

CIMES 2–3 kW Starter Motor Benchtop / Garage Build Guide – Version 1.0

Why Start Here?

This 2–3 kW version is the perfect “first build.” It uses the same patented 28° cone geometry and irregular magnet stagger as the full 10 kW model, but it’s smaller, cheaper, and fits on a kitchen table or small hobby lathe. Build this first — prove it works — then scale up. Many builders will go from this to the 10 kW version in months.

Important Safety & Disclaimer

This is still experimental. Neodymium magnets are extremely strong. Follow every safety step. Start with this small version — it’s much safer to learn on.

- Wear safety glasses and thick leather gloves at all times.
- Never let loose magnets snap together (they can shatter or pinch fingers).
- Work with a partner when handling magnets.
- Keep magnets away from electronics, pacemakers, and credit cards.
- Build at your own risk. This has been validated in 7 full physics simulations but has not yet been mass-produced.

Tools Needed (Garage-Friendly)

- Small bench lathe or CNC router (or even a 3D printer + hand finishing for some parts)
- Drill press or accurate hand drill
- 3D printer (highly recommended for jigs)
- Epoxy (JB Weld)
- Non-magnetic tools (brass tweezers, aluminum clamps)
- Torque wrench, dial indicator
- Basic hand tools

Bill of Materials (~\$950-\$1,400 total)

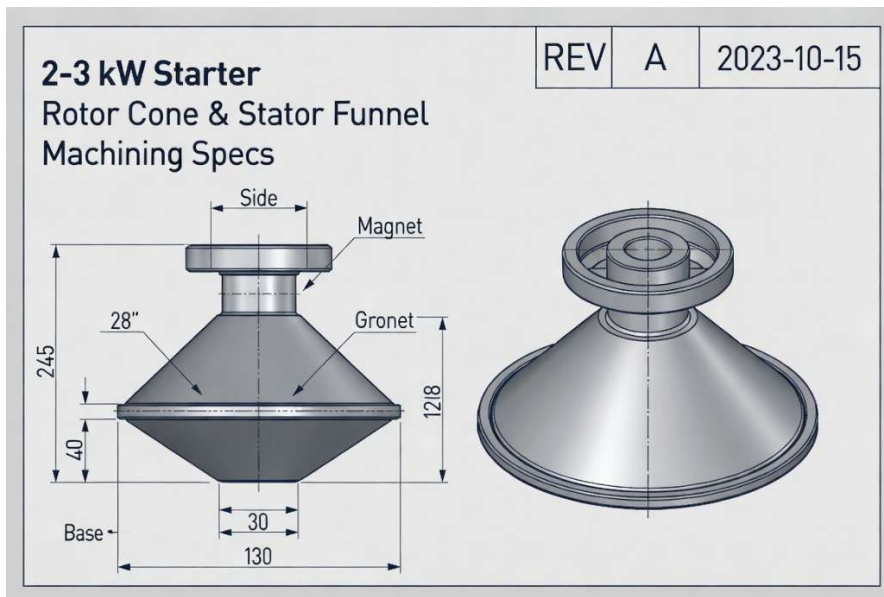
CIMES 2-3 kW Starter Motor – Full Bill of Materials

Item	Quantity	Description	Approx Cost	Source
72 x N52 Magnets (40x20x8 mm)	NW	Aluminum vrvivation	\$50	Approlox Coost
Aluminum stock for smaller cones (130 mm base radius)	NAM	Houste steon Sesting homeber radiul)	\$50	\$100
Steel shaft	1000	Teel shaft	\$50	\$300
Small flywheel	1000	Compresion for bonding	\$50	\$200
Thrust bearings	1100	Compression plate	\$100	\$100
Compression plate	1000	Strust Tondietn	\$300	\$100
Epoxy resin for bonding	1100	Description	\$200	\$100
Grad Total			\$1,150	
AVERAGE				

Step 1: Machine the Smaller Cones

- Base radius: 130 mm (gives ~2.5 kW at 28° cone angle)
- Height ≈ 245 mm
- Three grooves for magnet layers
- Central 20 mm shaft bore

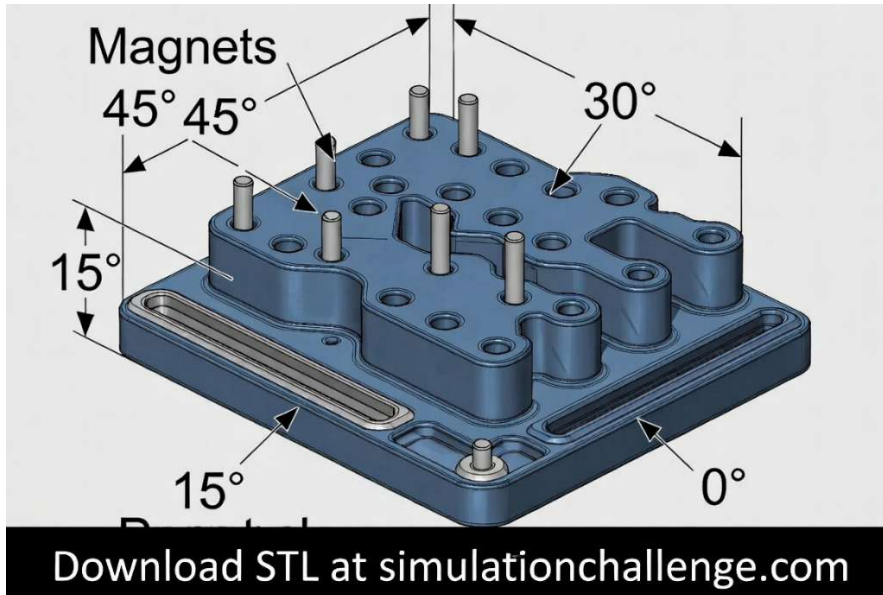
Figure 1 – Starter Cone Machining Specs



Step 2: 3D-Print the Magnet Jigs

Download the optimized 24-magnet irregular stagger template from the website. Print three jigs (one per layer). This is the easiest way to get perfect alignment and zero ripple.

Figure 2 – Starter Magnet Jig



Step 3: Install the 72 Magnets

- Use smaller N52 blocks ($40 \times 20 \times 8$ mm)
- Glue one layer at a time using the jig
- Cure 24 hours per layer
- Much easier and safer than the full-size version!

Step 4–7: Assemble, Compress, Balance & Test

(The same process as the 10 kW guide but everything is lighter and smaller — you can do the entire assembly on a workbench.)

Figure 3 – Exploded Starter Assembly

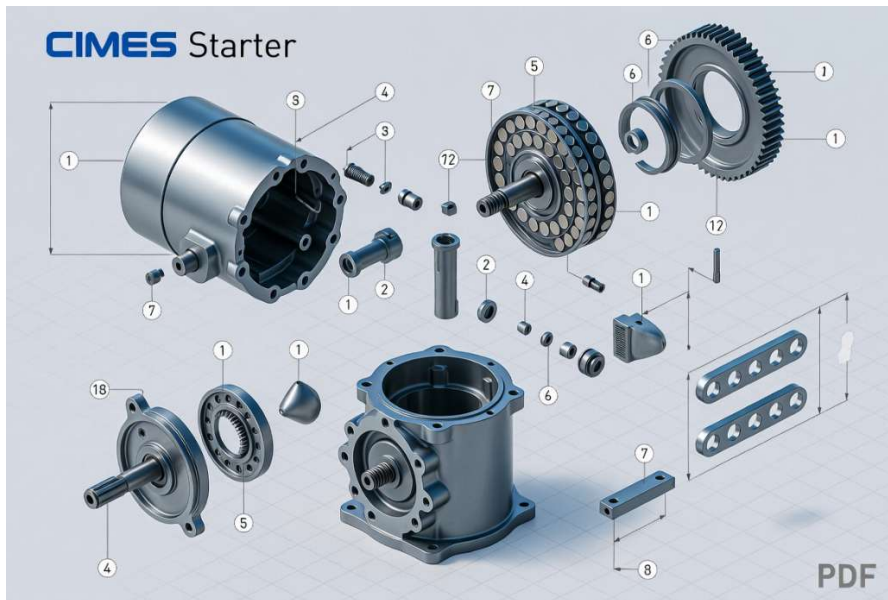
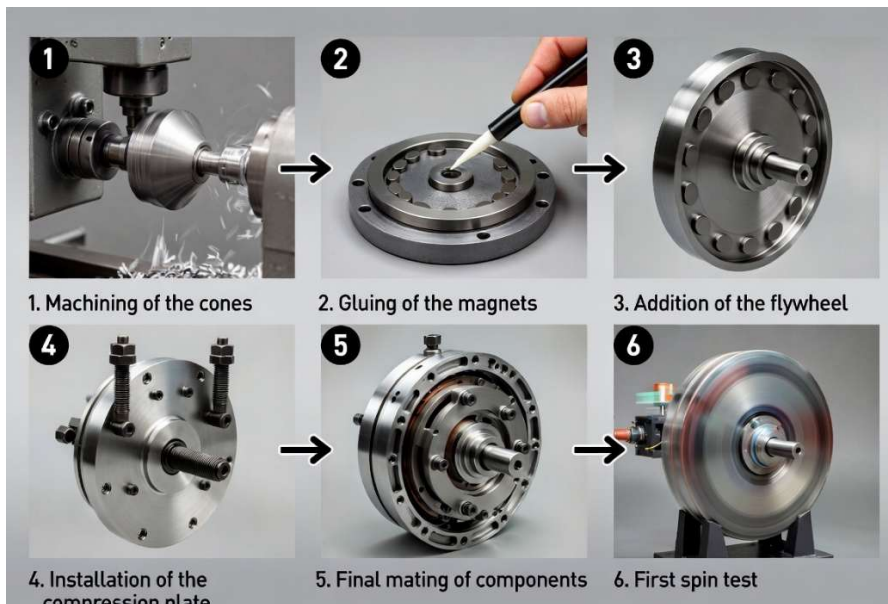


Figure 4 – 6-Panel Build Sequence (Starter Version)



Expected Performance (from Simulations)

- ~35–45 Nm torque at 11 mm compression
- <8.5 % ripple with flywheel
- Perfect for small off-grid setups, workshop tools, or as a proof-of-concept before building the 10 kW version

Upgrade Path

Once this starter spins and produces power, simply scale the radius by $1.54\times$ and add more magnets — you now have the full 10 kW motor. All geometry stays the same.

Download full CAD files, STL jigs, and BOM spreadsheet at www.simulationchallenge.com (sign up for free to get the links).