

# Hero 2 Steam Turbine Assembly Instructions

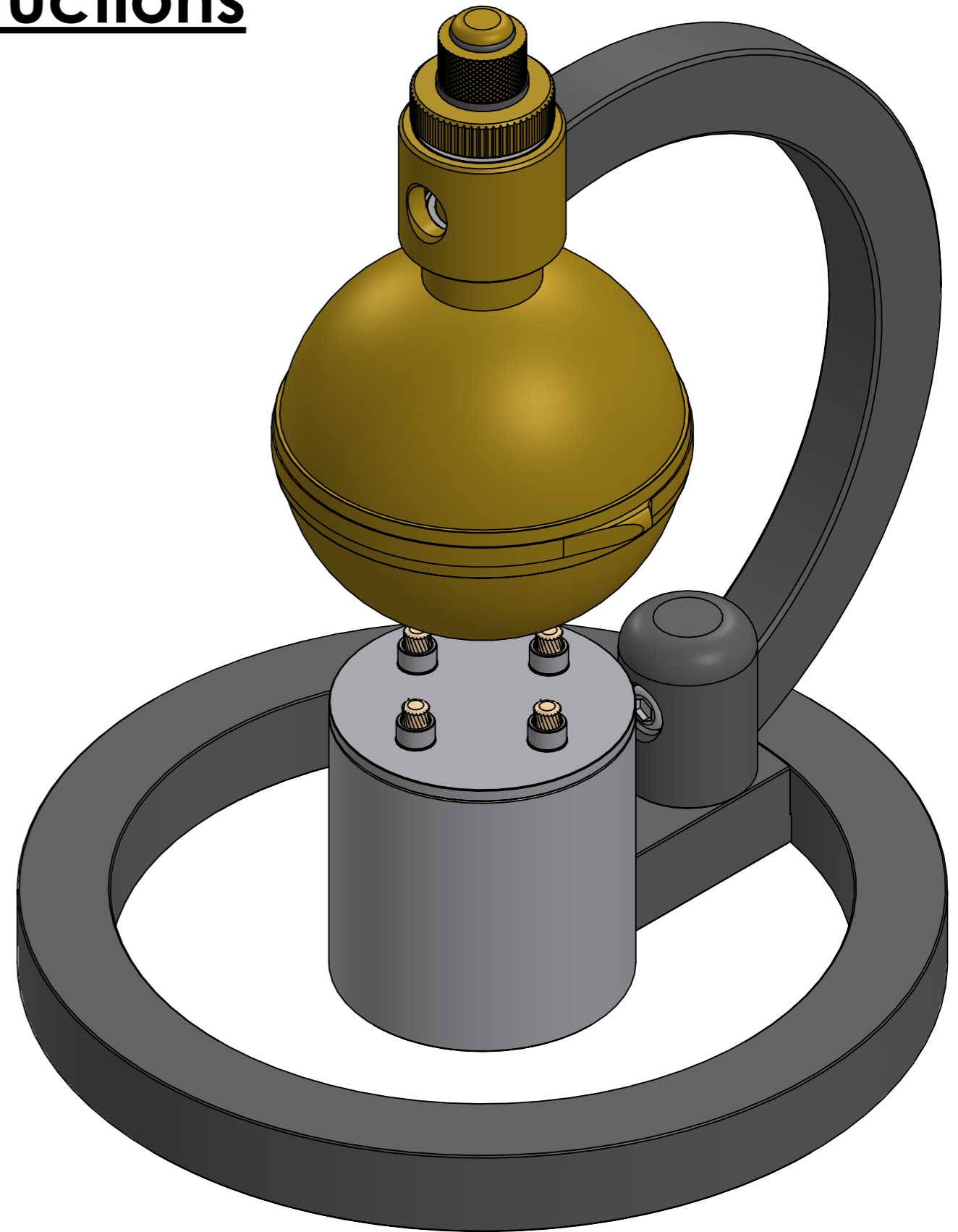
Please read all the way through the assembly instructions to familiarise yourself with the process before you start and pay close attention to the alignment of all the parts in the diagrams.

Assembly time should be approximately 10-15 minutes.

Operation instructions can be found at the end of this document.

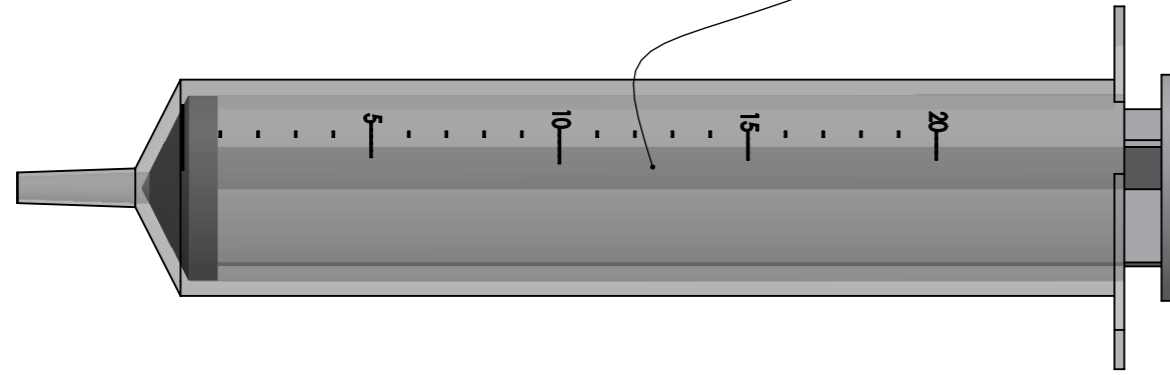
## **SAFETY NOTICE:**

- **Make sure you have a suitable fire extinguisher to hand in case of emergencies.**
- **Never leave a running turbine or naked flame unattended.**
- **All parts of the turbine will be very hot while in operation and will take time to cool down after running.**
- **In operation the turbine may spit very hot water from the jet nozzles.**
- **Make sure children are fully supervised.**
- **Ensure burner is extinguished after use.**



# Main parts

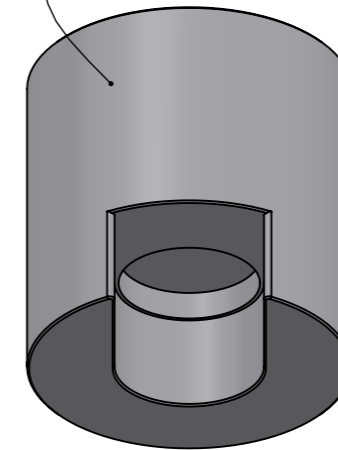
1x Syringe



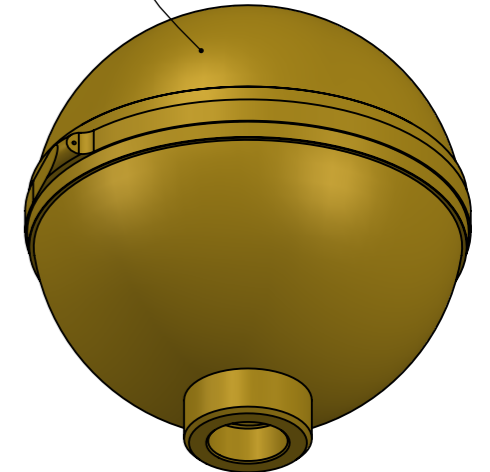
1x Pillar



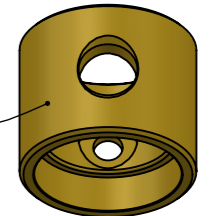
1x Burner body



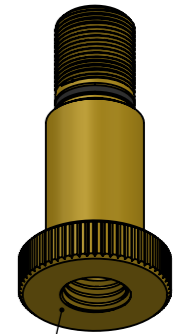
1x Boiler



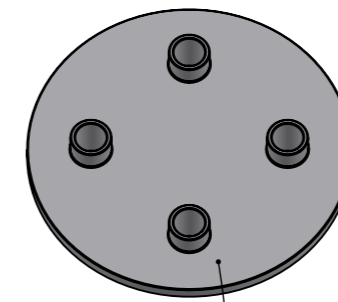
Cartridge 1x



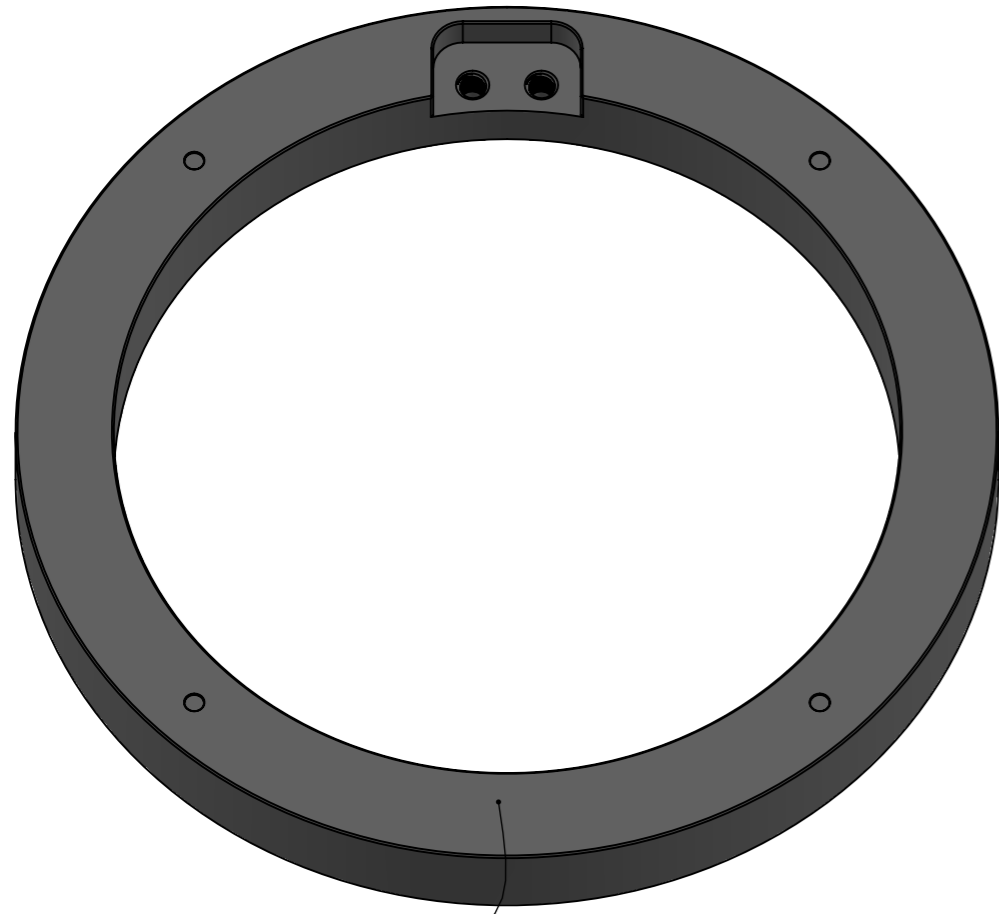
Stem 1x



Burner cap 1x



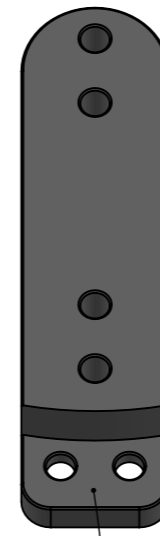
Base 1x



Arm 1x

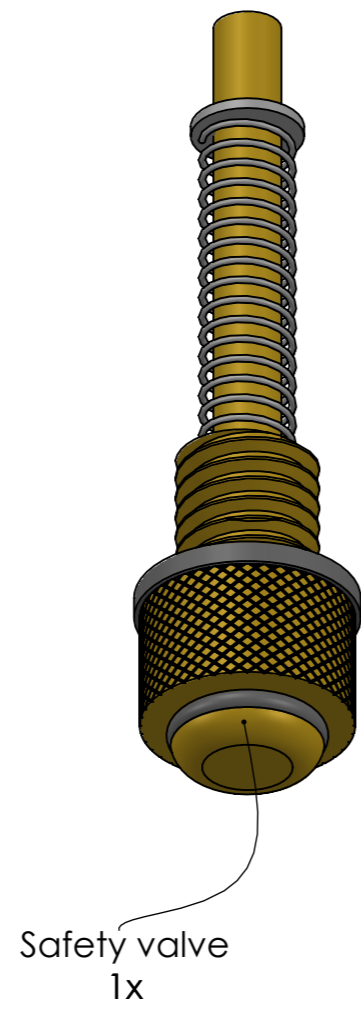
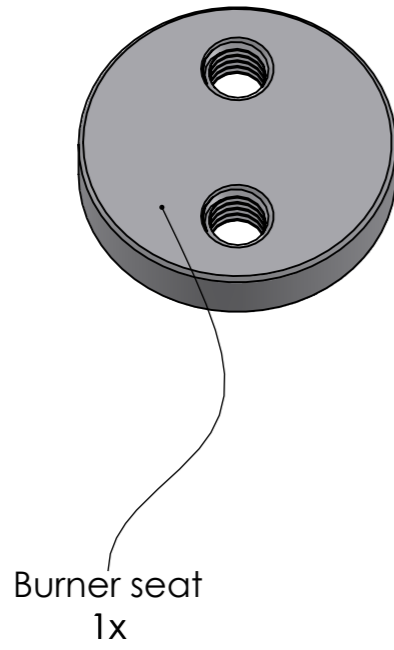
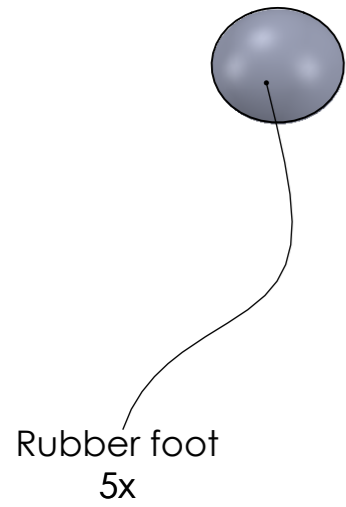
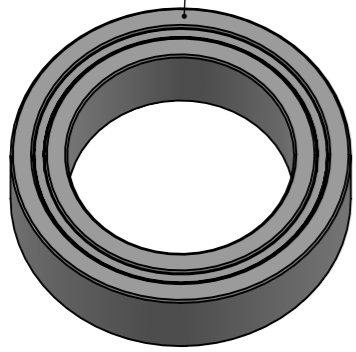


Strut 1x



# Small parts

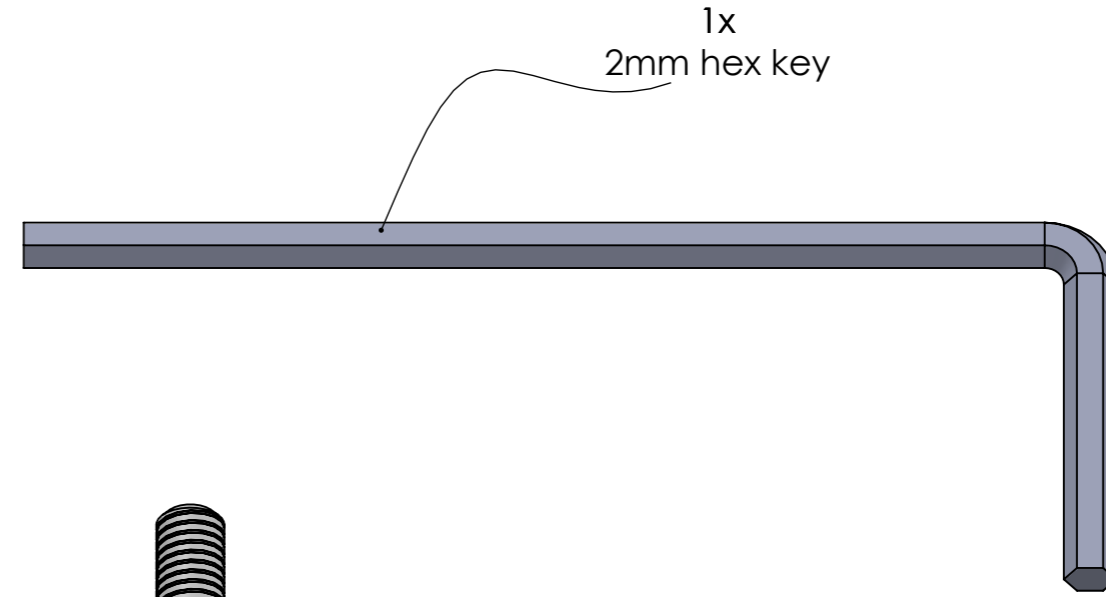
2x  
Ball-race bearing



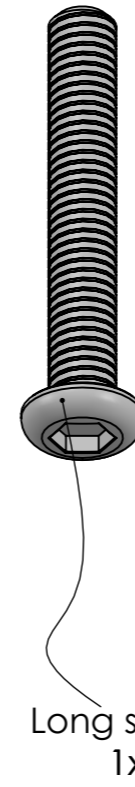
Safety valve  
1x



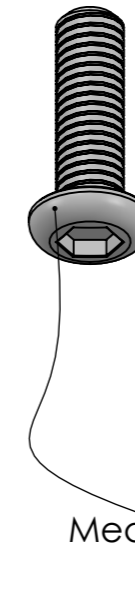
Length of wick  
1x



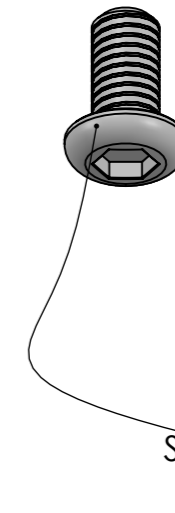
1x  
2mm hex key



Long screw  
1x

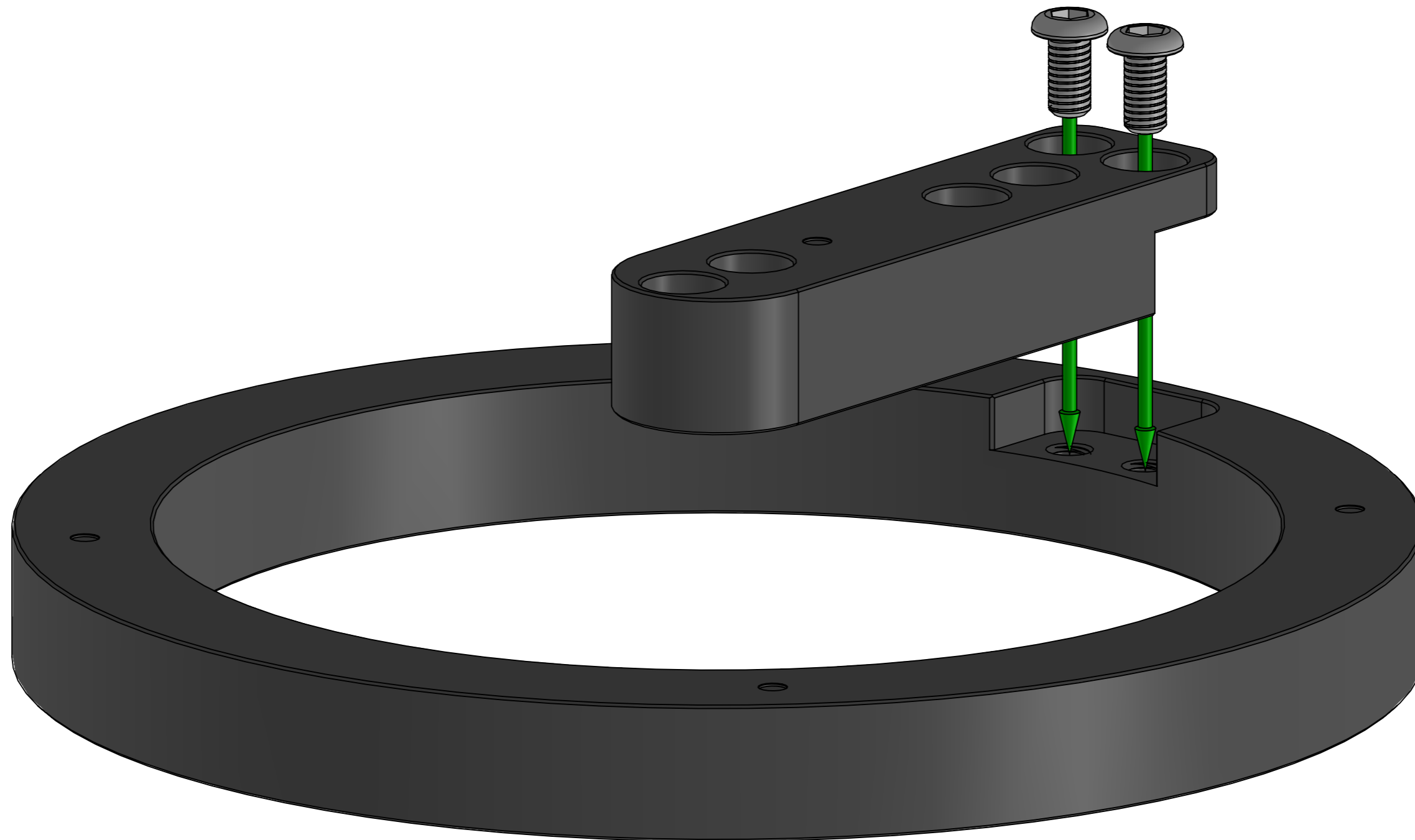


Medium screw  
4x

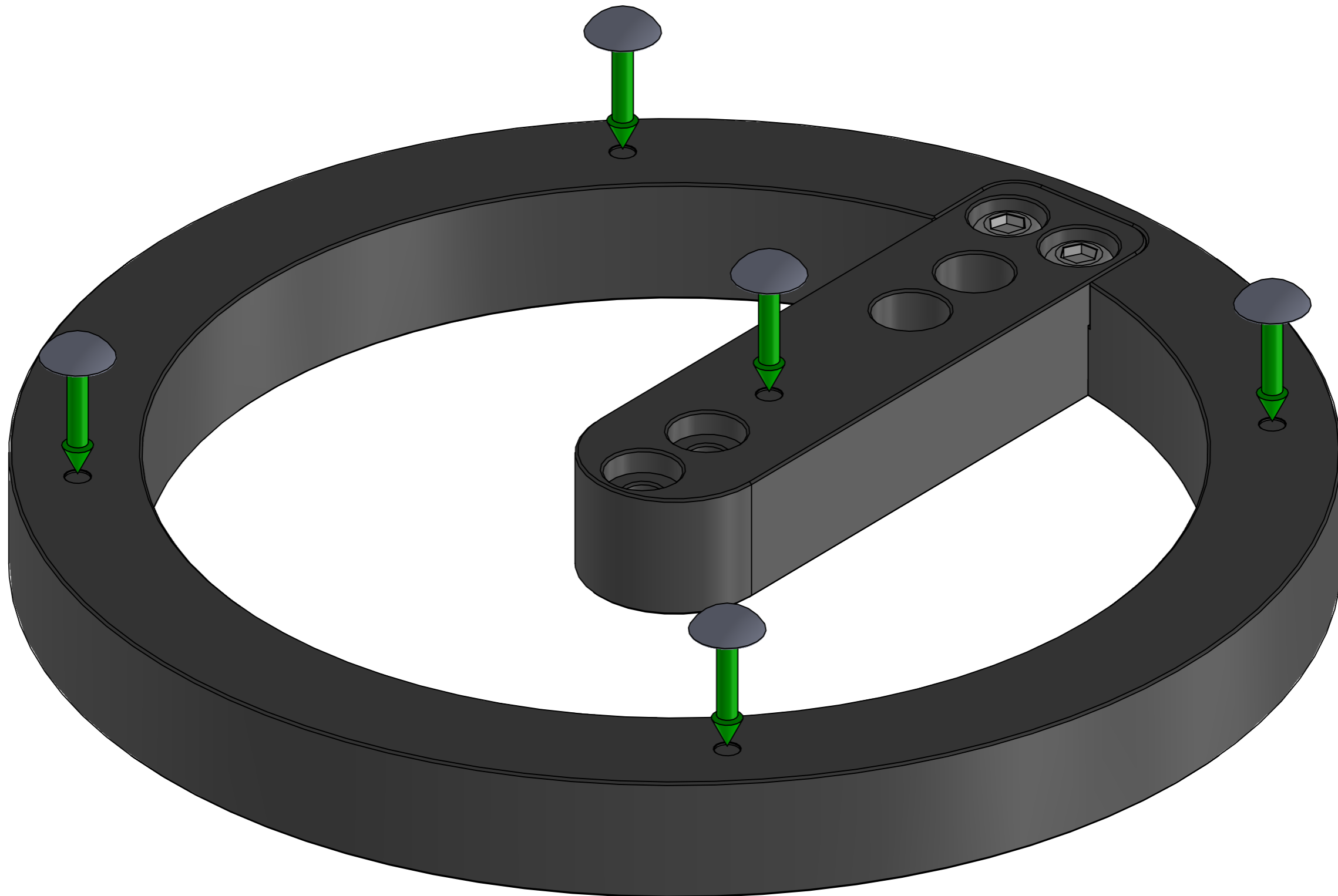


Short screw  
3x

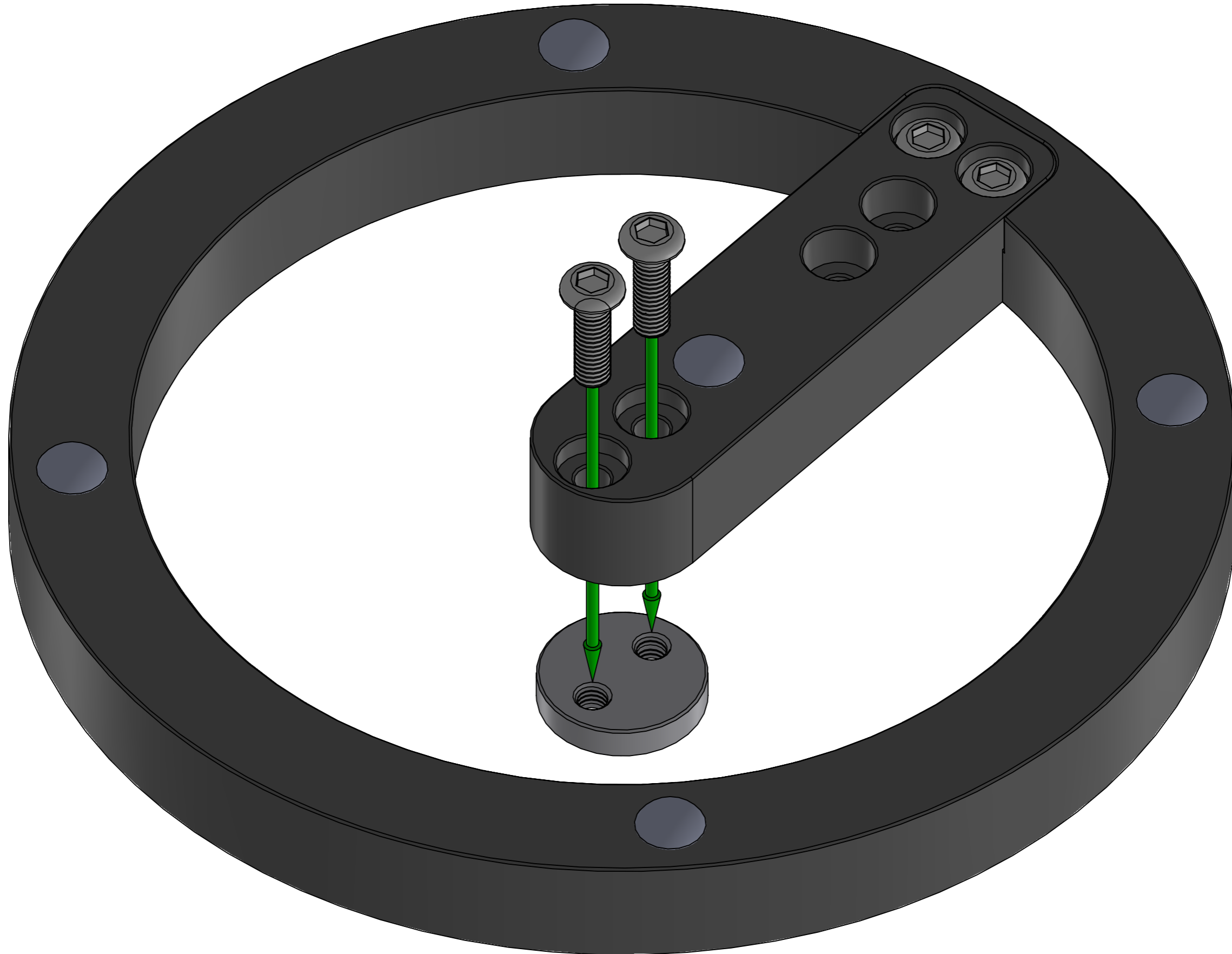
Fit the strut into the pocket in the base and screw two small screws through the strut into the base and tighten.



Peel the backing off the five adhesive rubber feet and stick them over the dimples on the bottoms of the base and strut.

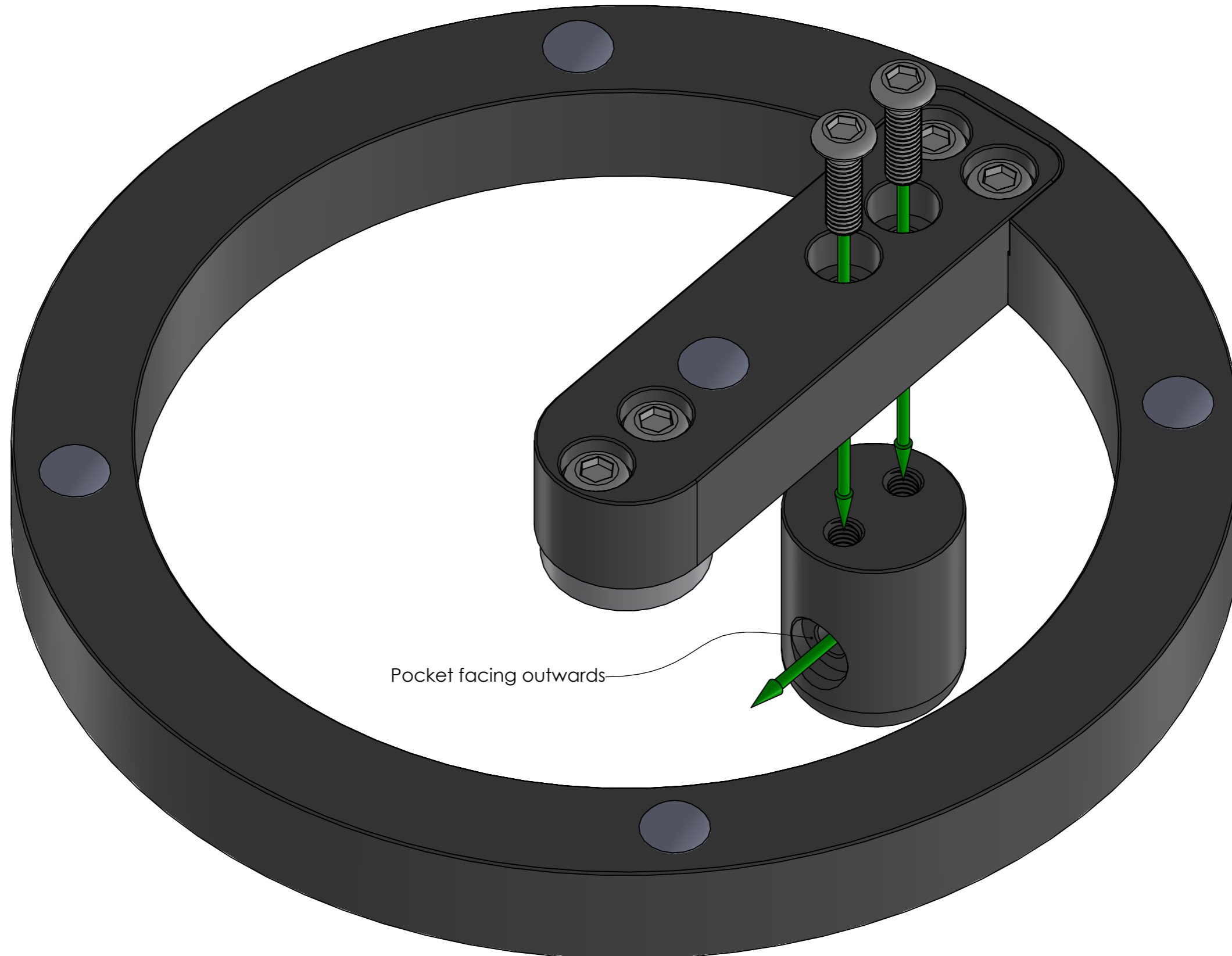


Screw two medium screws through the strut into the burner seat and tighten.

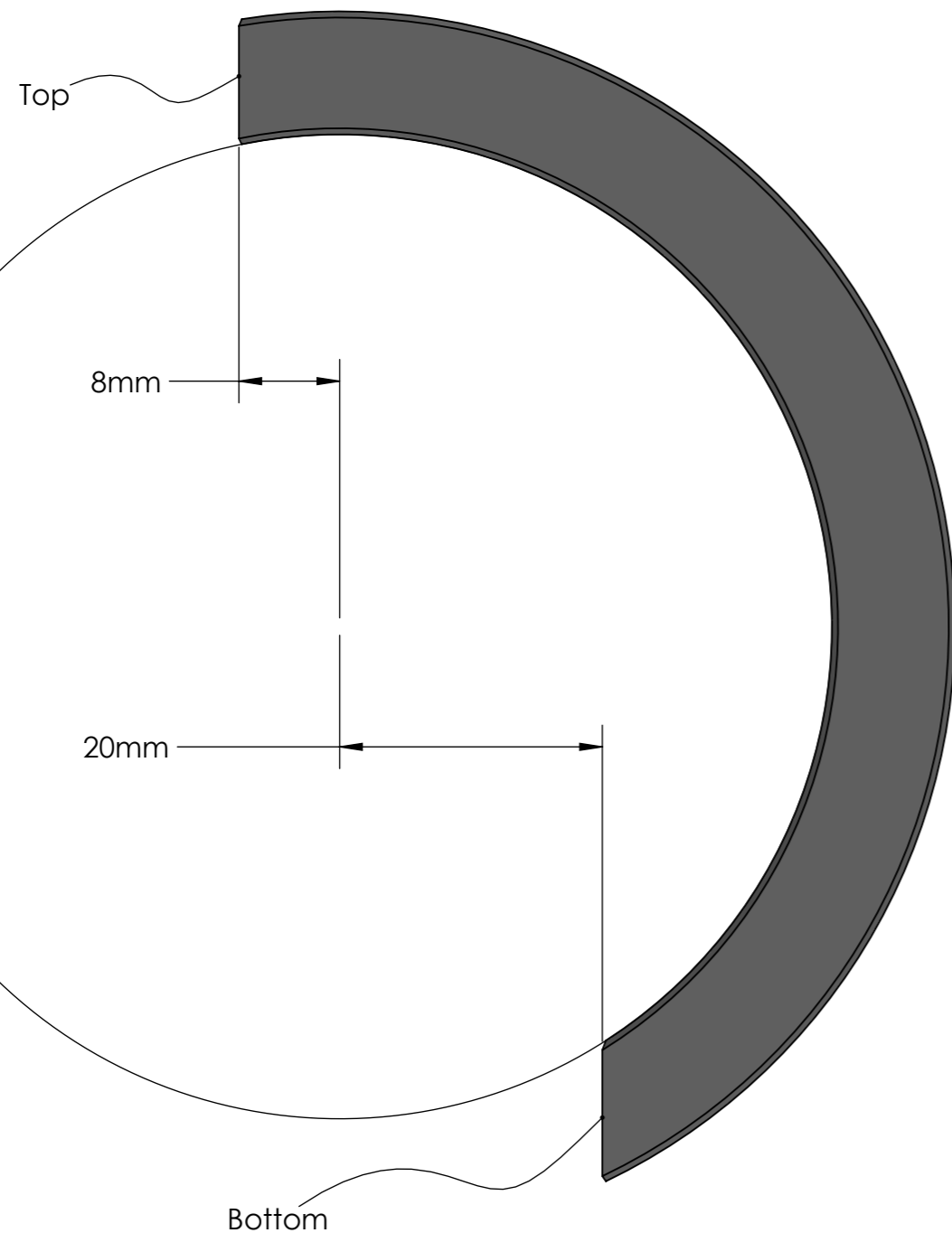


Screw two medium screws through the strut into the pillar and tighten.

*Note: the pocket on the pillar should face as shown.*

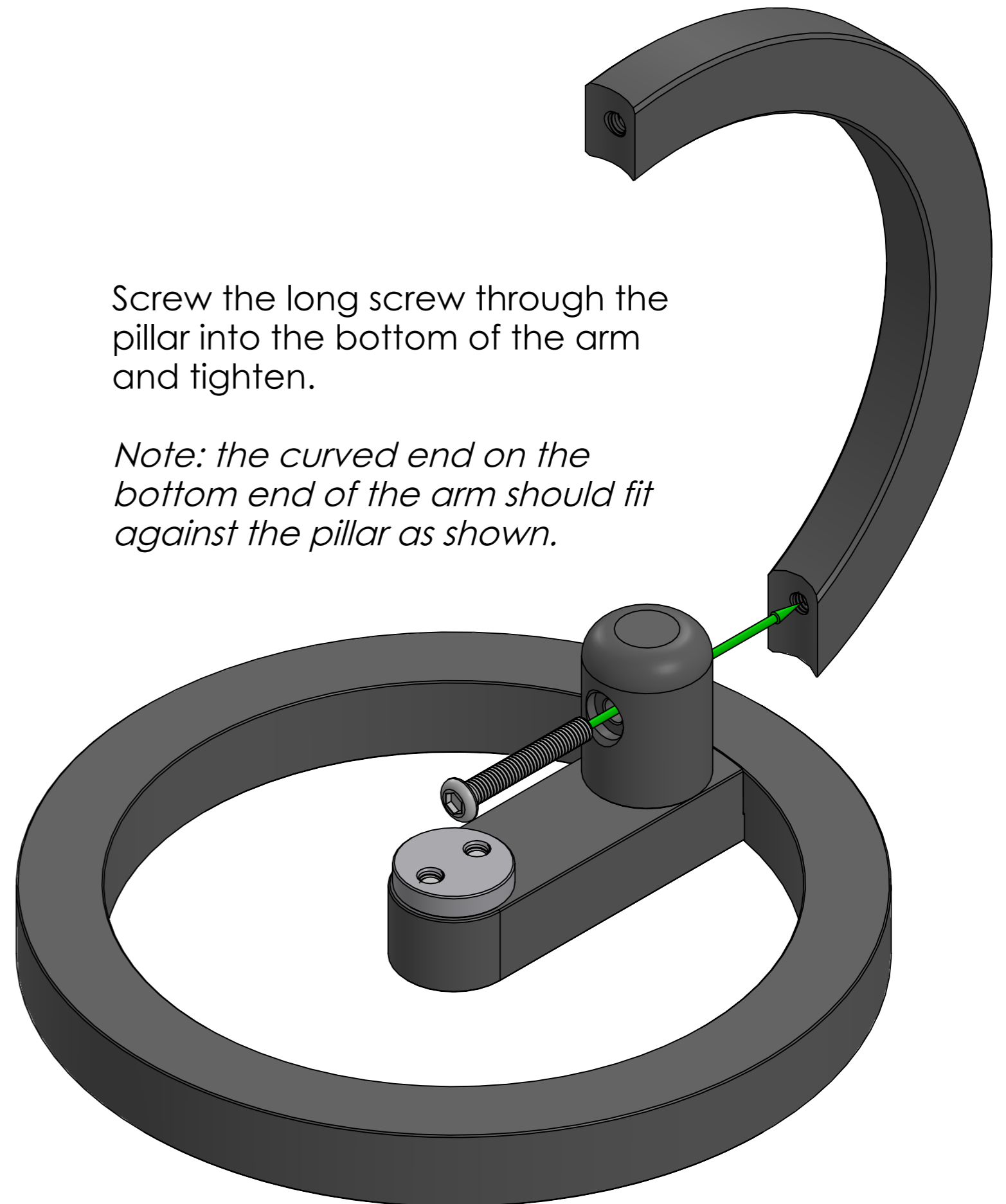


Identify the top and bottom ends of the arm as shown.



Screw the long screw through the pillar into the bottom of the arm and tighten.

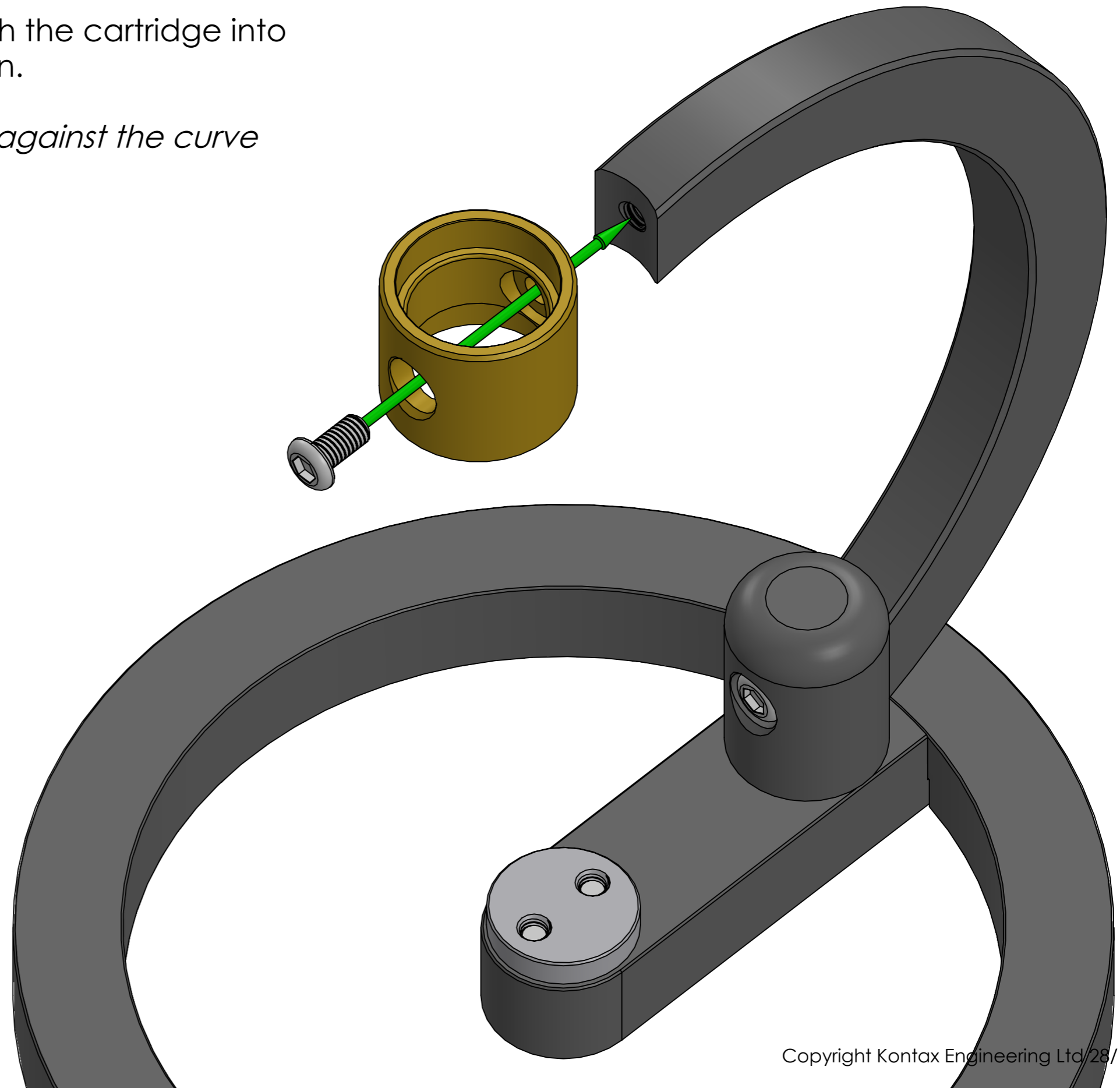
*Note: the curved end on the bottom end of the arm should fit against the pillar as shown.*

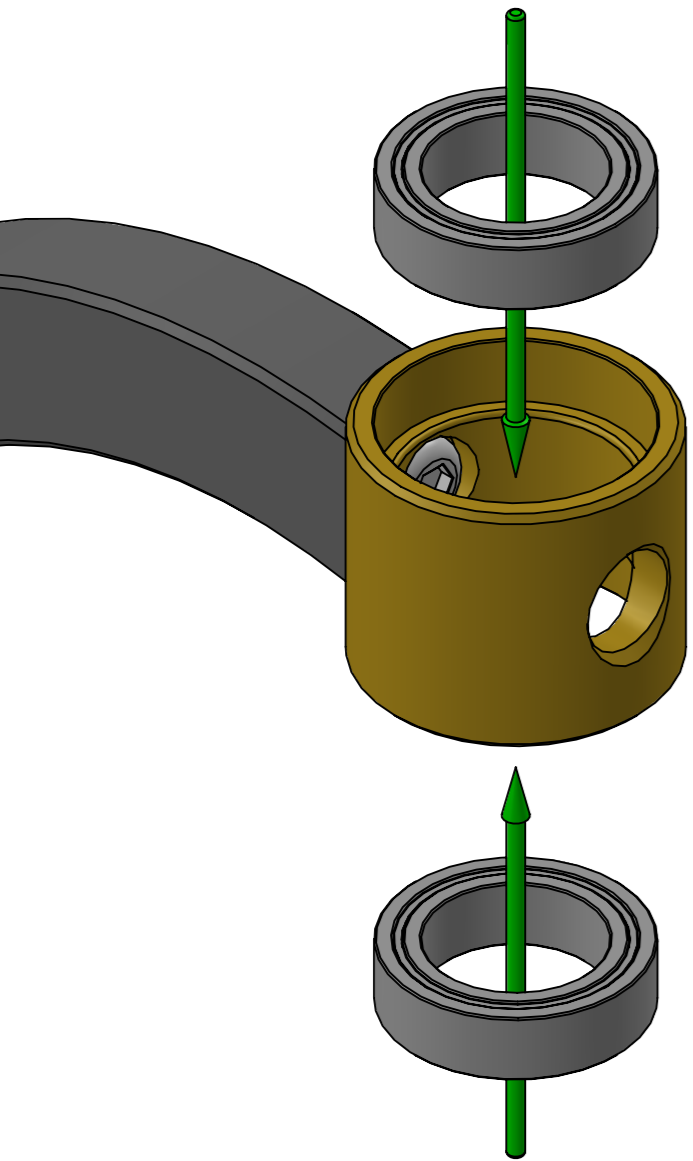




Screw one short screw through the cartridge into the top of the arm and tighten.

*Note: the cartridge should fit against the curve on the arm as shown.*

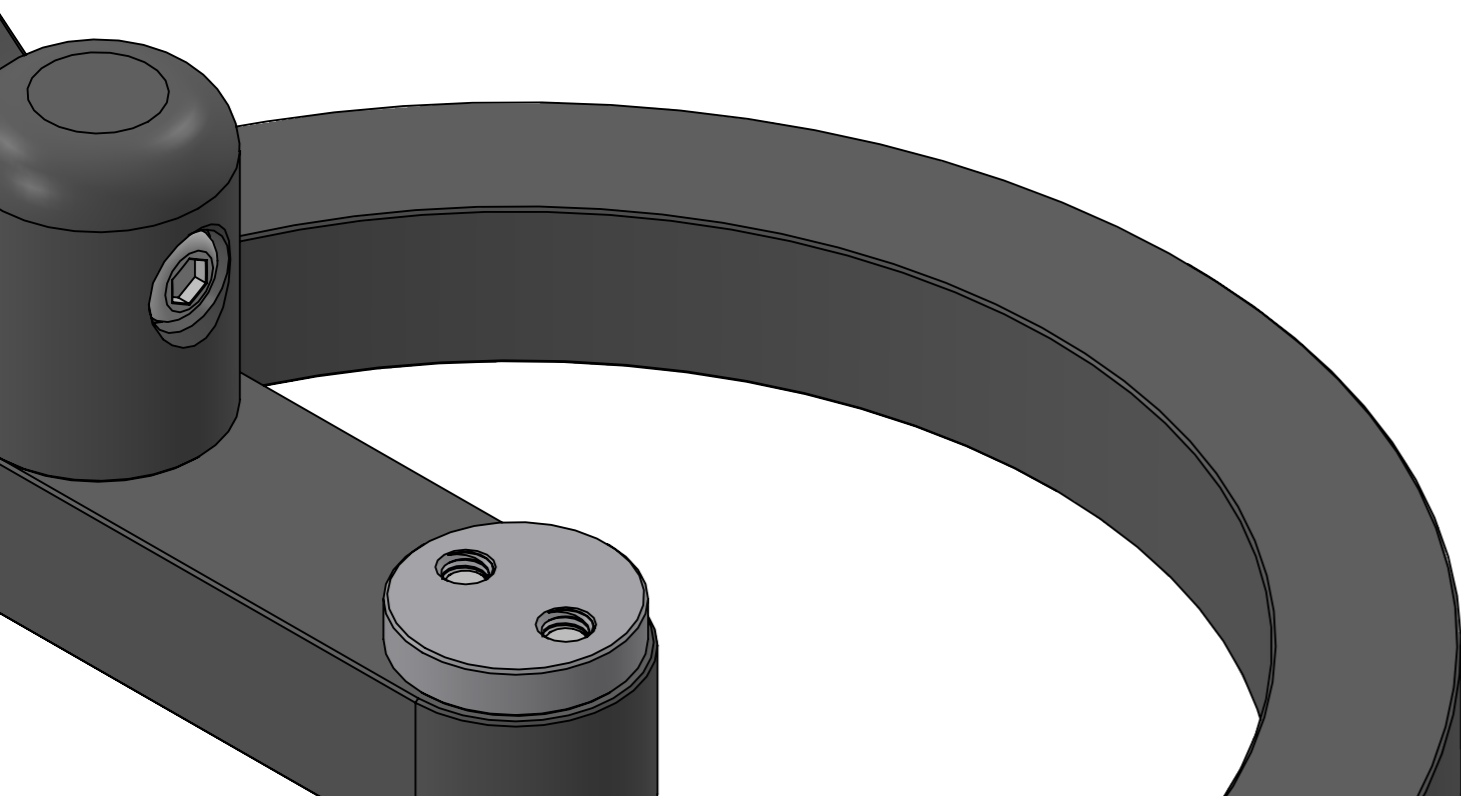




Fit the two ball-race bearings into the recesses in the ends of the cartridge. Make sure they are fitted fully flush into the recesses and that they do not protrude from the ends of the cartridge. If they do protrude they will significantly impede performance.

*Note: the bearings are a very close fit in the cartridge recesses, they must be offered into the recesses perfectly parallel or they may become wedged at an angle.*

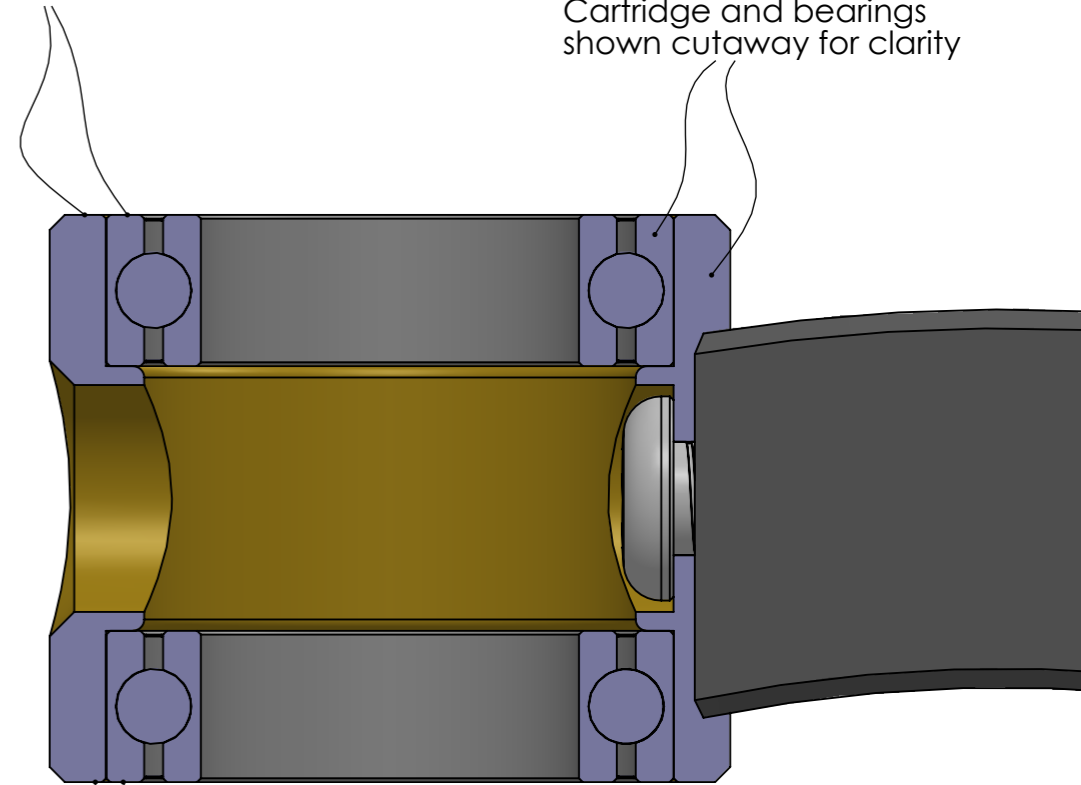
*It can be helpful to temporarily fit the stem into the top bearing to help with fitting it parallel, and then the bottom bearing can be fitted over the stem into the recess.*



Top bearing and cartridge must be flush

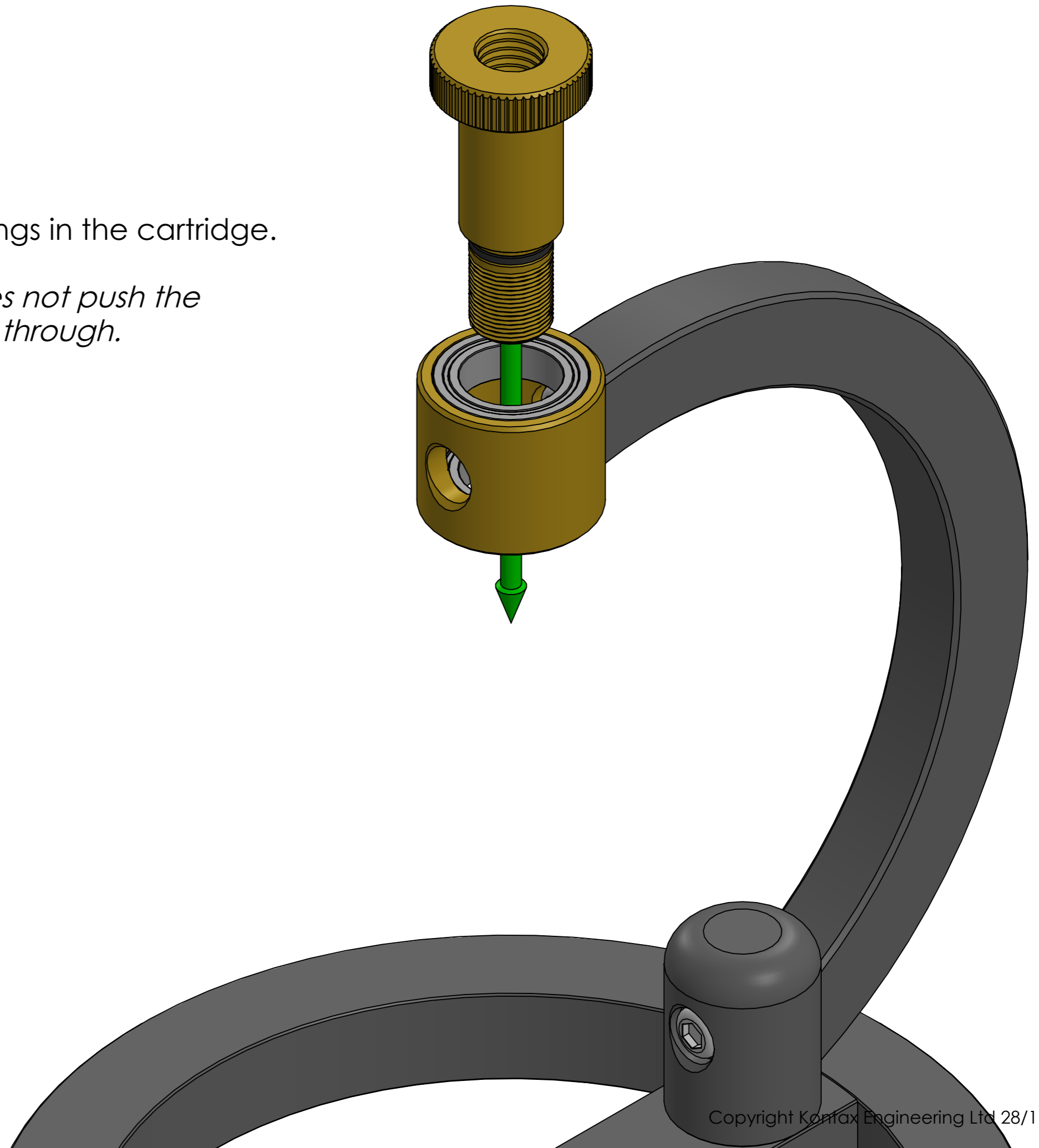
Cartridge and bearings shown cutaway for clarity

Bottom bearing and cartridge must be flush



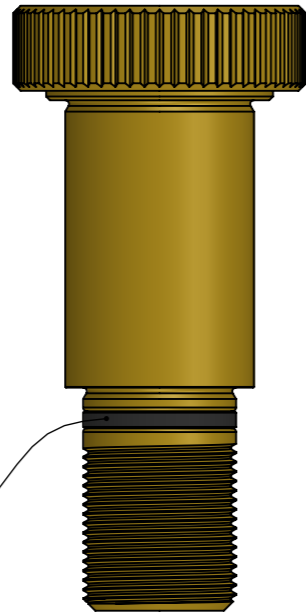
Fit the stem through the two bearings in the cartridge.

*Note: take care that the stem does not push the bottom bearing out as you push it through.*



*Note: the stem has a pre-fitted rubber O ring which provides an airtight seal between the stem and the boiler. Take care it does not become pinched as you screw the boiler onto the stem.*

Rubber O ring



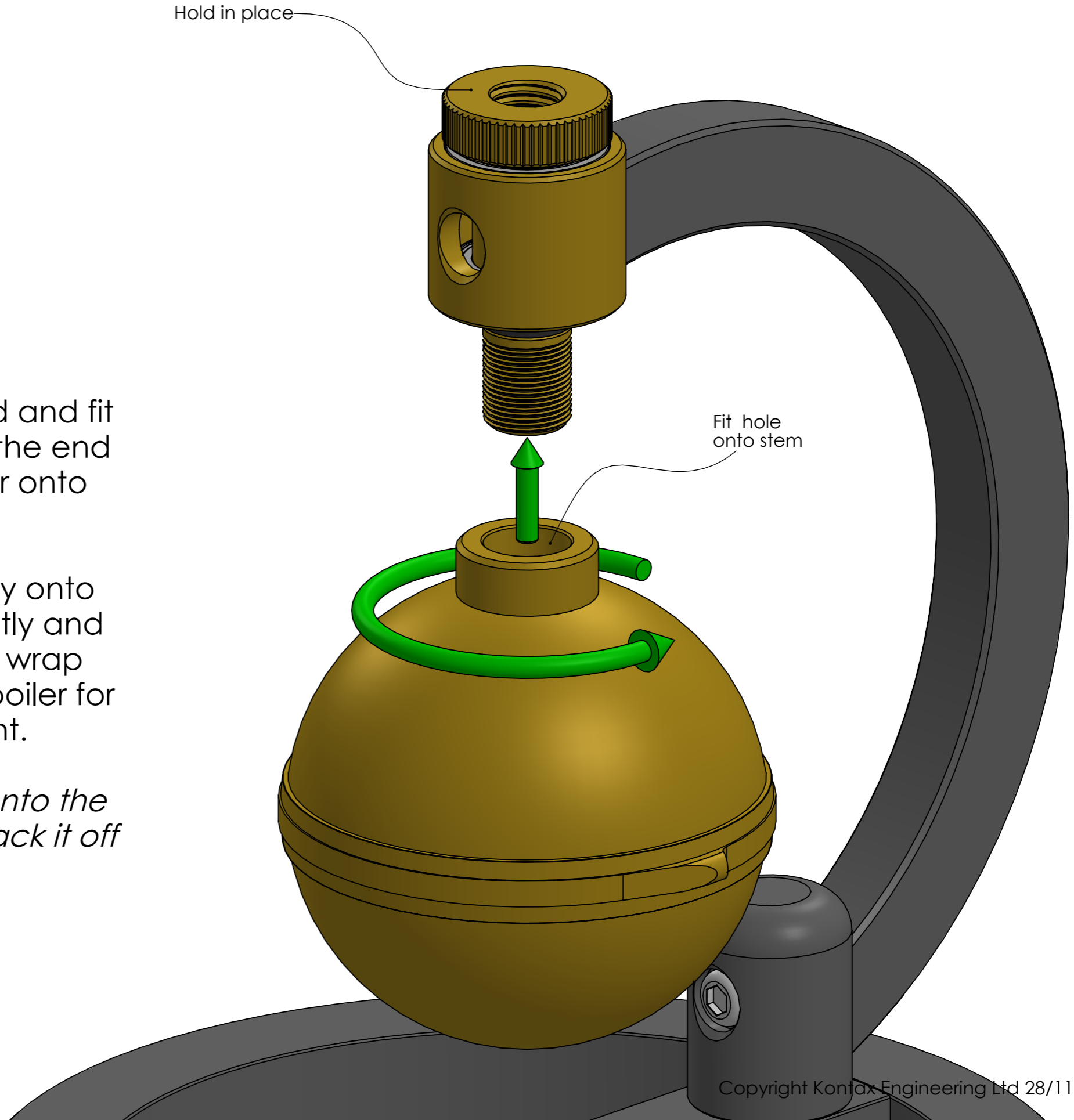
Hold the stem in place with one hand and fit the hole in the top of the boiler over the end of the stem. Carefully screw the boiler onto the stem.

Once the boiler is screwed all the way onto the stem grip the top of the stem tightly and tighten the boiler. You might need to wrap an elastic band around the stem or boiler for grip. See next page for correct fitment.

*Note: the boiler should screw easily onto the stem. If it feels tight do not force it, back it off a few turns and try again.*

Hold in place

Fit hole onto stem



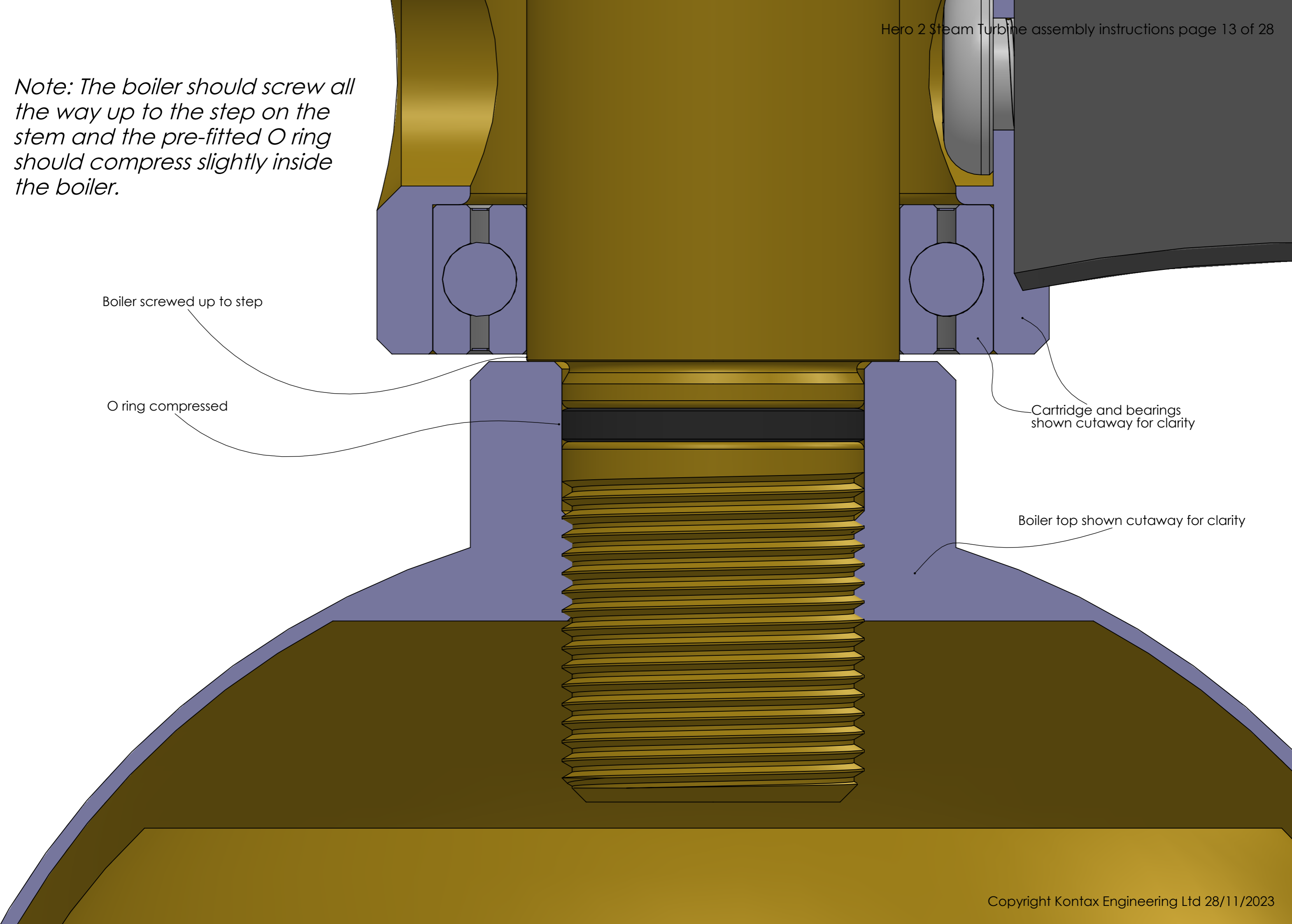
*Note: The boiler should screw all the way up to the step on the stem and the pre-fitted O ring should compress slightly inside the boiler.*

Boiler screwed up to step

O ring compressed

Cartridge and bearings shown cutaway for clarity

Boiler top shown cutaway for clarity

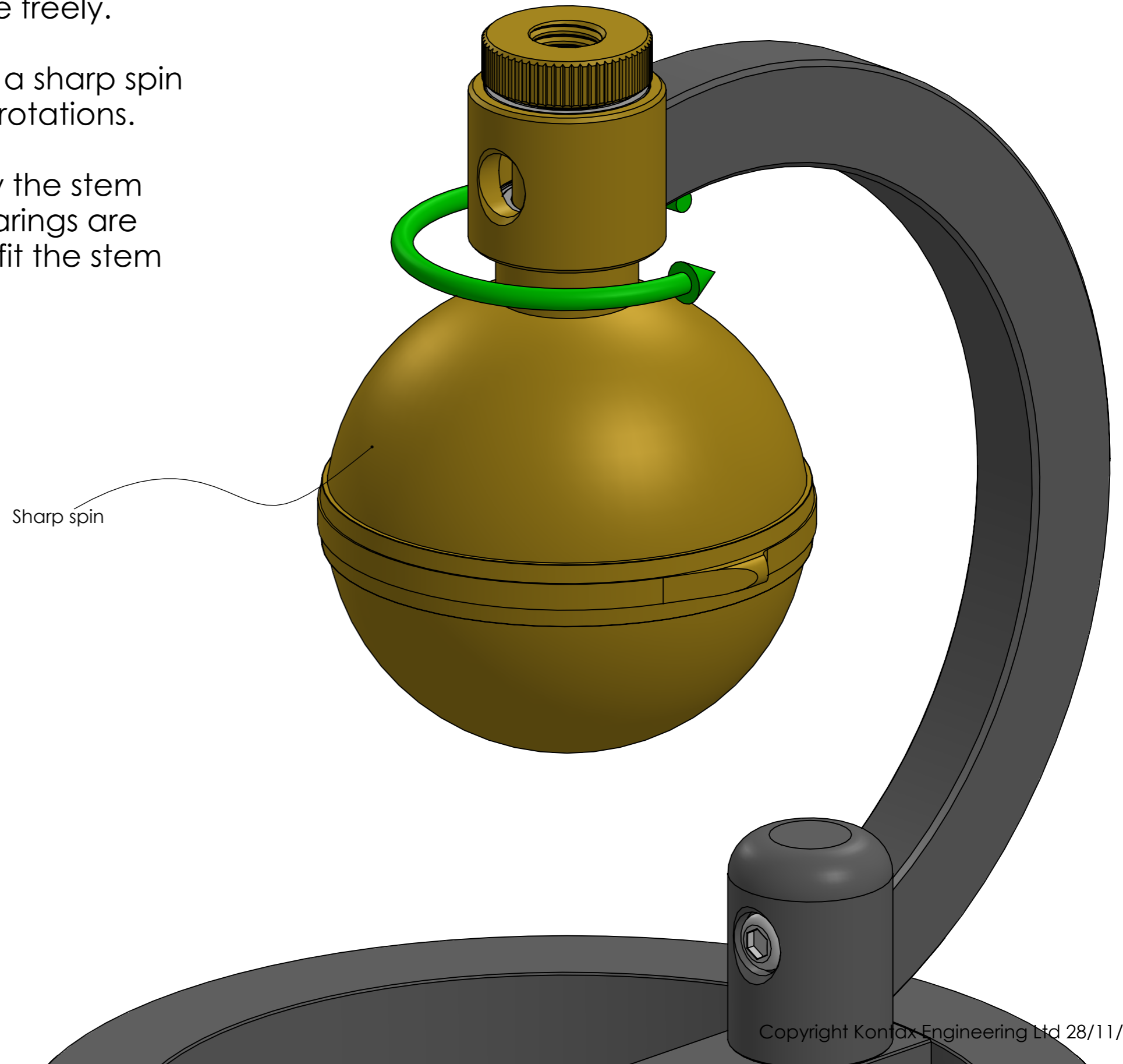


Check that the boiler and stem rotate freely.

You should be able to give the boiler a sharp spin and it should rotate easily for several rotations.

If it does not you will need to unscrew the stem from the boiler, re-check that the bearings are fitted flush with the cartridge, and re-fit the stem and boiler.

Sharp spin



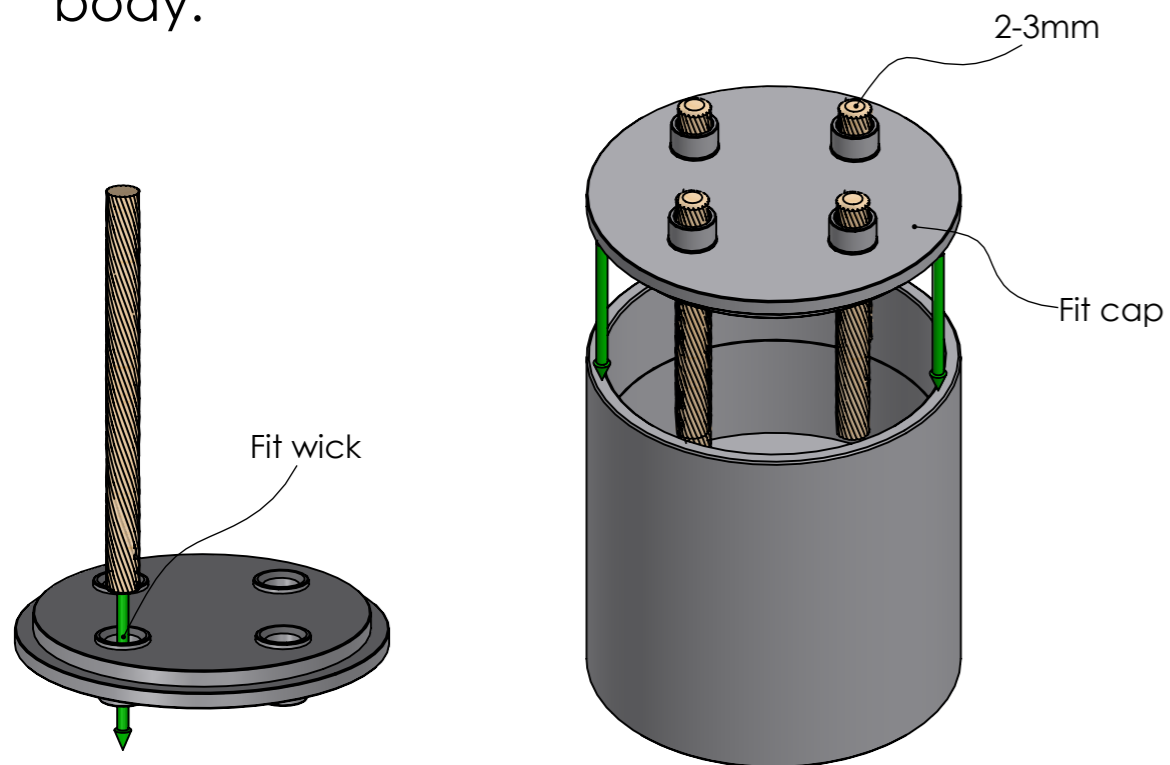
Cut a piece of wick 30mm long. If the cut end is frayed you will need to burn off the loose fibres, allow to cool, and then roll the end into a blunt point.

**ONLY EVER PERFORM THIS STEP ON DRY WICK, NEVER ON WICK THAT HAS BEEN SOAKED IN FUEL.**

Insert the prepared end of the wick through one of the holes in the bottom face of the burner cap, a pushing and twisting motion works best.

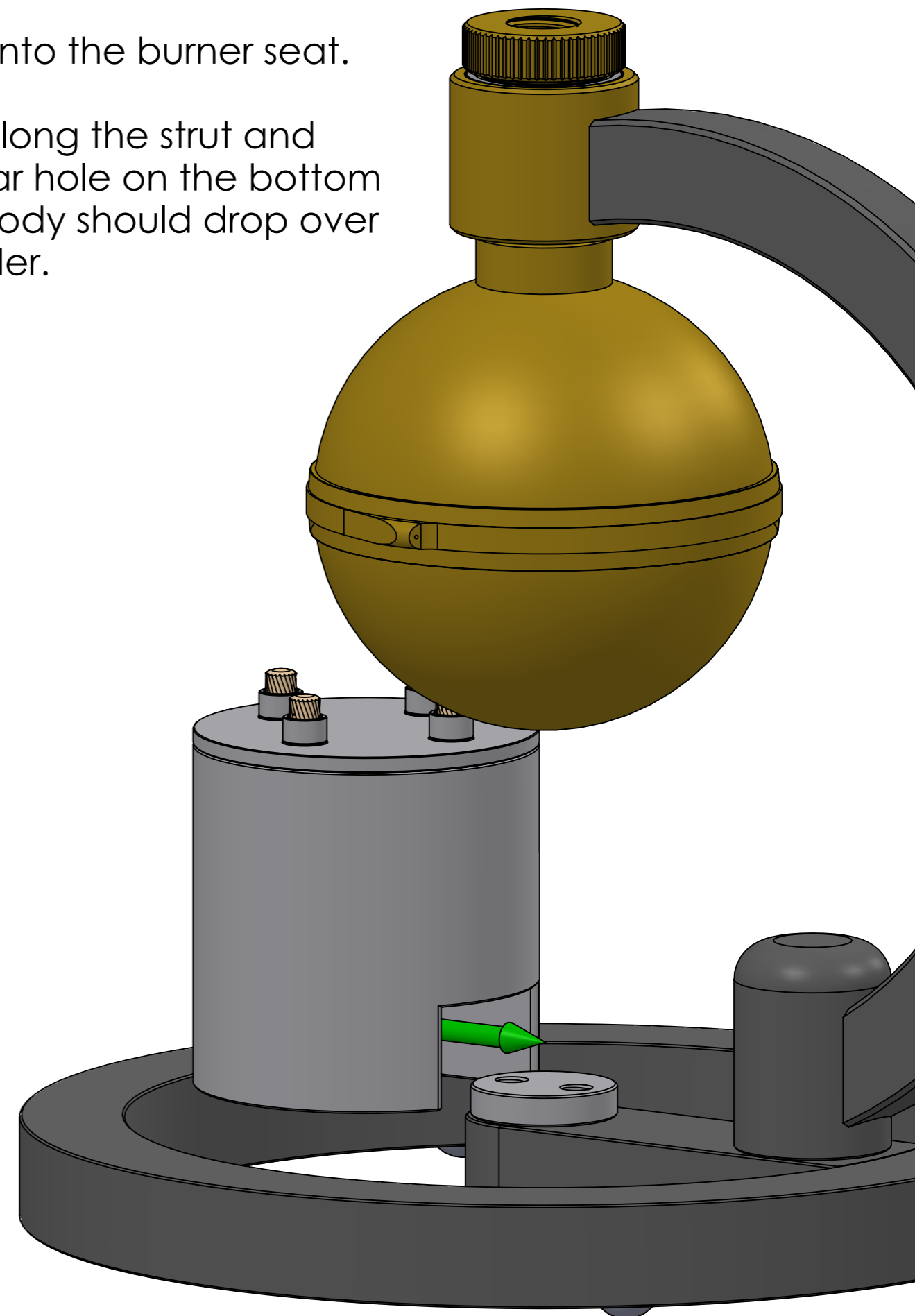
There must be 2-3mm of wick protruding from the top of the burner cap for efficient running.

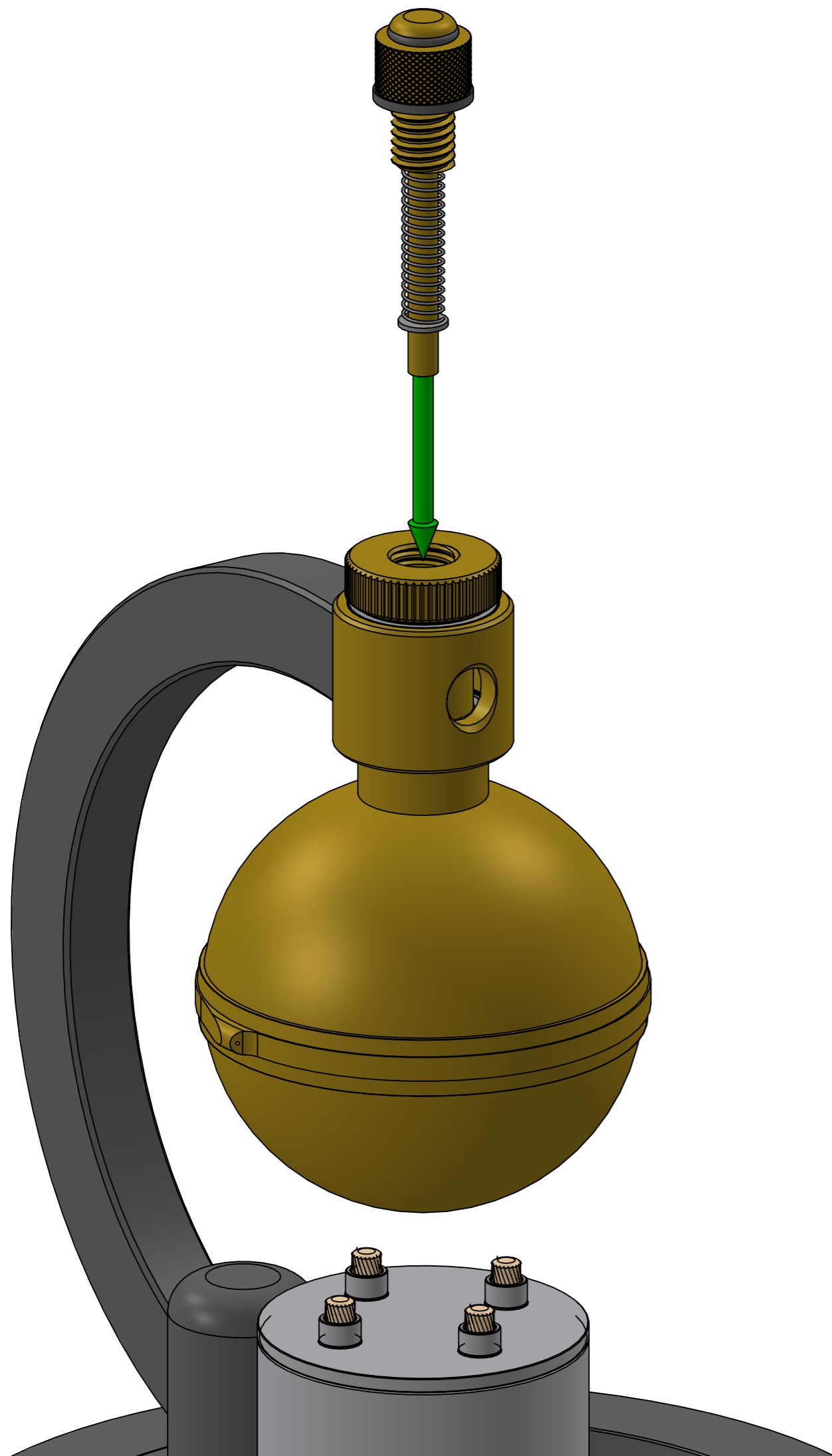
Repeat for the other 3 wicks and then fit the burner cap into the burner body.



Fit the burner onto the burner seat.

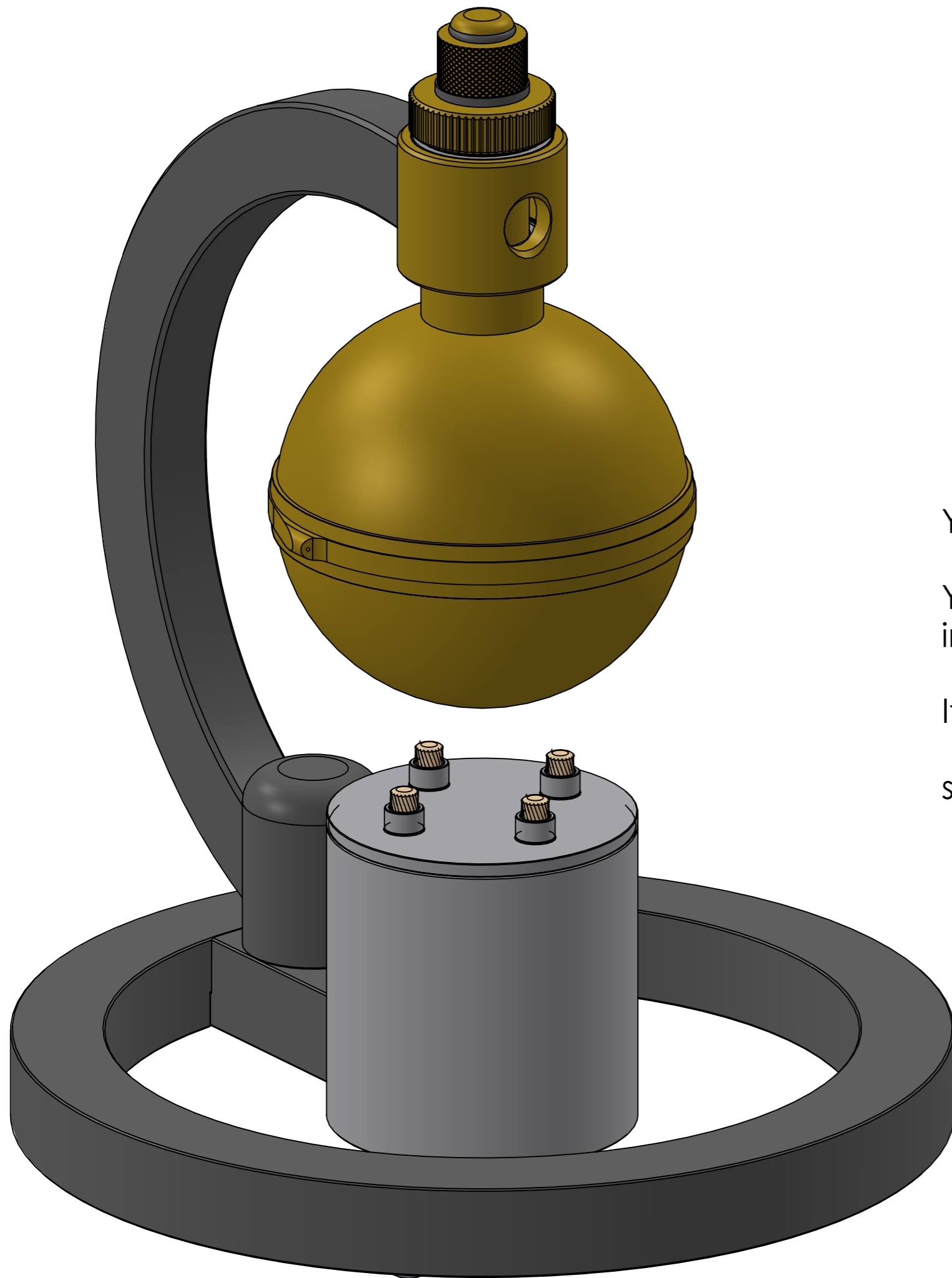
It should slide along the strut and then the circular hole on the bottom of the burner body should drop over the burner holder.





Screw the safety valve into the stem,  
you can use a paper towel to grip the  
boiler while you screw it in.



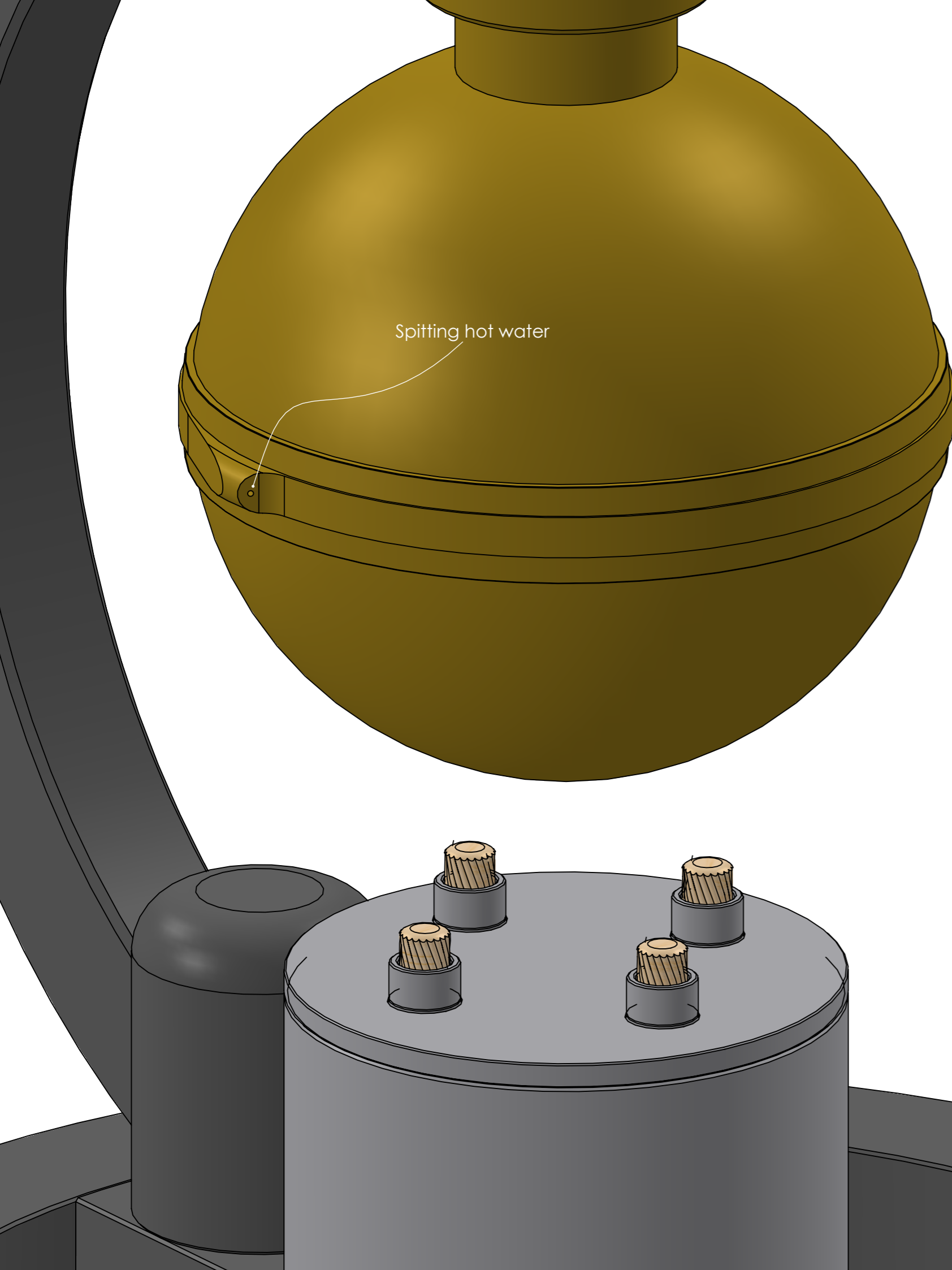


Your Hero 2 steam turbine is now fully assembled.

You can find safety, operation and maintenance instructions on the next few pages.

If you need help with your turbine you can email us at:

[support@stirlingengine.co.uk](mailto:support@stirlingengine.co.uk)



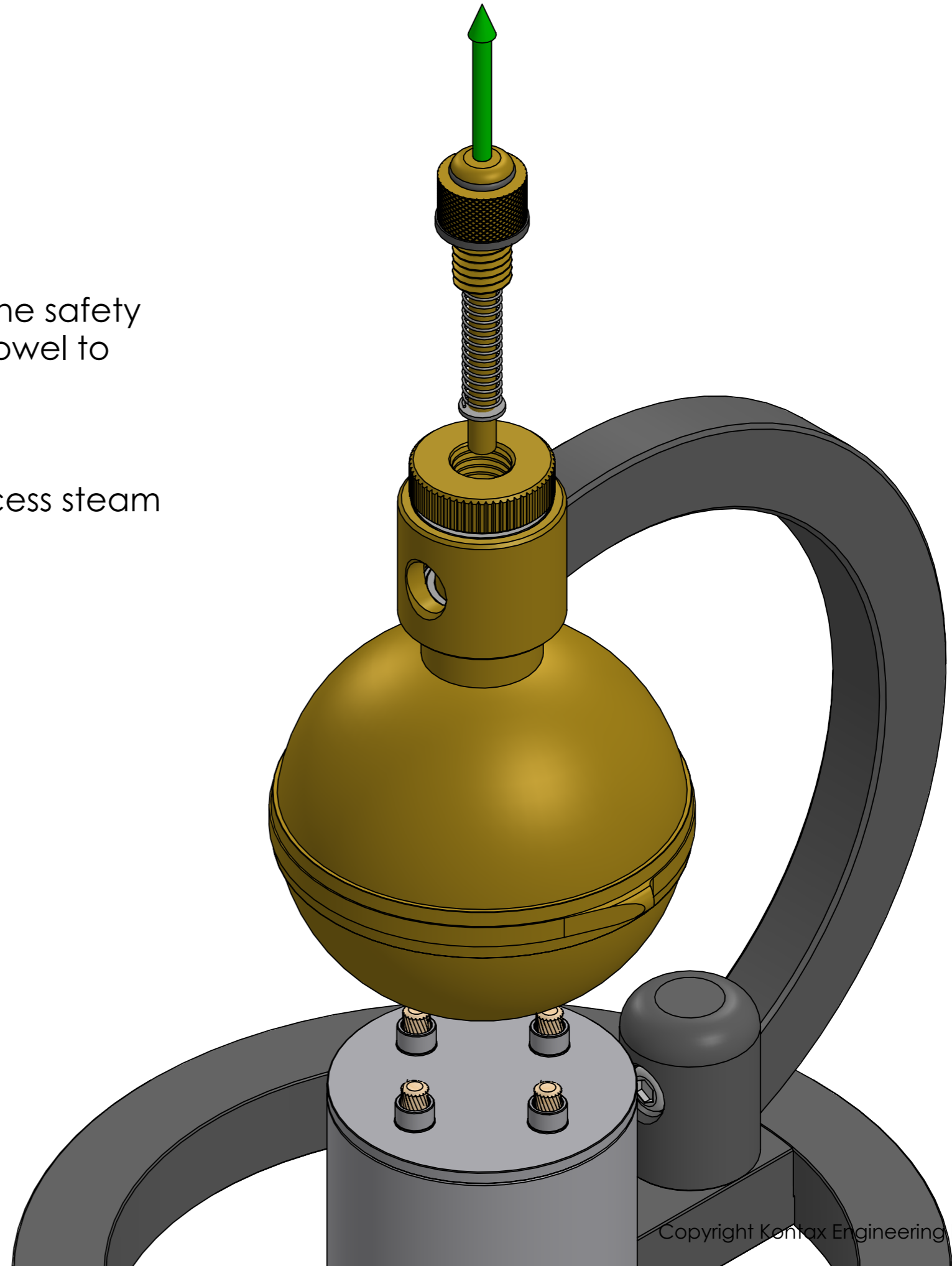
### **SAFETY NOTICE:**

- **Make sure you have a suitable fire extinguisher to hand in case of emergencies.**
- **Never leave a running turbine or naked flame unattended.**
- **All parts of the turbine will be very hot while in operation and will take time to cool down after running.**
- **In operation the turbine may spit very hot water from the two jet nozzles.**
- **Make sure children are fully supervised.**
- **Ensure burner is extinguished after use.**

# Operation

Make sure the turbine is cold and unscrew the safety valve from the stem, you can use a paper towel to grip the boiler while you unscrew it.

Note: The safety valve is pre-set to allow excess steam pressure to escape safely during operation.

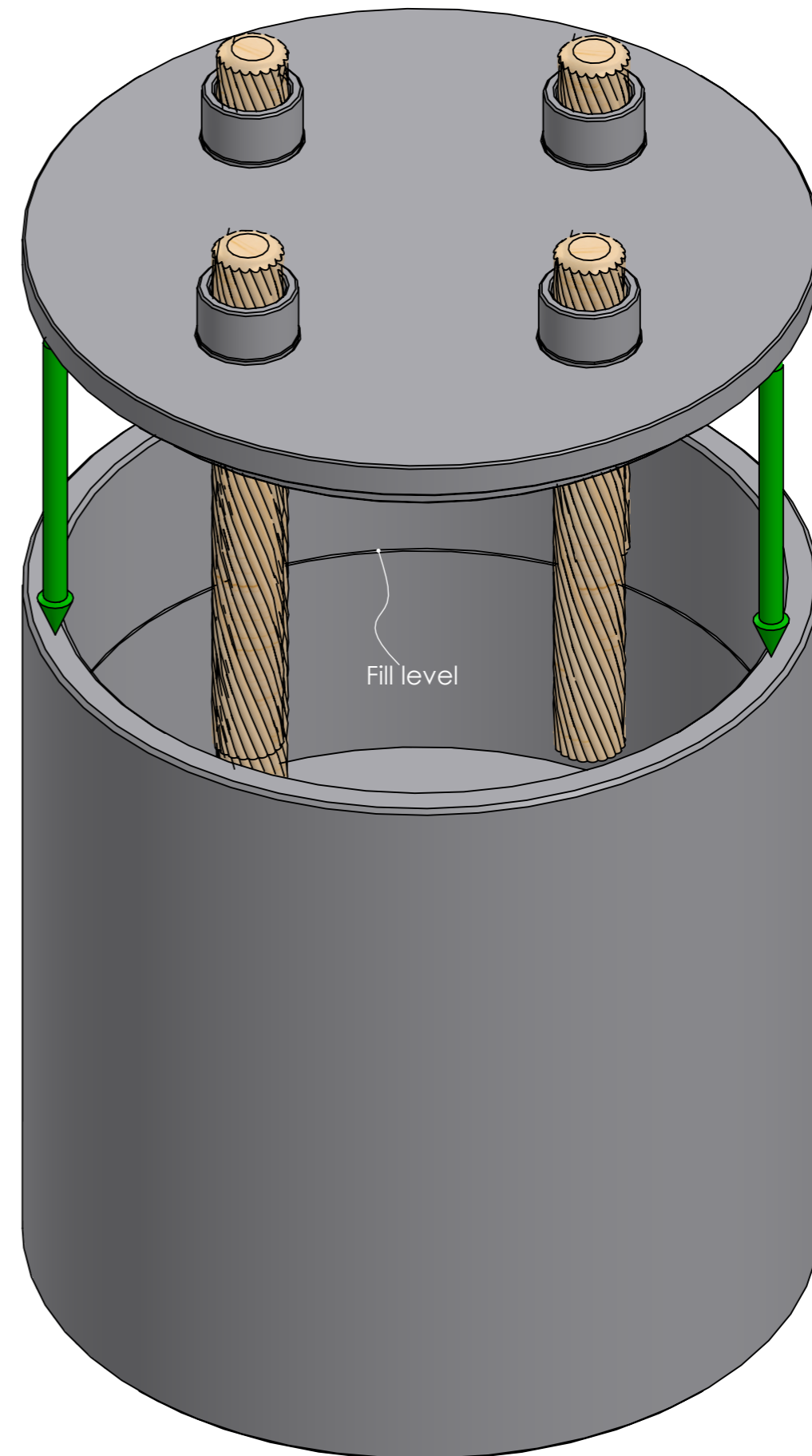


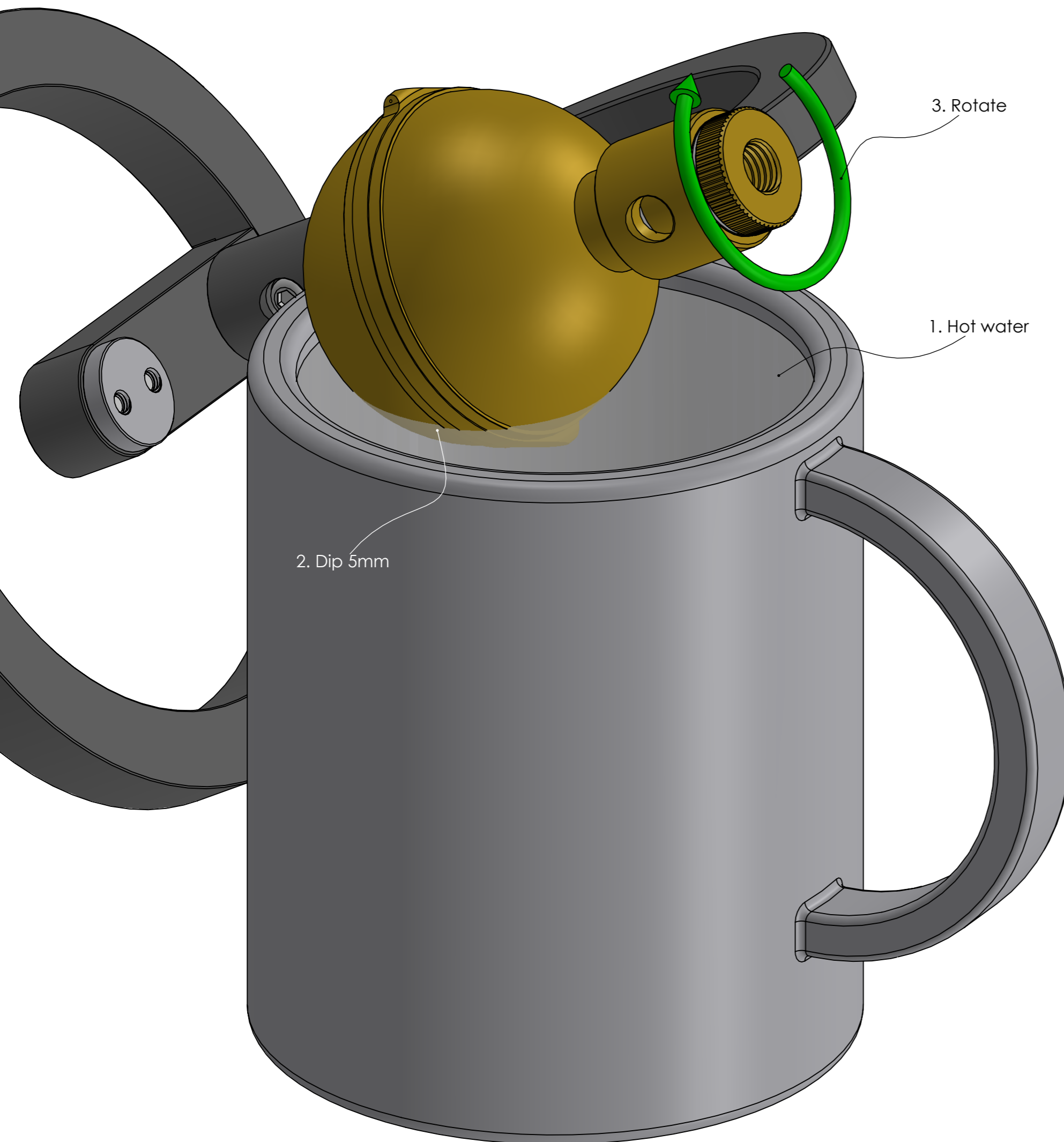
The turbine uses Methylated Spirits or Denatured Alcohol as fuel.

Remove the burner from the turbine and the burner cap from the burner body. Adjust the wick to 2-3mm protruding from the top and 15mm-30mm from the bottom.

Fill the burner body with fuel to the fill level AND NO MORE. Fit the burner cap back in the burner body.

Put the filled burner to one side, do not fit back onto the turbine yet.

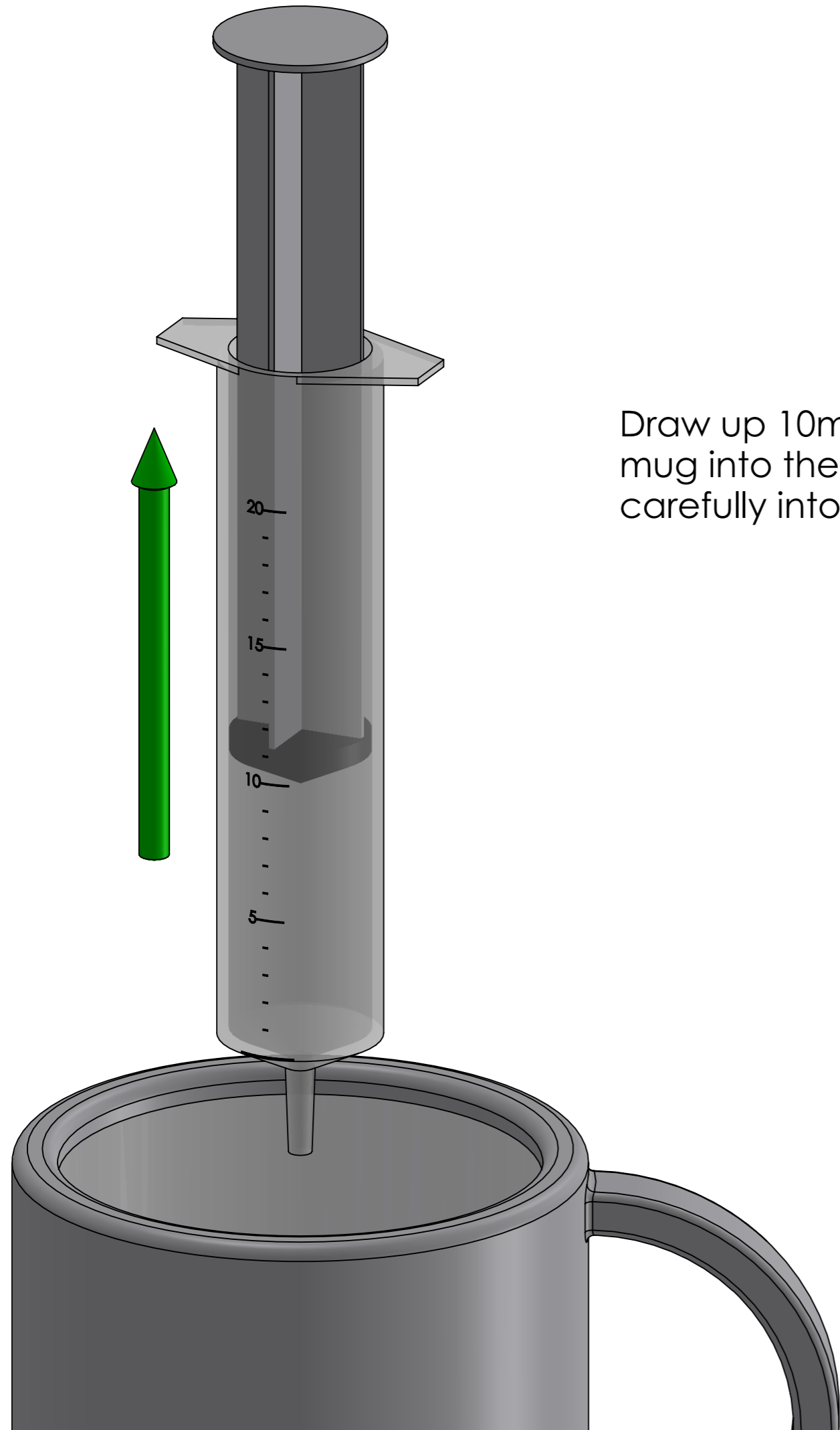




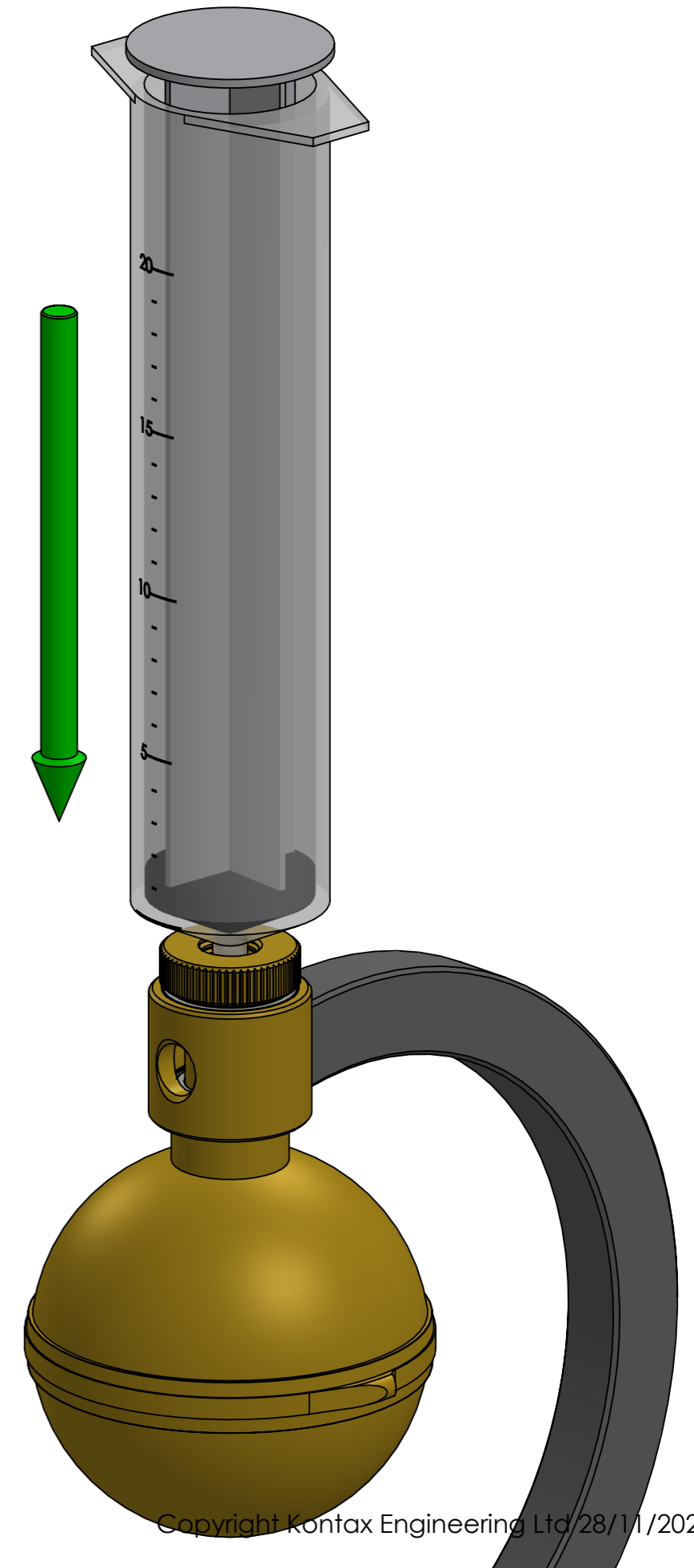
For efficiency it is recommended to warm the boiler before operation.

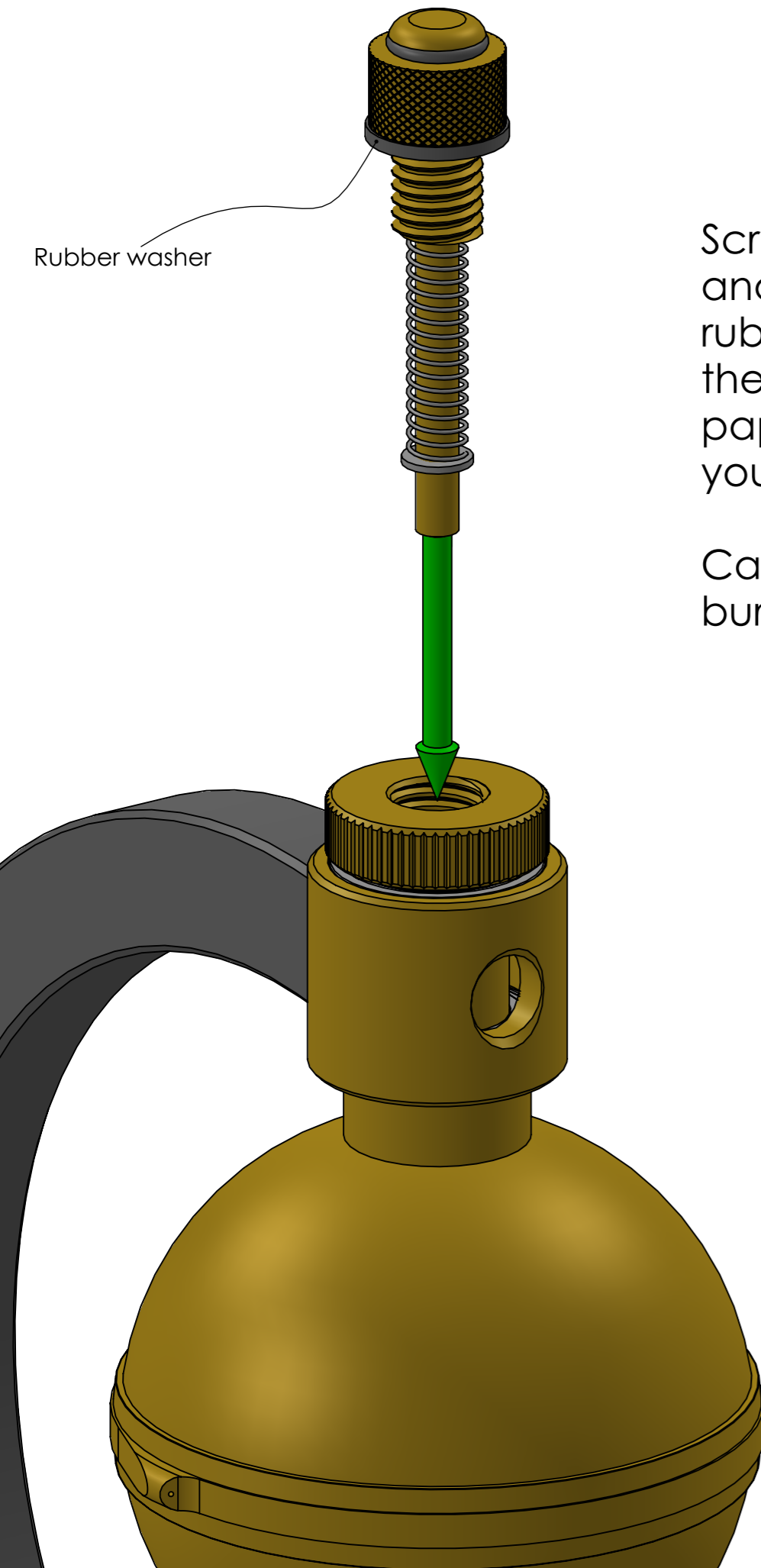
*Note: make sure you have the syringe, safety valve, and filled burner ready for the next step before warming the boiler.*

1. Fill a mug with hot water.
2. Tilt the turbine at an angle and dip the boiler into the water by about 5mm.
3. Rotate the boiler in the water for about 10 seconds to warm it up.



Draw up 10ml of hot water from the mug into the syringe and squeeze it carefully into the boiler.

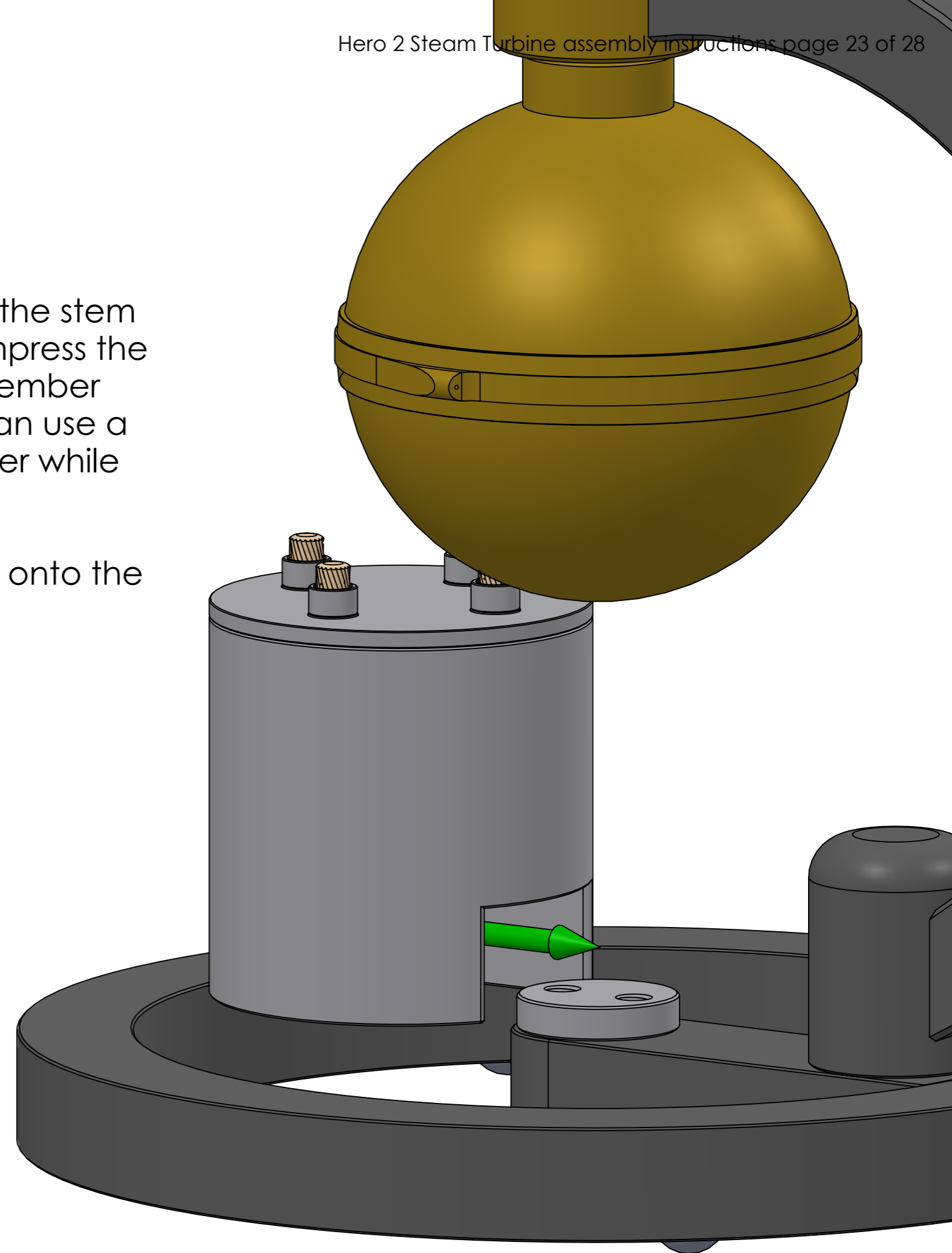


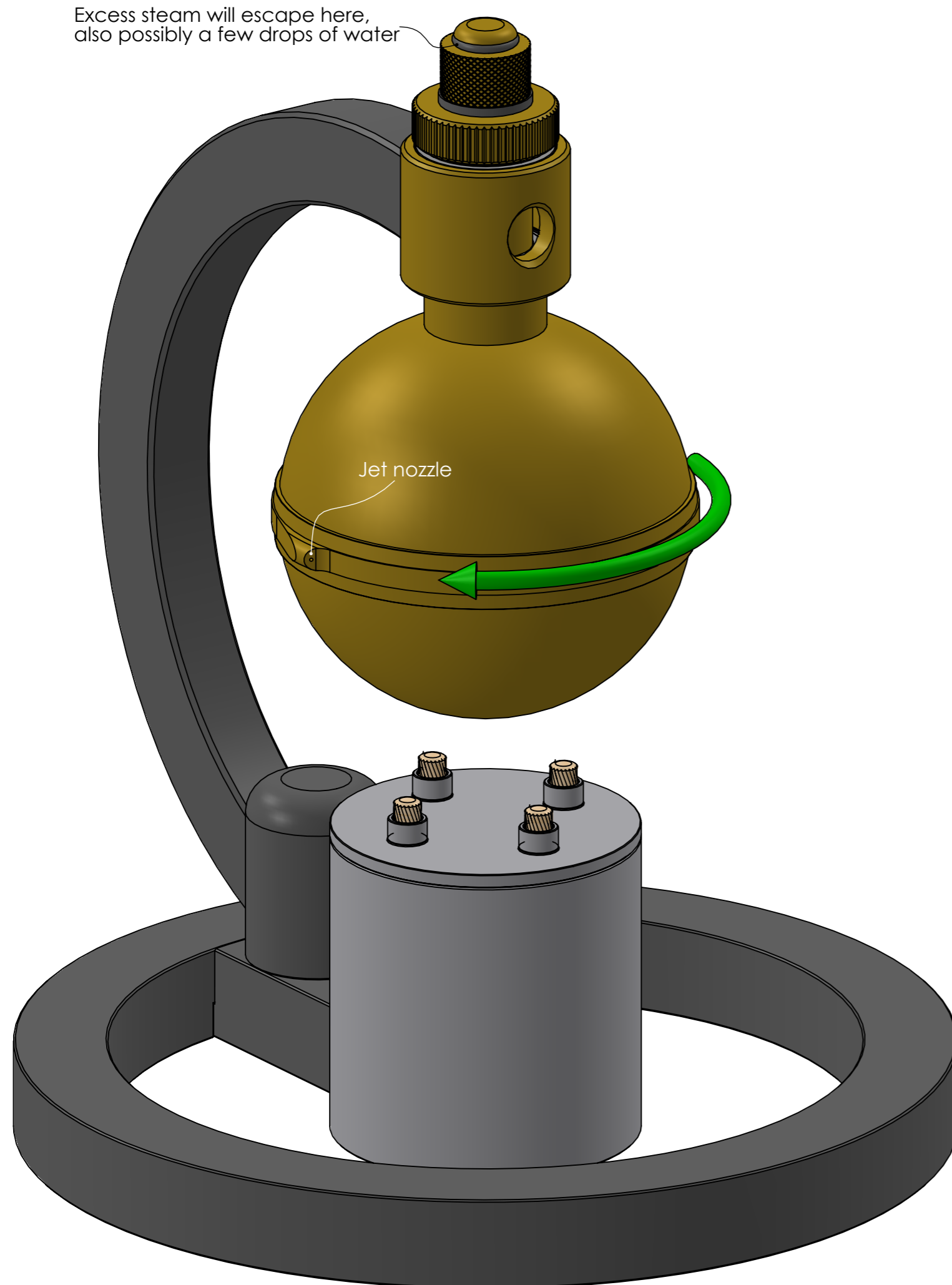


Rubber washer

Screw the safety valve into the stem and tighten enough to compress the rubber washer slightly. Remember the boiler will be hot, you can use a paper towel to grip the boiler while you tighten the valve.

Carefully fit the filled burner onto the burner seat.





Light all four wicks.

As the water inside boils and turns to steam the steam will be ejected from the 2 nozzles and force the boiler to spin in the direction shown.

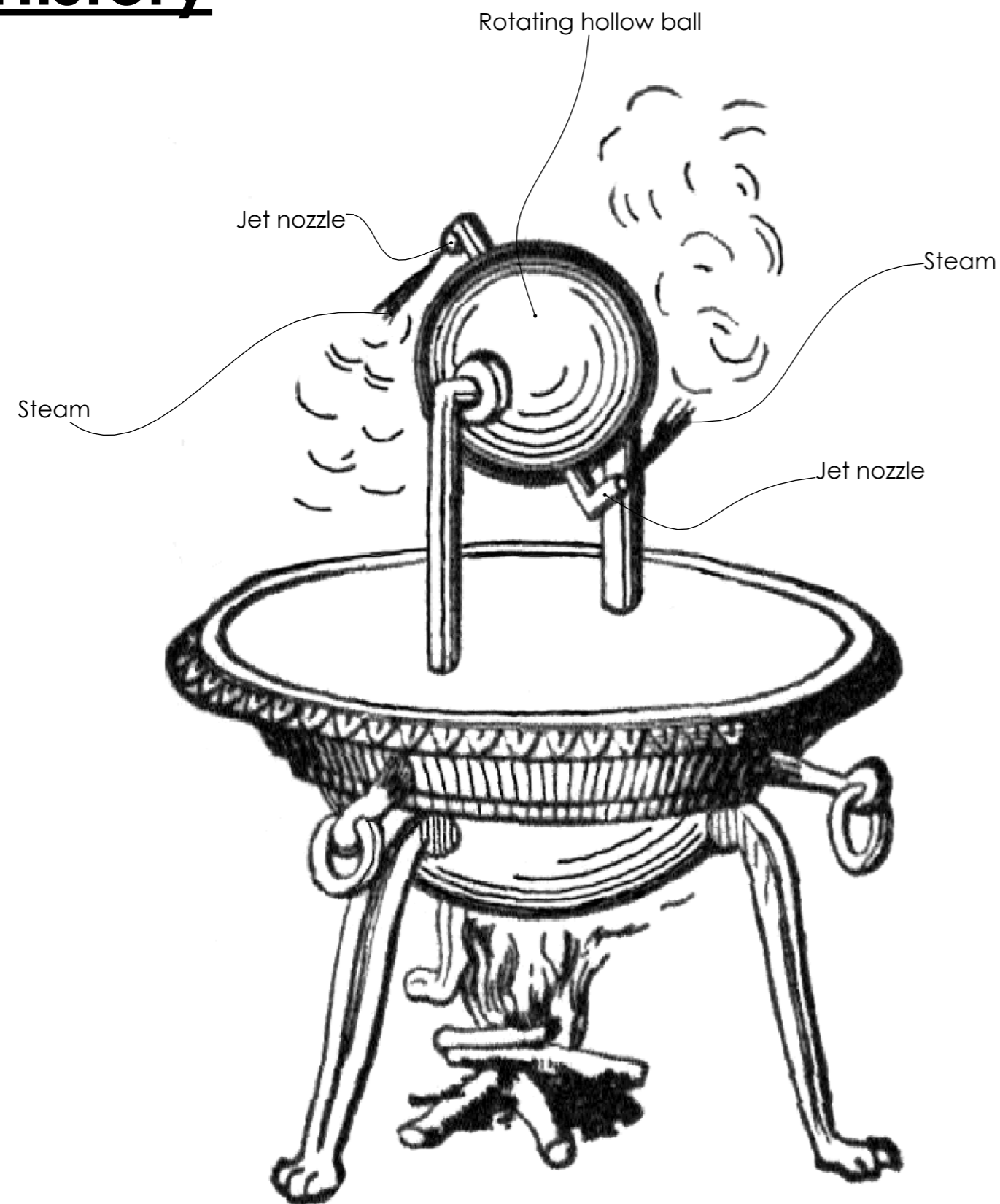
The turbine should take about 90 seconds to start spinning and will steadily increase speed until all the water has boiled away, and then it will coast to a stop.

Remember that the safety valve is preset to allow excess steam pressure inside the boiler to escape. As the excess steam escapes it is quite normal to see a few drops of water bubbling out of the top of the valve.

At the same time as the water boils away all (or most) of the fuel should have been used up, it is important to extinguish the flames when the boiler stop spinning to prevent the wicks smouldering down to the burner cap.



# History

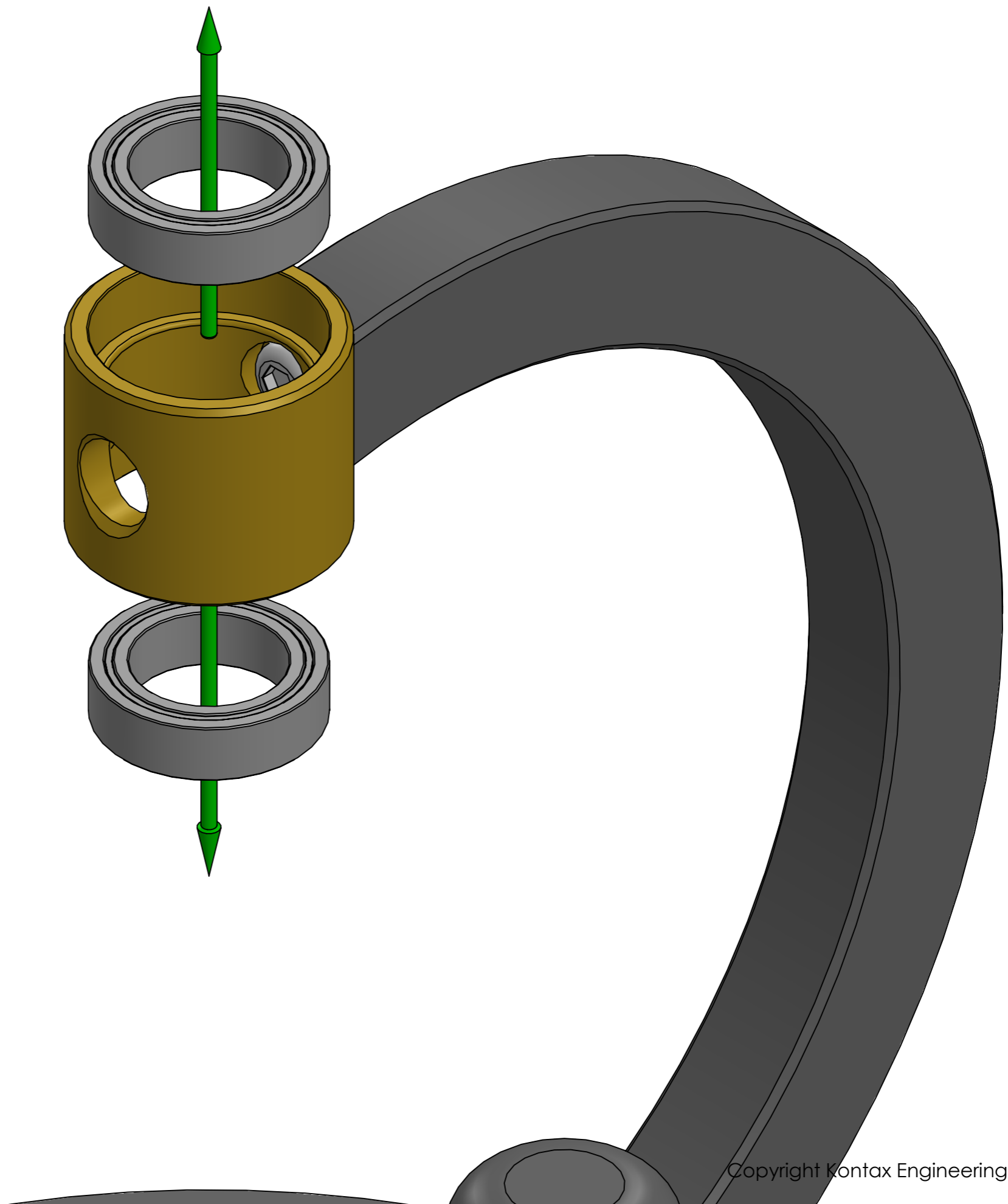


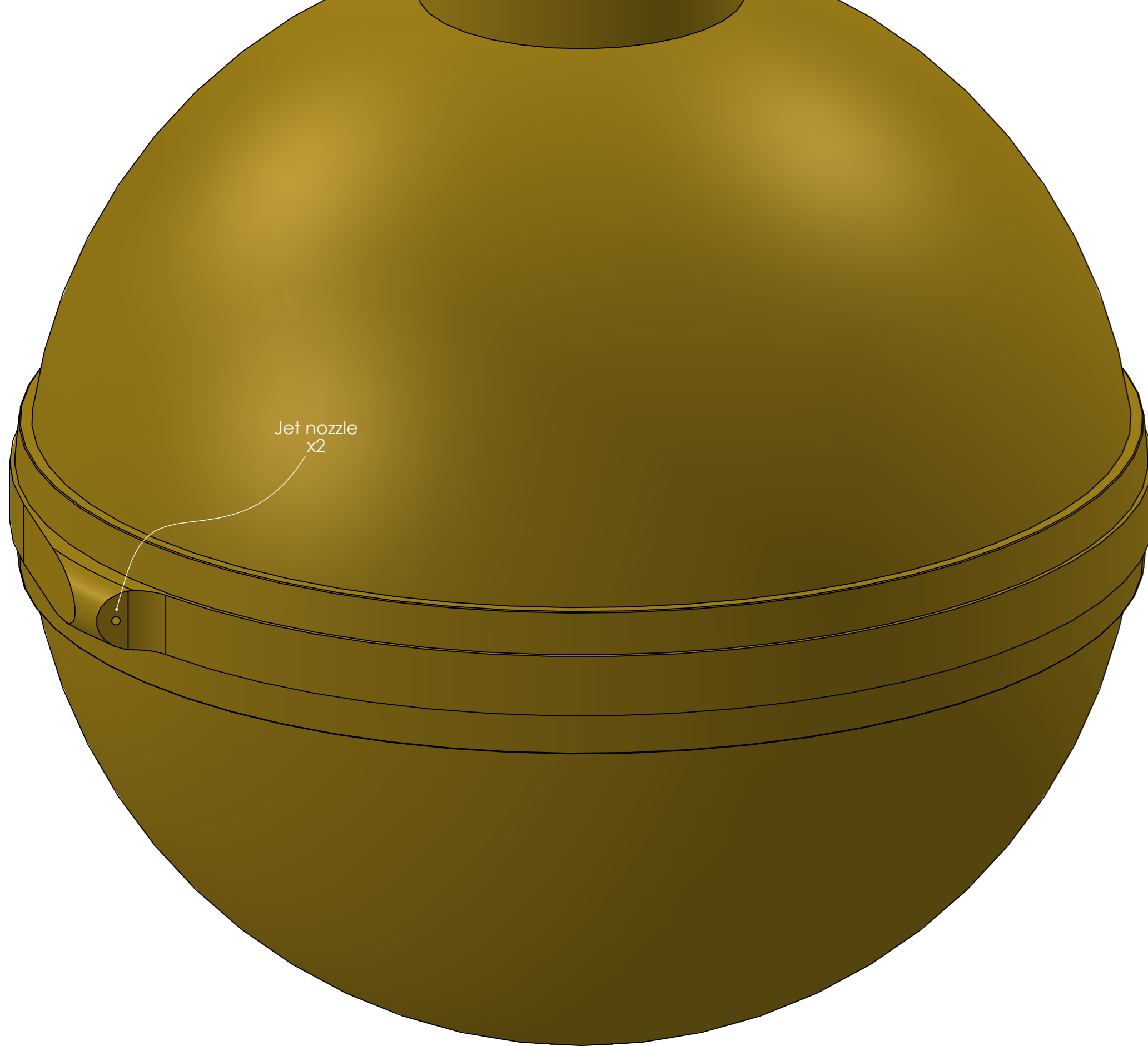
It is commonly believed Hero of Alexandria (c. 10 - 70 AD) invented the first steam turbine (see illustration on left). It was known as an aeolipile, or sometimes an aeolipyle or eolipile. Vitruvius (c. 80 BC - c. 15AD) mentioned the aeolipile by name, hence many historians believe its origins are a little older predating Hero. The name aeolipile comes from the Greek words "aeolos" (Greek god of wind) and "pila" (ball). It uses rocket-like propulsion to turn, forcing high pressure steam from small jet nozzles at the periphery of a rotating hollow ball.

## Maintenance

Your Hero 2 steam turbine should run for many hours without needing any maintenance.

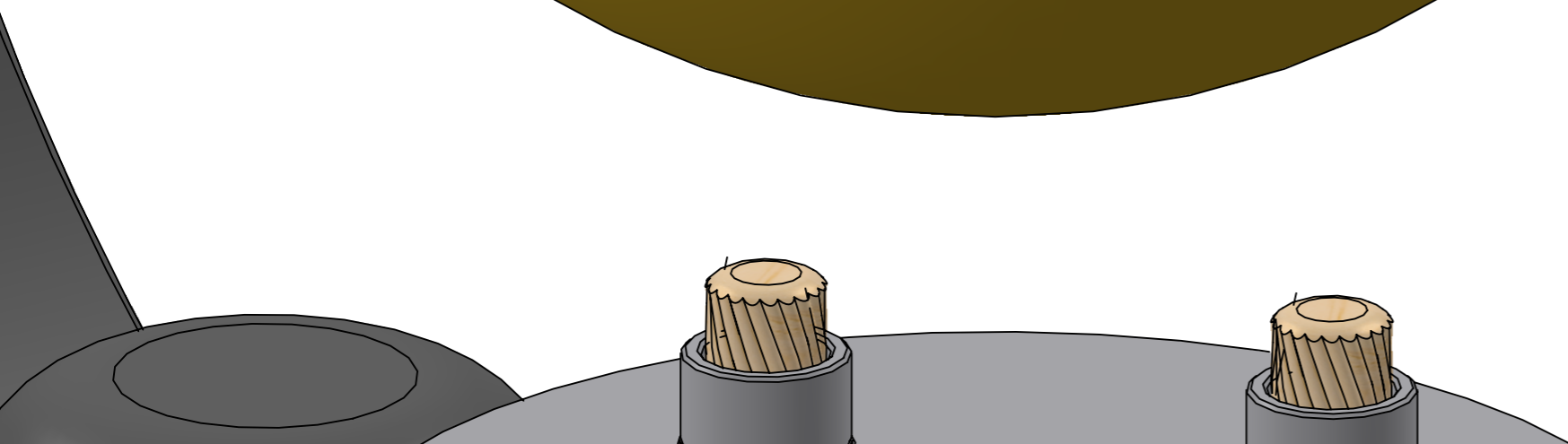
But if you find the performance is not as it used to be then the bearings might need cleaning. They can be removed and rinsed in Methylated Spirits or Denatured Alcohol and refitted with one or two drops of sewing machine or 3-in-1 oil. Never use motor oil or any other general oil.





Jet nozzle  
x2

If oiling the bearings does not return the turbine to normal performance then the jet nozzles might need cleaning. You can use a small pin, a sewing needle or an acupuncture needle to clean out the two jet nozzles.





Our workshop is located in the Thames Valley, United Kingdom and is staffed by a skilled team of 9 designers, machinists and assemblers. We have 4 CNC mills, 3 CNC lathes and 3 CNC mill-turn centres.