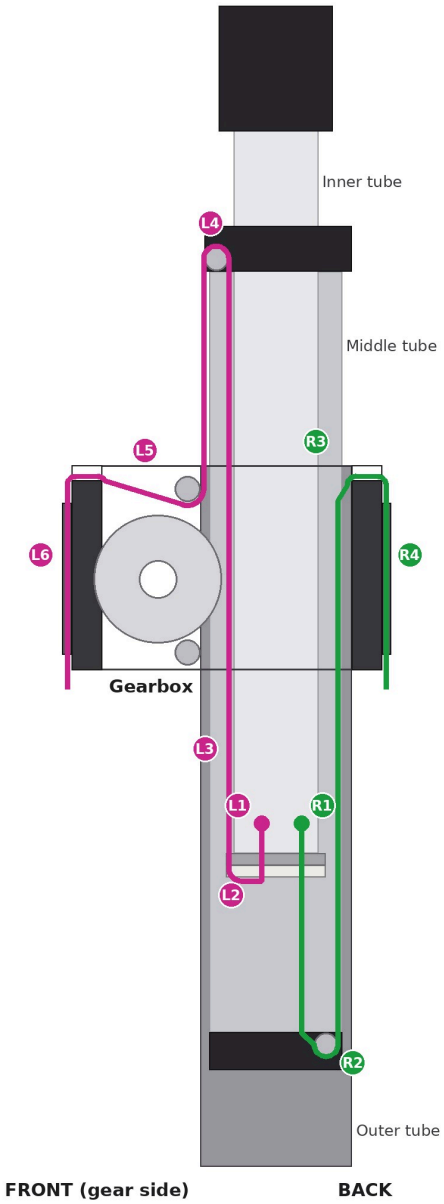
Step 3. Anchor the ropes in the inner tube



1. Push both knots into the bottom end of the inner tube (the end without holes). A flat screwdriver or Allen key helps.
2. Put four **M3 × 25 mm socket-head screws** (the partly threaded ones) through the white plate and the steel plate and start them in the tube. Start all four before you tighten any (2.5 mm Allen key or driver bit).
3. Pull on both ropes to seat the knots against the plates, then tighten all four screws.
4. Check that the rounded edge of the white plate faces out, away from the tube.

Build the middle stage

The two ropes make the inner tube follow the middle tube. The **lift rope** (pink) pulls the inner tube up and the **return rope** (green) pulls it back down. You don't have to build all of this now. This is the rope layout you'll end up with. The steps below build it one piece at a time and refer to these numbers.



Lift rope (pulls the inner tube up)

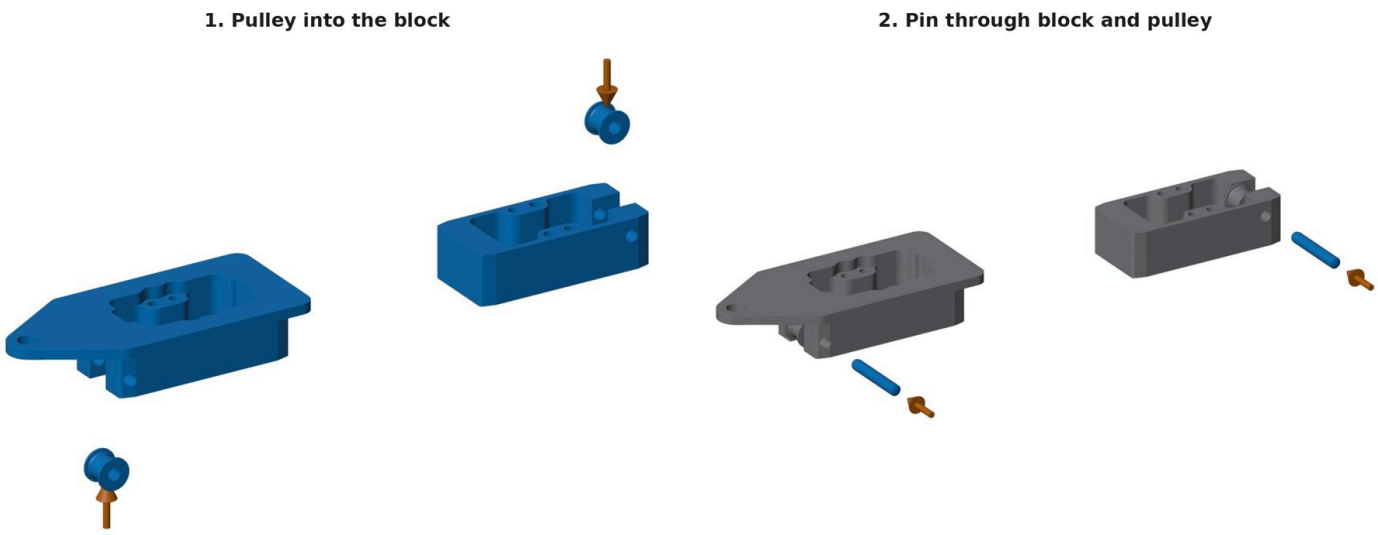
- L1 Knot inside the bottom of the inner tube
- L2 Around the rounded edge of the white plate
- L3 Up the slot on the front of the inner tube
- L4 Over the pulley in the top block of the middle tube
- L5 Down, then under the upper standoff in the gearbox
- L6 Through the notch in the front block, then down under the front clamp plate

Return rope (pulls it back down)

- R1 Knot inside the bottom of the inner tube
- R2 Down and around the pulley in the bottom block of the middle tube
- R3 Up the back of the middle tube and out the top of the gearbox
- R4 Through the notch in the back block, then down under the back clamp plate

Shown partly extended, from the side.
Not to scale.

Step 4. Build the pulley blocks



There are two pulley blocks: the **bottom block** and the **top block** (the one with the hat). Each gets one small steel pulley and one **3 × 20 mm steel pin**.

1. Set the pulley into the slot in the block.
2. Put a little Loctite on the end of the pin.
3. Slide the pin through the block and the pulley. Pressing the block on a hard surface helps get the pin fully in.

One-stage build: build only the bottom block.

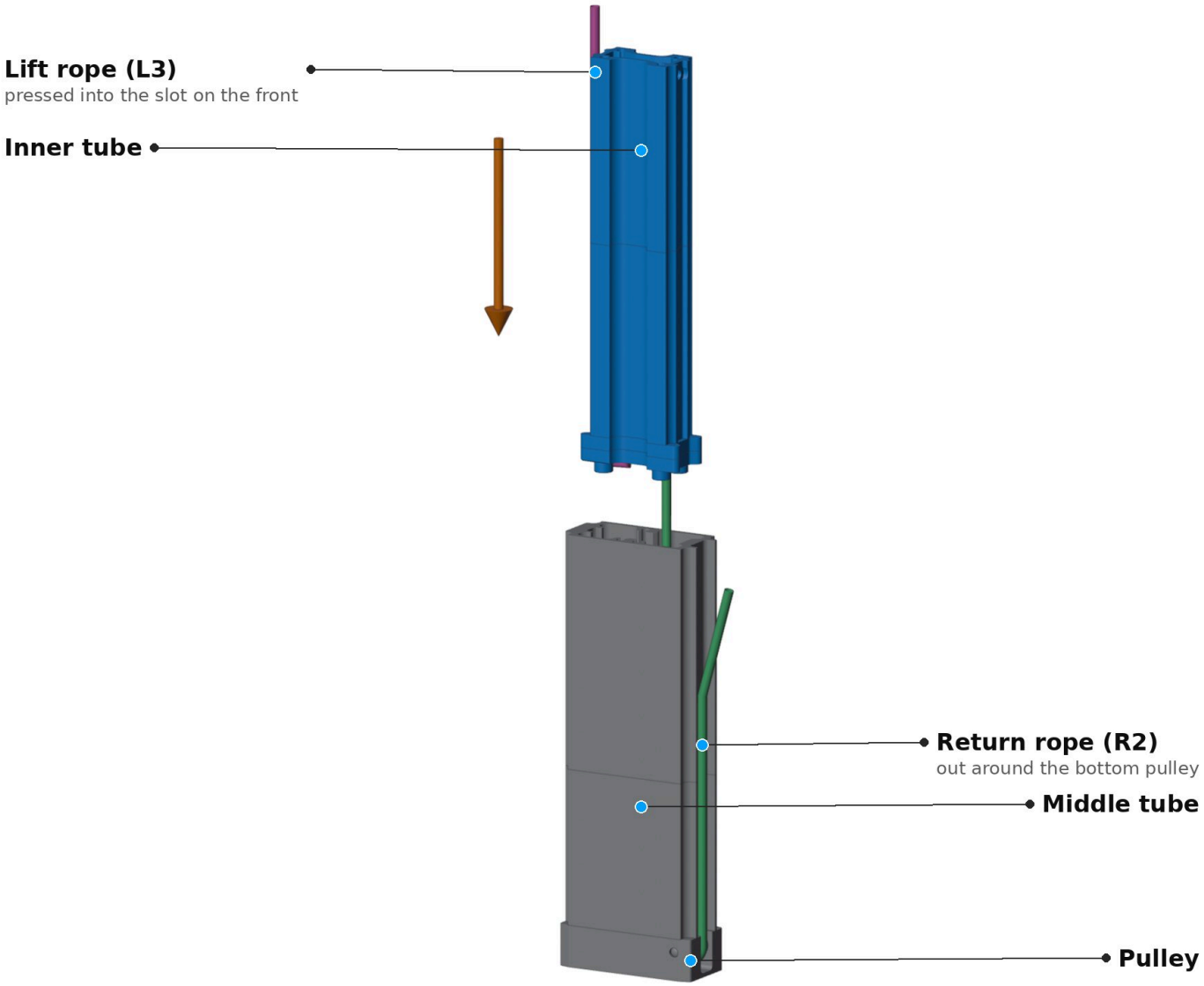
Step 5. Bottom block on the middle tube



1. Put the bottom block in the bottom end of the middle tube with the **pulley at the back**, away from the gear rack.
2. Start four **M3 × 25 mm socket-head screws** by hand, then drive them in with the 2.5 mm driver bit. Do one, then the opposite corner, then the other two, and finish tightening all four.

This step is easy to get backward. Check the pulley side again before you move on.

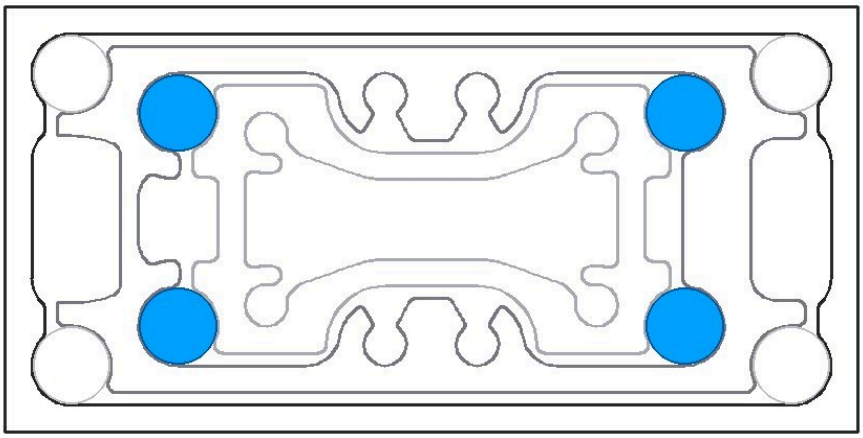
Step 6. Route the return rope and insert the inner tube



1. Feed the **return rope** (green) into the top of the middle tube (the end without the block), down through the tube, and out around the bottom pulley (**R2**).
2. Press the **lift rope** (pink) into the slot on the front of the inner tube (**L3**).
3. Slide the inner tube into the top of the middle tube, with its return rope on the same side as the rope coming out of the bottom pulley.

One-stage build: skip this step.

Step 7. Load the balls between the inner and middle tubes



4 slots, one bag of balls in each

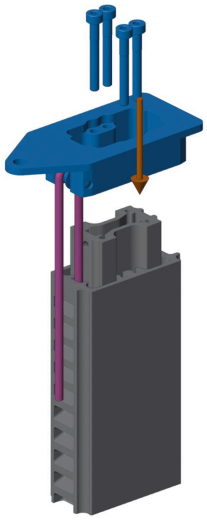
There are four ball slots between the inner and middle tubes.

1. Prop the stage at an angle so the balls roll down the slots on their own.
2. Empty one bag of balls into one slot. You don't need to count them.
3. Fill the other three slots the same way.

Losing one or two balls per slot is fine. If you lose more, top it up from a spare bag or tip the stage out and start that stage again.

One-stage build: skip this step.

Step 8. Top block on the middle tube



1. Thread the **lift rope** (pink) through the pulley in the top block (**L4**).
2. Set the top block on the top of the middle tube with the hat at the front, on the same side as the lift rope.
3. Fasten it with four **M3 × 25 mm socket-head screws**, the same way as step 5.
4. Test the stage: pull the lift rope (pink) and the inner tube should extend. Pull the return rope (green) and it should retract. It should feel smooth.
5. Fully retract it and look into the bottom. If rope is caught down there, pull both ropes until it's clear.

One-stage build: skip this step.

Put the stages in the outer tube

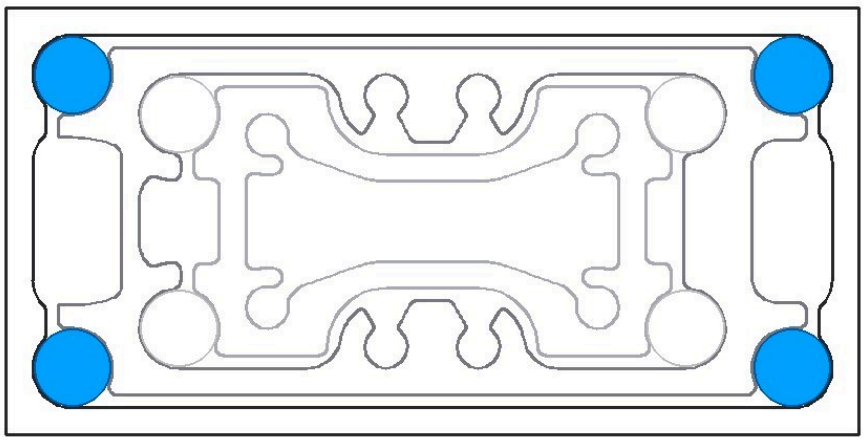
Step 9. Slide the middle stage into the outer tube



The outer tube has a big slot on one side and a smaller slot on the other. The gear rack on the middle tube goes on the **big slot** side, because that's where the gear goes.

Hold the **return rope** in the channel on the back of the middle tube with your finger (**R3**) and slide the stage into the outer tube.

Step 10. Load the balls between the middle and outer tubes



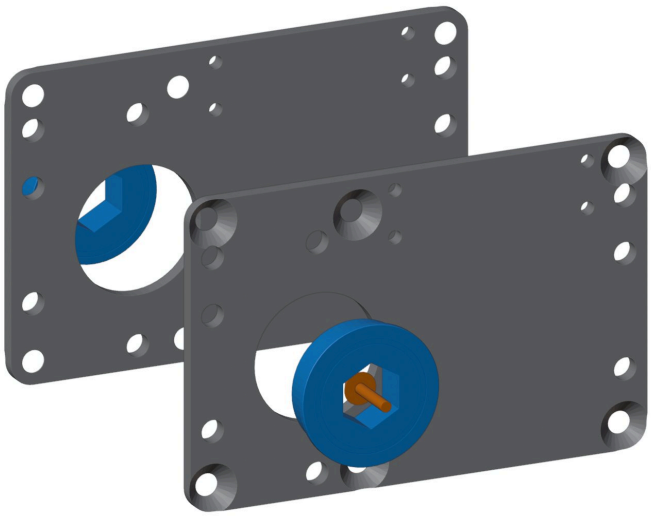
4 slots, one bag of balls in each

Fill the four slots between the middle and outer tubes the same way as step 7, one bag per slot. Prop the elevator at an angle so the balls roll in.

> ⚠ **Caution:** From here until step 15, keep the elevator upright and don't tip it over.

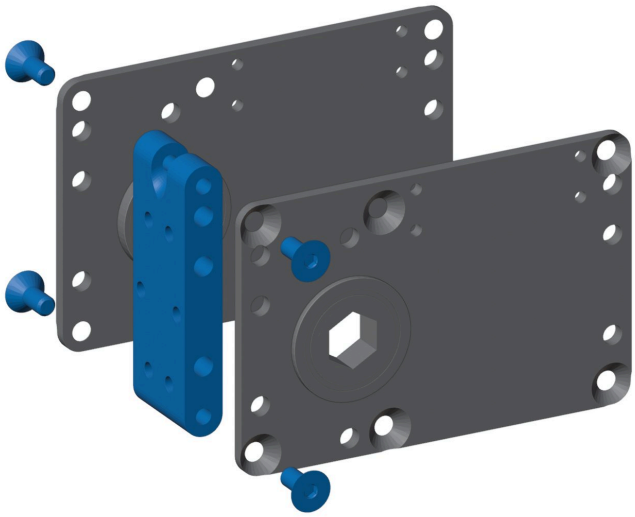
Build the gearbox

Step 11. Bearings in the side plates



The two side plates are mirror images. Press a flanged bearing into each one with the **flange on the same side as the countersunk holes**. Most go in by hand. A light tap with a mallet helps a stiff one.

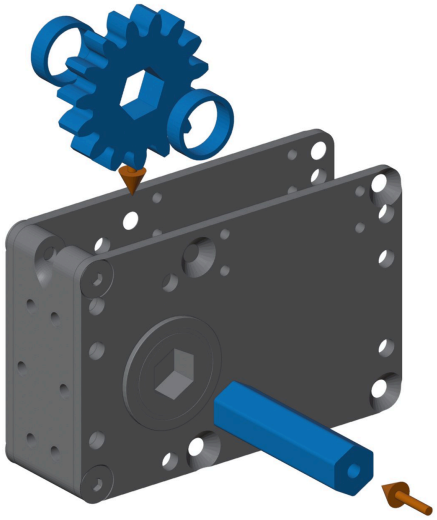
Step 12. Front block between the plates



Use the 1/8 in Allen key for the **10-32 × 5/16 in flat-head screws**.

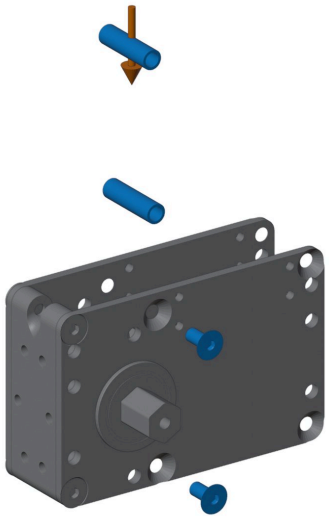
1. Add Loctite to a flat-head screw. Put it through the countersunk hole near the bearing in one side plate and into the top of the front block. Turn the block as shown.
2. Do the same with the bottom hole, then tighten both.
3. Attach the other side plate to the other side of the block the same way.

Step 13. Axle and gear



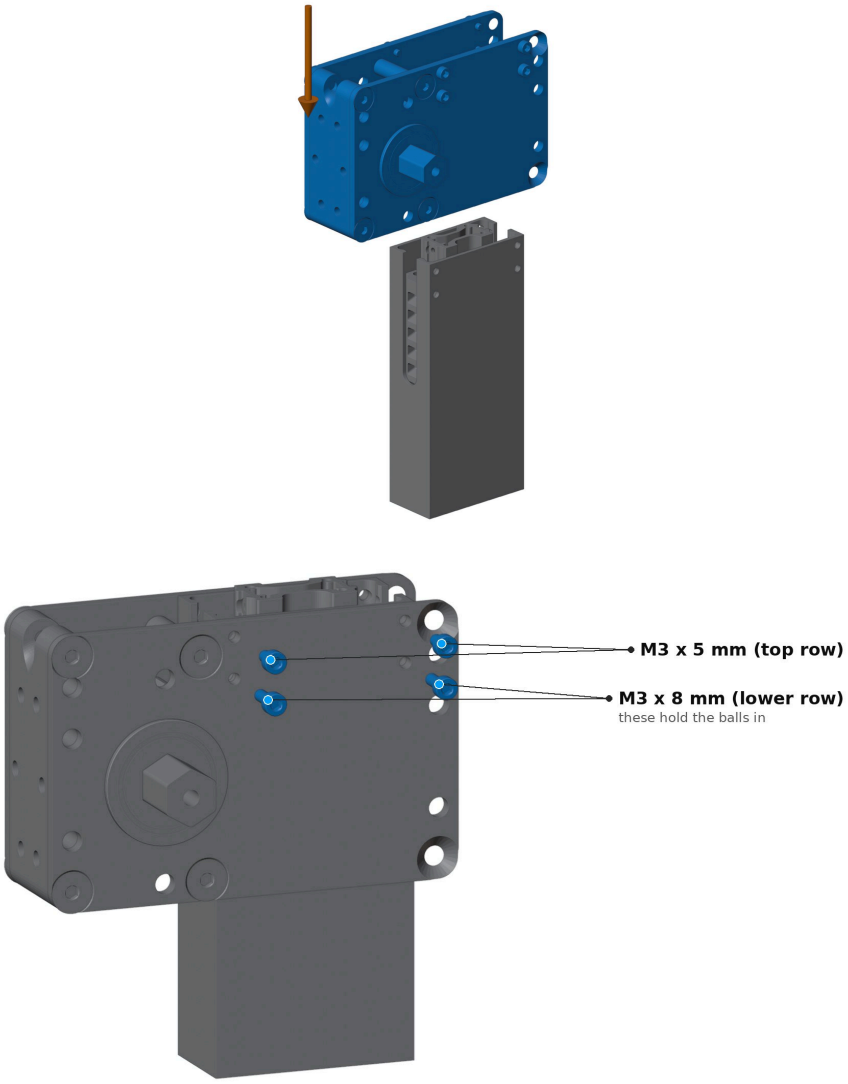
Start the **1/2 in hex axle** (included, or your own) into one bearing. Slide on a hex spacer, then the **15-tooth gear**, then the second spacer, and push the axle through the other bearing. The gear sits between the two spacers.

Step 14. Standoffs



Put the two silver **standoffs** between the plates and fasten each end with a **10-32 × 5/16 in flat-head screw** and Loctite. Use the 1/8 in Allen key.

Step 15. Mount the gearbox on the outer tube

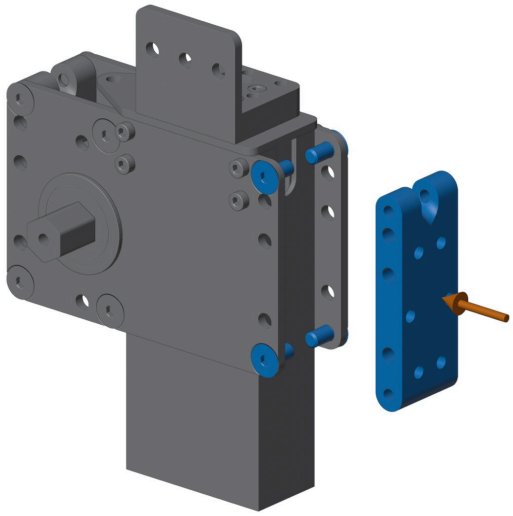


1. Slide the gearbox onto the top of the outer tube so the four holes in each side plate line up with the four holes in the tube, and the gear meets the gear rack.
2. Take four **M3 × 5 mm** and four **M3 × 8 mm socket-head screws**. Use the 2.5 mm Allen key or driver bit.
3. Add Loctite and put the M3 × 5 mm screws in the **top** holes. Look through each hole first to check it lines up with the tube.
4. Put the M3 × 8 mm screws in the **lower** holes the same way.
5. If holes don't line up, push the gearbox down against the tube.

The M3 × 8 mm screws hold the balls in. Once all eight screws are in, the balls can't fall out.

Pull the stage out and push it back to check it runs smoothly and the gear turns.

Step 16. Back block

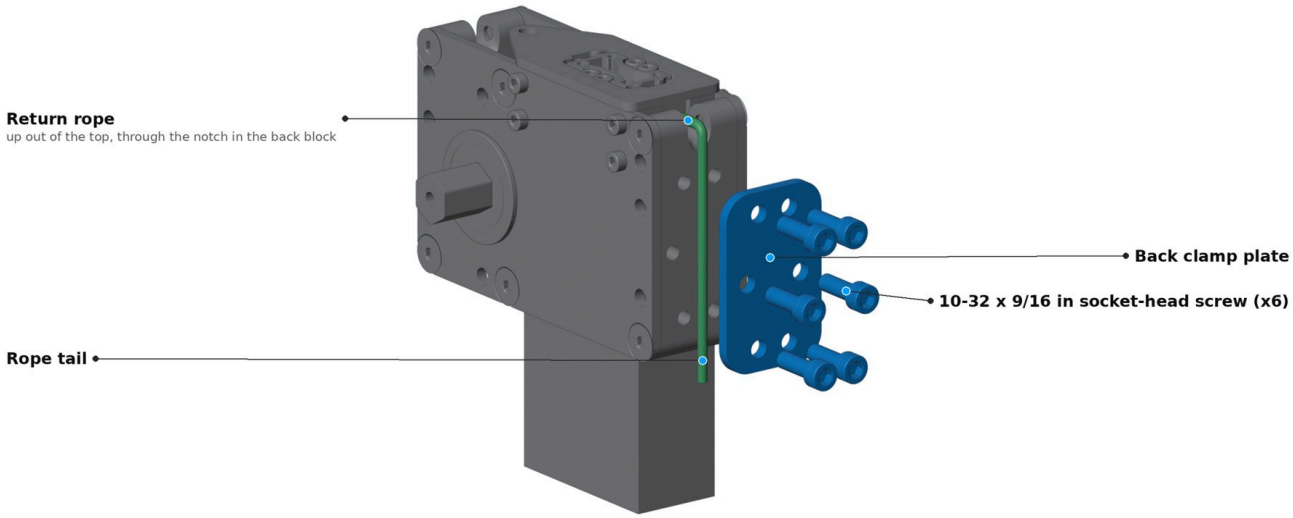


Put the back block between the side plates at the back. The cutout in the block is for the return rope, so it faces the rope. Fasten it with four **10-32 × 5/16 in flat-head screws**, two through each side plate, and tighten them with the 1/8 in Allen key.

Tension the ropes

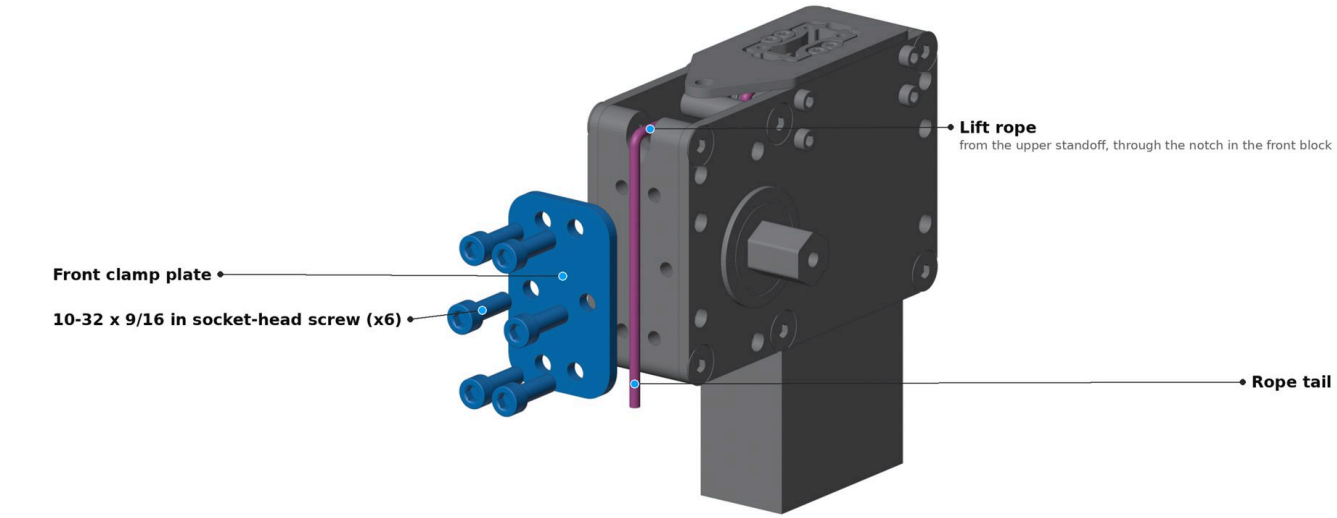
Fully retract the elevator before you start. Look into the bottom and make sure no rope is tangled. A tangled rope here causes problems later.

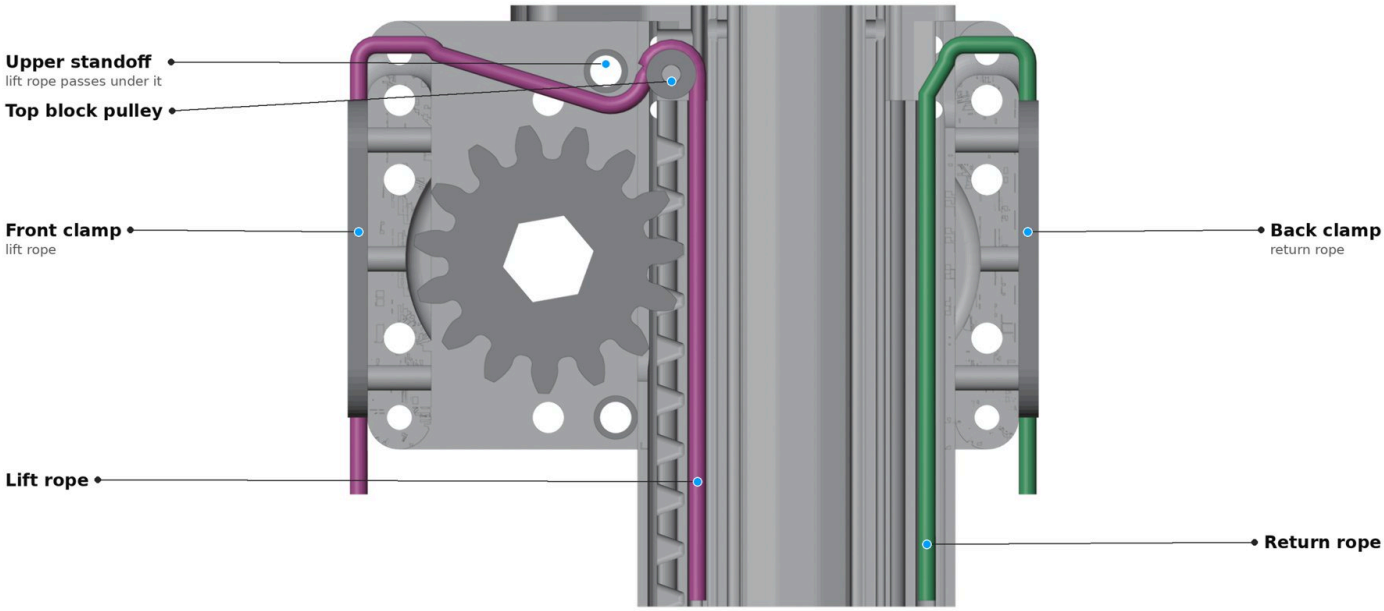
Step 17. Return rope to the back clamp



1. Bring the **return rope** (green) up out of the top of the gearbox, into the notch across the top of the back block, and down its back face, centered between the six screw holes (**R3**, **R4**).
2. Put the back clamp plate on top and start six **10-32 × 9/16 in socket-head screws** partway with the 5/32 in Allen key. **No Loctite yet.**
3. Pull the rope as tight as you can, wrap the tail around the block, and keep it tight.
4. Fully tighten all six screws.

Step 18. Lift rope to the front clamp





1. Pass the **lift rope** (pink) under the upper standoff inside the gearbox (**L5**). Pliers make it easier to pull through.
2. Lay it into the notch across the top of the front block and down its front face, centered between the six screw holes (**L6**).
3. Put on the front clamp plate and start six **10-32 × 9/16 in socket-head screws** with the 5/32 in Allen key, no Loctite yet.
4. Pull the rope as tight as you can, wrap the tail around the block, and tighten all six screws.

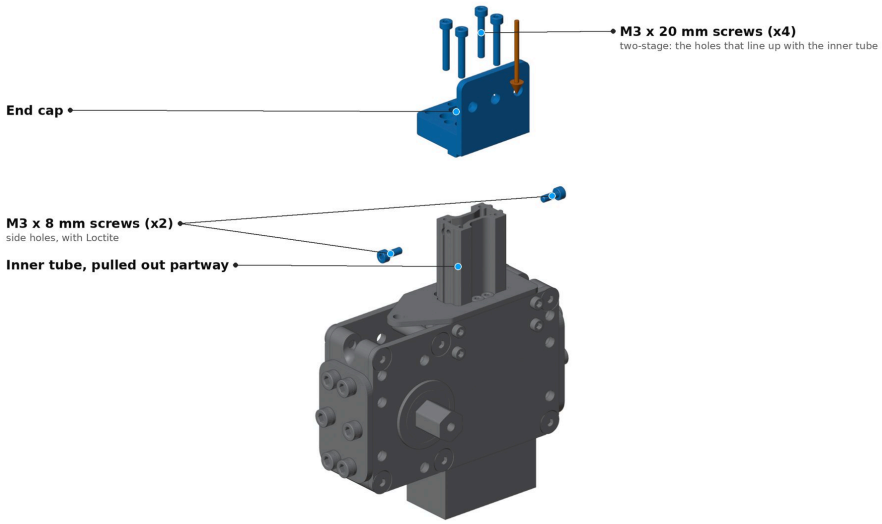
Extend the elevator to check it. It may feel a little rough until you grease it in step 20.

Re-tensioning. The rope is pre-stretched, but shock loads (for example, climbing with the elevator) can stretch it more the first time or two. You'll see it as play between the middle and inner stages. That's normal. Loosen the six clamp screws, pull the rope tight, and retighten. Once the rope has stretched that first time, add Loctite to the clamp screws.

One-stage build: skip steps 17 and 18.

Finish

Step 19. End cap

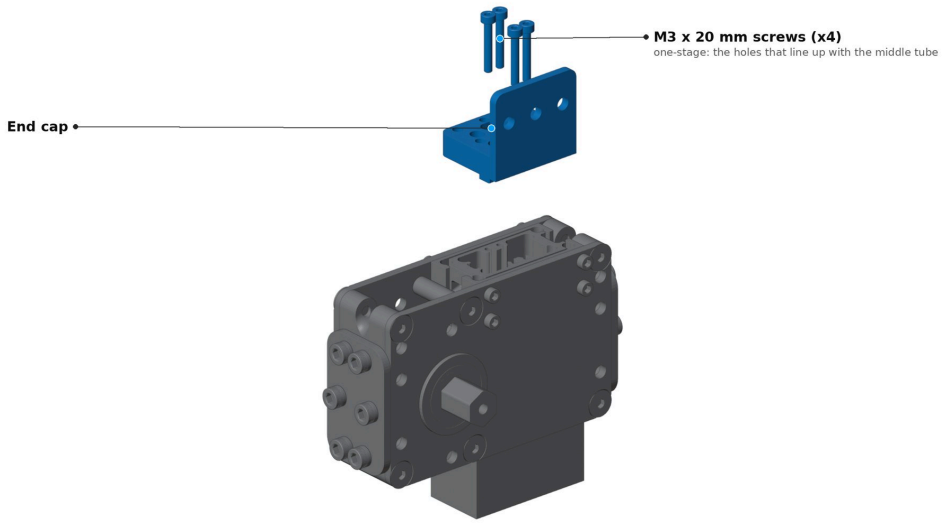


The end cap goes on the top of the inner tube so you can attach things to it. It can go on either way round.

Pull the inner tube partway out first. The screws can't go in when it's fully retracted.

1. Take four **M3 × 20 mm socket-head screws** (fully threaded). Use the 2.5 mm Allen key or driver bit for all the end cap screws.
2. Put them down through the end cap into the tube. Use the four holes that line up with the inner tube.
3. Add Loctite to two **M3 × 8 mm socket-head screws** and put them in the side holes.

One-stage build: the end cap goes on the middle tube. Use the four holes that line up with the middle tube. The two side M3 × 8 mm screws don't go on a one-stage build, so skip them.



Step 20. Grease



Grease every channel the steel balls roll in.

Common mistakes

- **White plate upside down.** The rounded edge must face out, away from the tube (step 3).
- **Bottom block pulley on the front.** The pulley goes at the back, away from the gear rack (step 5).
- **Ropes mixed up.** The lift rope (pink) goes up the front and over the top pulley. The return rope (green) goes around the bottom pulley and up the back (see the rope diagram).
- **Rack on the wrong side.** The gear rack goes on the big-slot side of the outer tube (step 9).
- **Balls spilled.** Keep the elevator upright until the M3 × 8 mm gearbox screws are in (step 15).
- **Tangled rope at the bottom.** Fully retract and clear the rope before you clamp it (steps 8 and 17).

One-stage build

The one-stage build uses the outer tube, the middle tube, the bottom block, the gearbox, and the end cap. There's no inner tube, no rope, and no top block.

- Step 1: cut only the outer and middle tubes.
- Skip steps 2, 3, 6, 7, 8, 17 and 18.
- Step 4: build only the bottom block.
- Step 19: put the end cap on the middle tube, using the holes that line up with the middle tube. Leave out the two side M3 × 8 mm screws.

Need help?

Discord support server (fastest), website chat, or support@swyftrobotics.com.