TORQUE METER FOR EXTERNAL WINDING
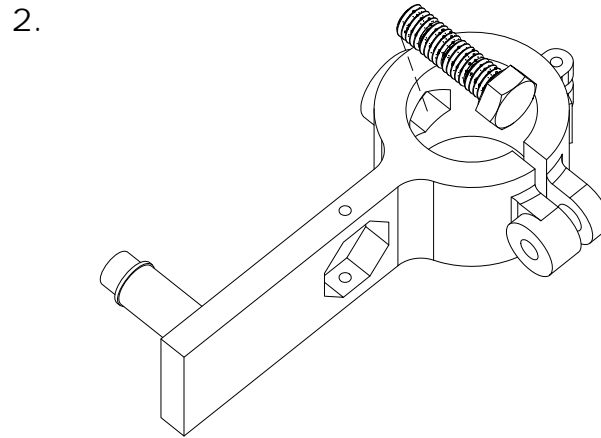
TORQUE
INCH-OUNCES
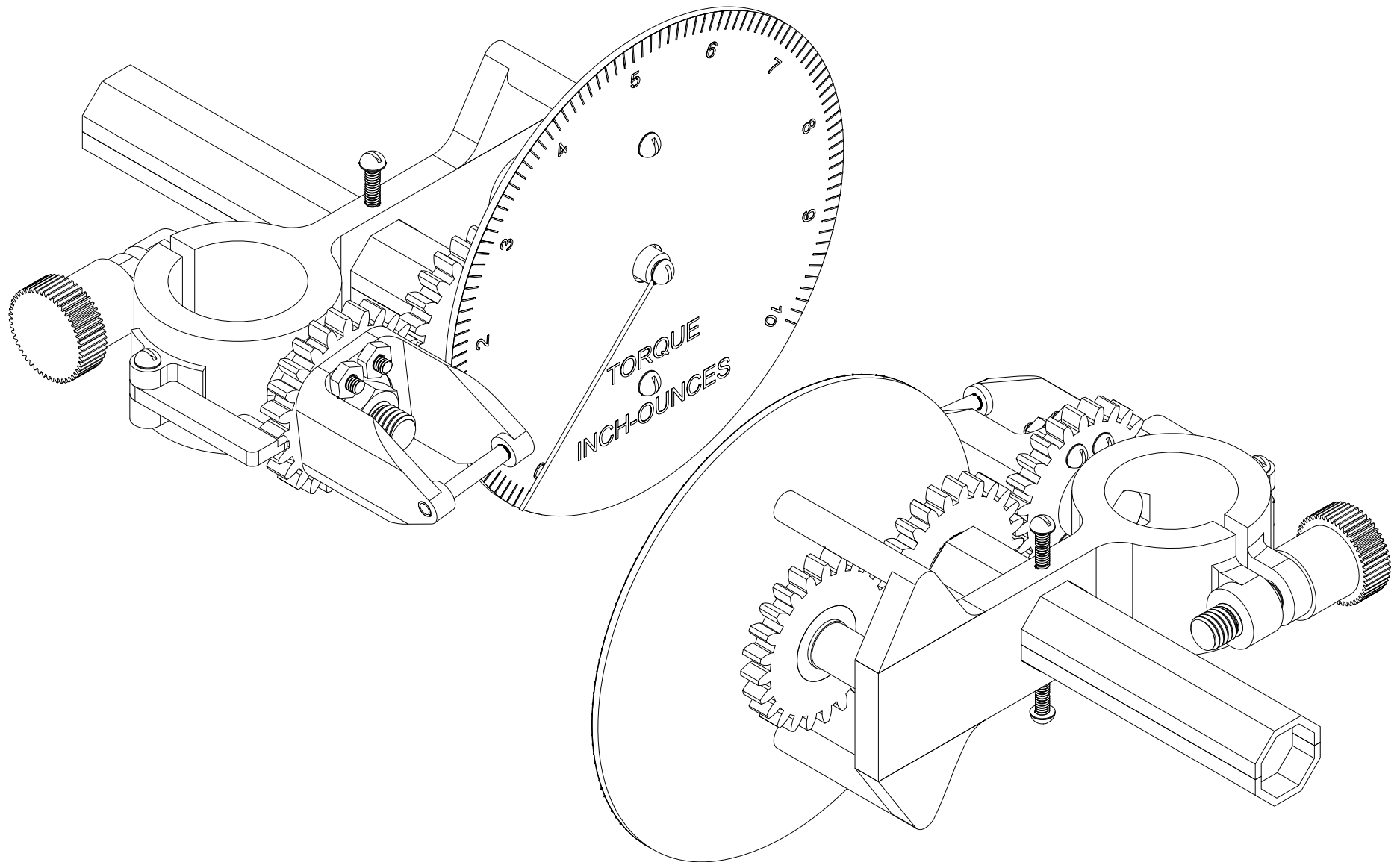
ASSEMBLY GUIDE
SEPTEMBER 2023 Rev 1.1
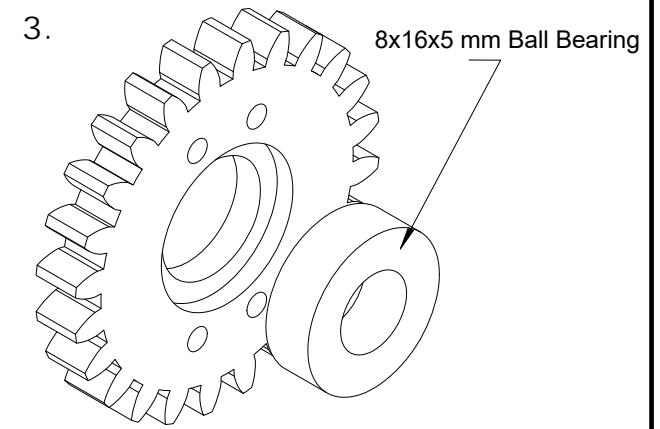
BY PAUL BRADLEY
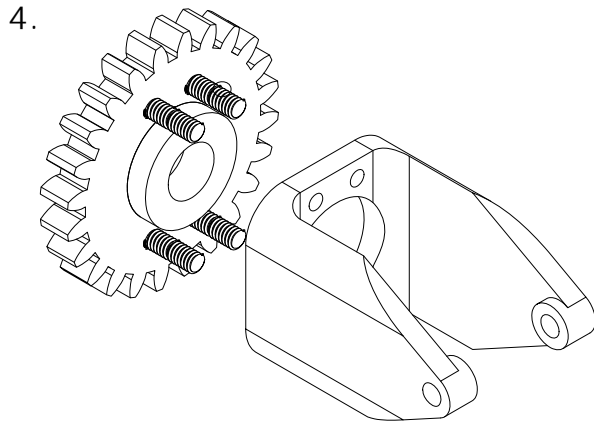
1.

Tap for 1/4-20

Tap for 4-40
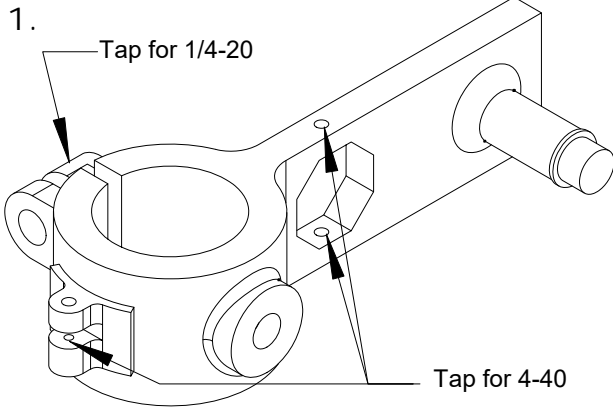
Tap the indicated holes for the thread sizes shown.

2.

Insert a 1" 1/4-20 hex head bolt in the meter backbone as shown.
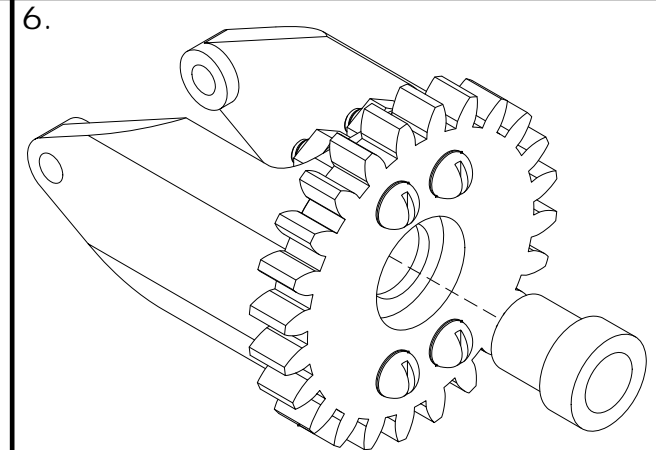
3.

8x16x5 mm Ball Bearing

Place a 8x16x5 mm ball bearing in the opening of the rubber motor anchor gear as shown. This is a light press fit.
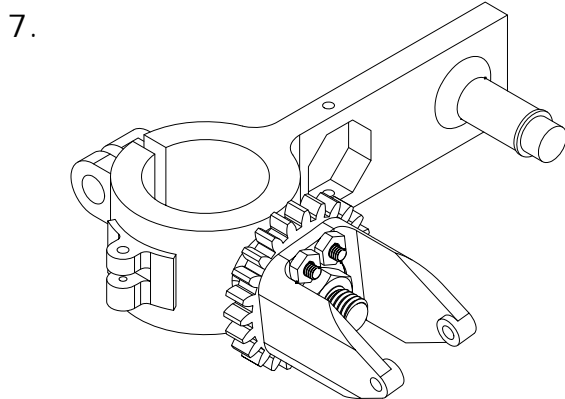
4.

Insert four 4-40 screws in the motor anchor gear and slide the motor anchor on to the screws as shown.

5.
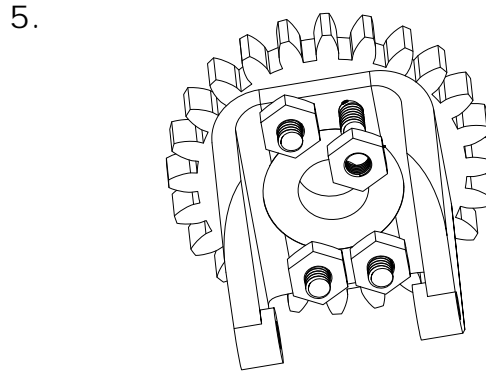
Place 4-40 nuts on the screws. Tighten the nuts. The nuts will capture the ball bearing.

6.

Slide the gear spacer into the ball bearing as shown,

7.

Place the motor anchor gear assembly on the 1/4-20 bolt. Place a 1/4-20 nut on the bolt and tighten the nut so it is firm against the gear spacer. Confirm that the motor anchor will rotate freely.

8.

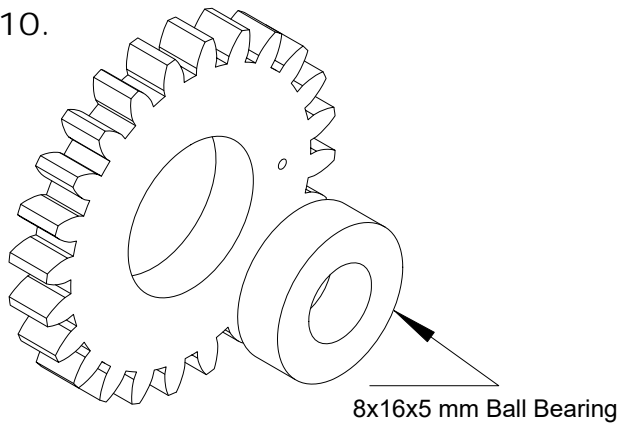Calculated length for the torque wire
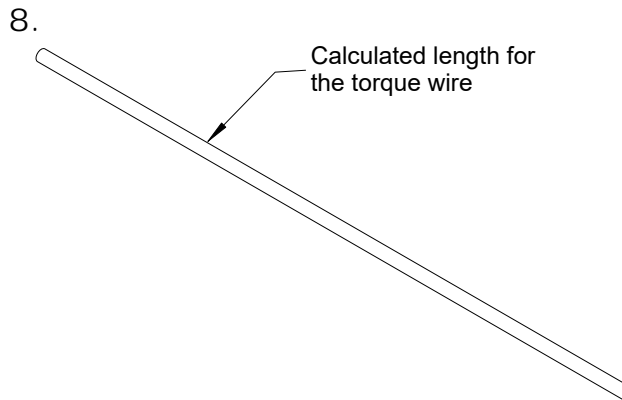
Cut a piece of 1/16" brass tubing to the length of the torsion wire. Use the length shown at the end of this guide for the torsion range you will be using.
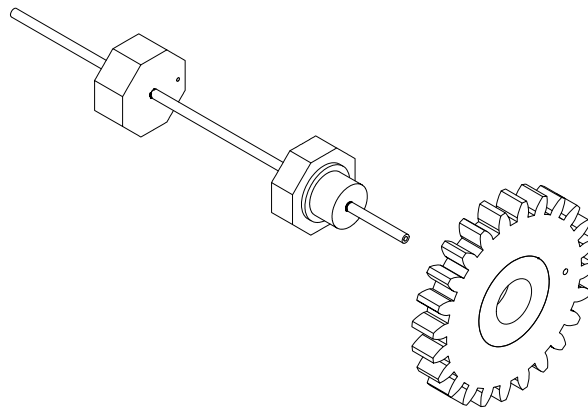
9.
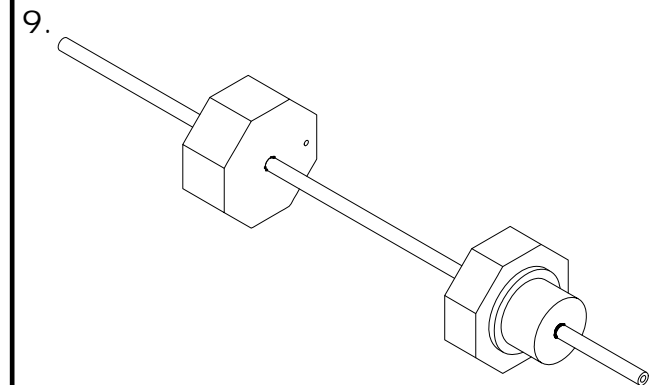
Slide the torsion tube supports on to the torsion tube. Push them in away from the ends of the tube as shown.
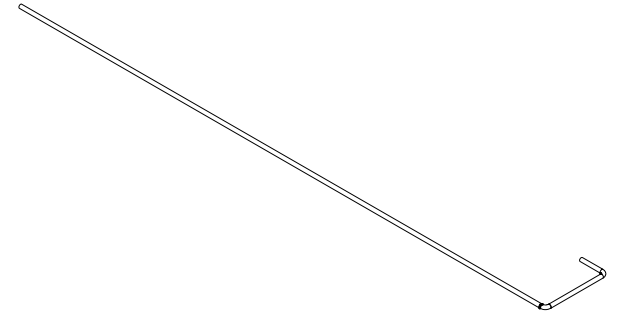
10.

8x16x5 mm Ball Bearing

Insert a 8x16x5 mm ball bearing in the torsion tube gear opening as shown. This is a light press fit.
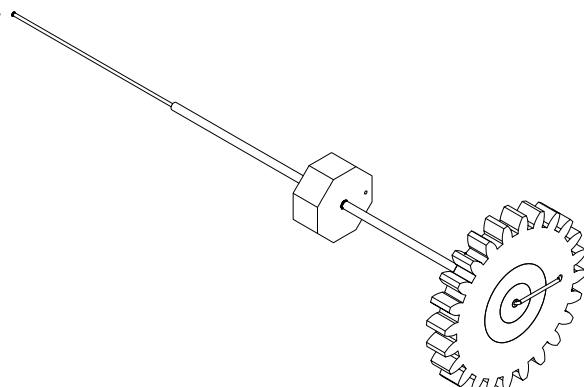
11.

Place the torsion tube supports on the torsion tube. Also place the torsion tube gear on the support with the bearing axel.

12.

Cut a pice of the torsion wire 1 1/2 inches longer than the calculated length. Bend one end to match the holes in the torsion gear as shown. For the 10 inch-ounce meter this will be a 4 1/2 inch length of .025 inch music wire.

13.

Slide the torsion gear and tube support to the end of the torsion tube. Place the torsion wire in the tube and slide it so the bent end fits in the gear hole and tight against the gear.

14.
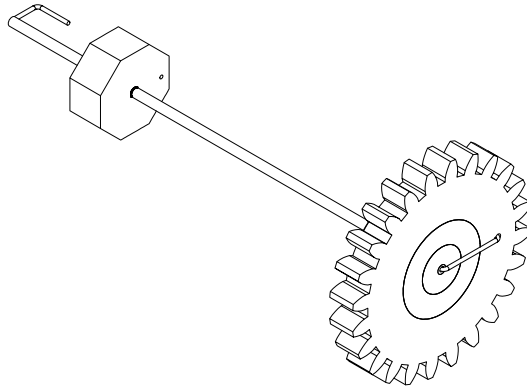
Bend the free end torsion wire to a 90 degree angle tight against the end of the torsion tube. Use the tube support as a guide to make a second 90 degree bend where the hole in the tube support is located.

15.
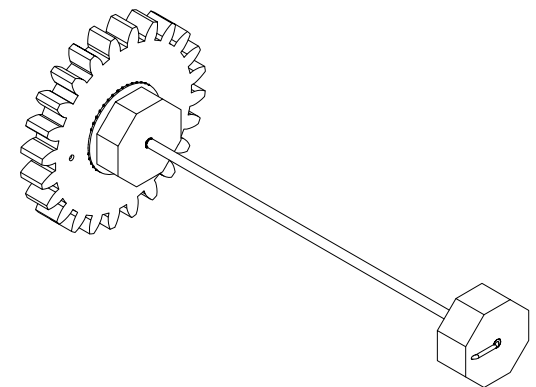
Trim off excess wire from the last bend in the torsion wire. Slide the tube support so it is aligned with the end of the torsion tube and engages the bent end of the torsion wire in the support hole. The support should be tight against the torsion wire.

16.
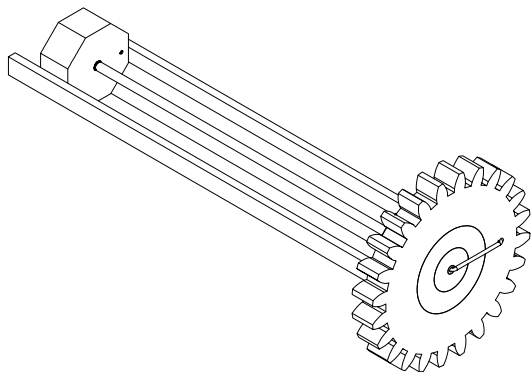
Place the torsion tube assembly in one of the torsion tube cover halves. The support on the gear end should be aligned with an end of the cover. Make sure both supports are snug in the cover and glue them in place. If ABS is used as the print filament, acetone can be used to glue the parts in place.

17.
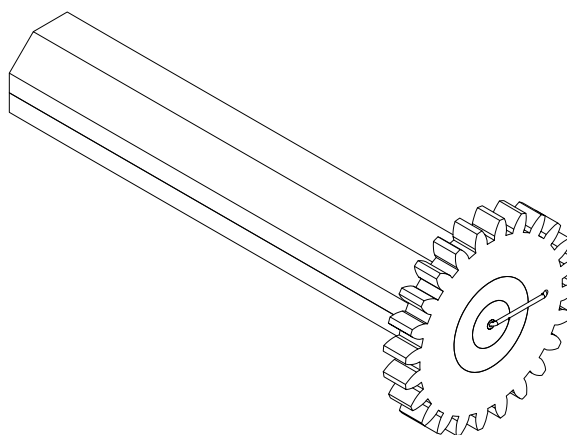
Once the glue or solvent has set, glue the other half of the tube cover to the assembly as shown.

18.
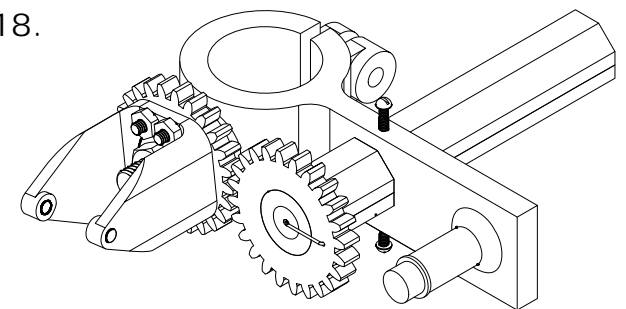
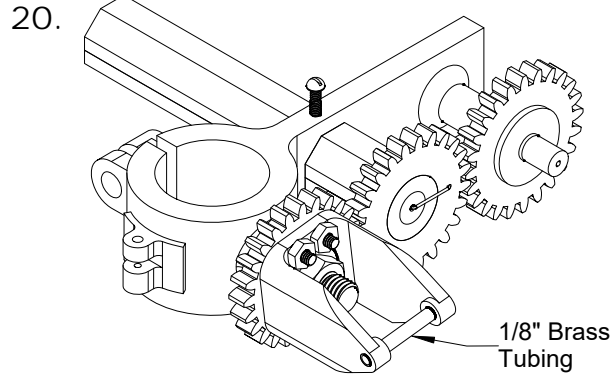Slide the torsion tube assembly into the meter backbone. Push it back until the gear engages the motor anchor gear. Before engaging the motor anchor gear, rotate it if necessary so the anchor bar holes will be close to level. It is not necessary to have it perfectly level. Once your are satisfied with the position of the torsion tube assembly, use two 4-40 1/2" screws to hold it in place. Tighten the screws lightly.

19.

8x16x5 mm Ball Bearing

Tap for 4-40 thread
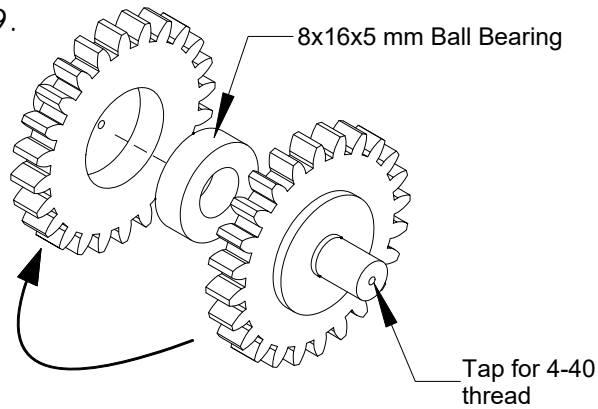
Tap the hole in the dial pointer support post for a 4-40 thread. Insert a 8x16x5 mm ball bearing in the dial pointer gear as shown. This is a light press fit.

20.

1/8" Brass Tubing

Place the gear and just installed ball bearing on the dial gear support. Make sure it is aligned with the torsion tube assembly gear. All three gears should be in line with each other. Cut a length of 1/8 inch diameter brass tubing and insert it in the holes of the motor anchor.

21.
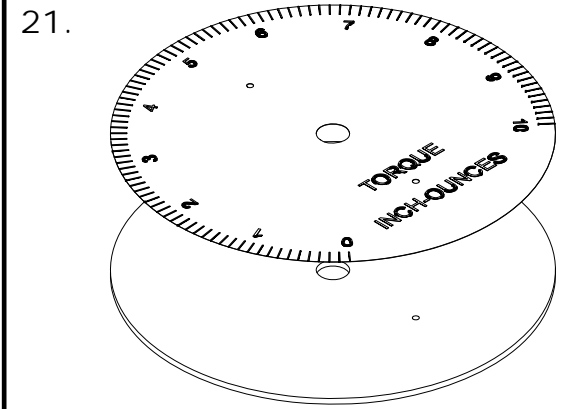
TORQUE
INCH-OUNCES

Cut out the dial face for the torque range you will be using. Glue the dial face to the dial face plate. Apply a clear protectant such as Krylon Crystal Clear.

22.

TORQUE
INCH-OUNCES

Tap for 4-40 thread
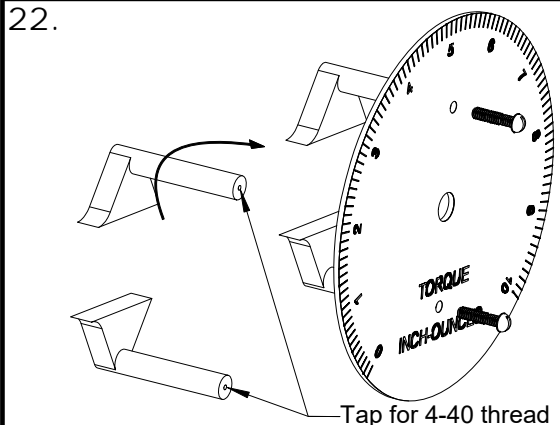
Tap the two meter face brackets for 4-40 screws. Using 1/2 inch 4-40 screws, attach the two brackets to the meter dial face as shown.

23.
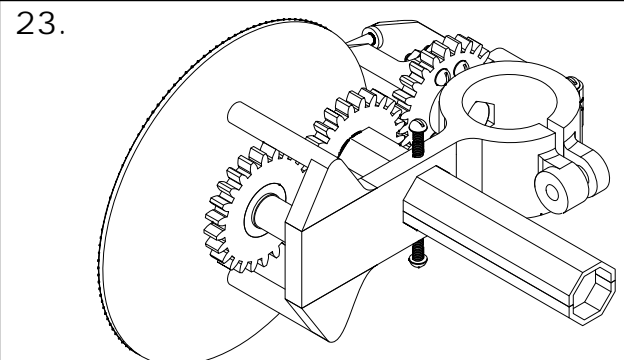
Place the dial face assembly on the meter backbone. The hole in the dial face should be centered on the needle support post. Once everything is aligned, glue the brackets to the meter backbone using the glue or solvent of your choice. Make sure the gears can rotate freely without the needle support post rubbing on the dial face.

24.
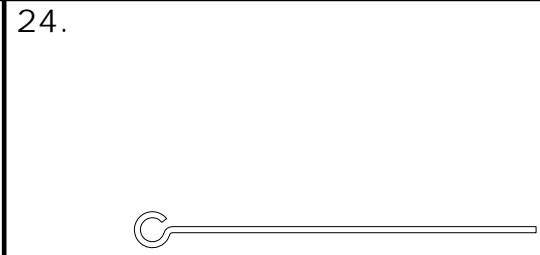
Make the indicator needle from 1/32" music wire using the pattern provided here.

25.
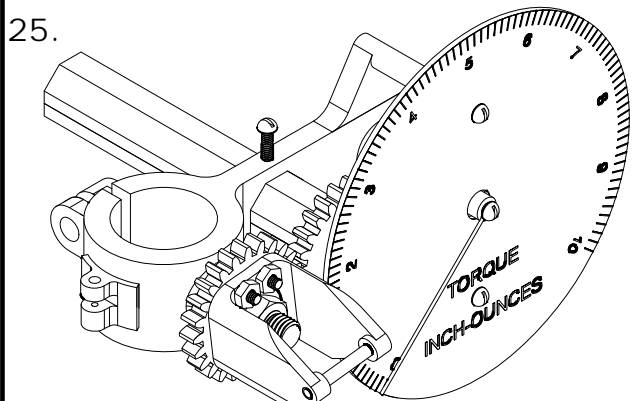
TORQUE
INCH-OUNCES

Using a 1/2 inch 4-40 screw, attach the needle indicator to the support post. Line it up with the 0 torque point on the dial face. It's position can be adjusted later if necessary.

26.

Glue in place after screw is seated
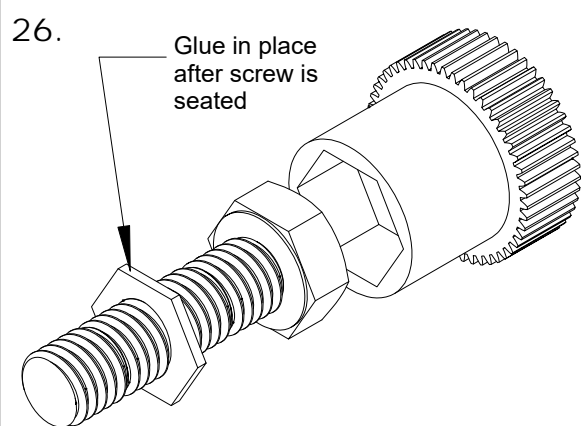
Make up the clamp thumb screw as shown using a 1 inch 1/4-20 hex head bolt.

27.

4-40 Screw
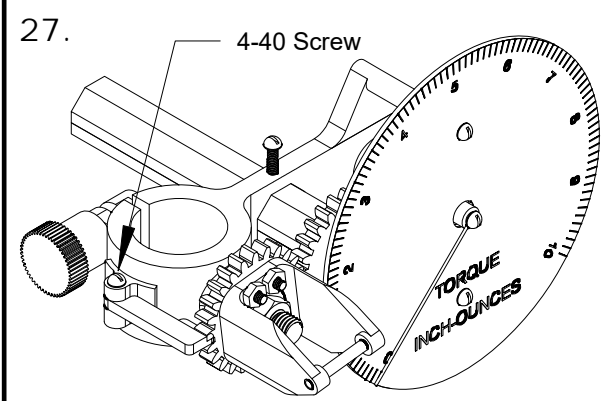
TORQUE
INCH-OUNCES

Insert the clamp thumb screw in the clamp bracket. The clamp is designed for 1 inch diameter tubing that is commonly used for winding stooge support poles. Also attach the anchor gear stop arm using a 4-40 screw.
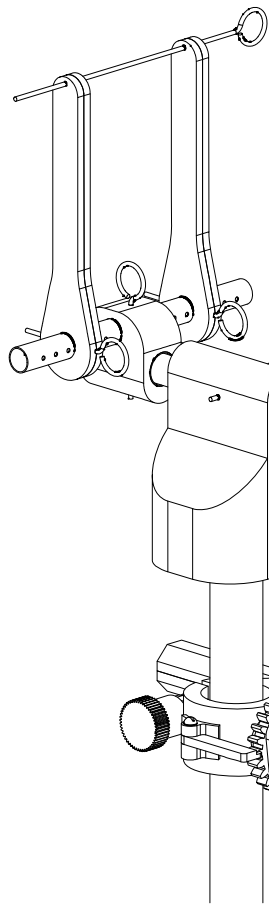
A convienient set up for the torque meter is to place it below the model support stooge. With the model mounted in the support stooge, the motor is attached to the torque meter and then wound. Once wound the motor is transferred to the model.
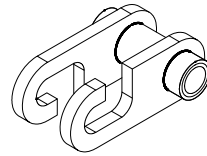
A key part that allows easy transfer of a fully wound motor is a twist lock rear motor anchor. The twist lock motor anchor shown here uses 3D printed components and is suitable for motors that develop up to 10 inch-ounces of torque. The same design can be used with stronger materials for higher torque motors.
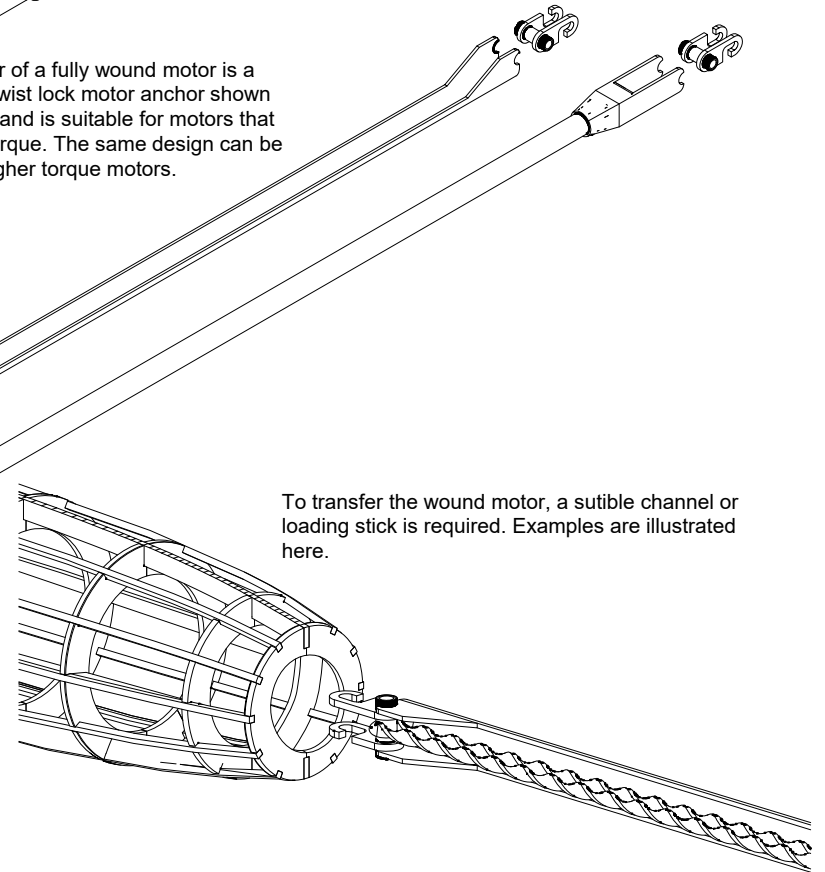
To transfer the wound motor, a sutible channel or loading stick is required. Examples are illustrated here.

The core components of the torque meter can be used for multiple torque ranges. Print the components for the torque tube, torque tube gear, and dial face. Using the appropriate torsion wire set up, make up multiple torque tube/dial face assemblies. They can be swapped out by removng the dial pointer, dial face, losening the torque tube set screws and then sliding out te torque tube. The alternate torque tube and associated dial face can then be installed.

When using the torque meter, the motor anchor will rotate as the motor is wound. When the target torque has been reached, the anchor gear can be locked using the locking arm. Simply rotate the arm until the blade engages the anchor gear. That makes it easier to attach the motor loading channel/stick to the motor twist lock anchor.

After the wound motor has been transferred to the loading stick/channel, it is transferred to the model. Rotate the motor so the rear twist lock anchor is verttical as shown.

Insert the motor into the model's fuselage. Push the loading stick/channel into the model until the twist lock anchor rests against the fuselage motor peg. Rotate the loadng stick/channle 90 degrees clockwise. Lightly pull on the loading stick/channel to make sure the twist lock anchor has engaged the motor peg.

Attach the prop to the forward end of the motor. This can be done with a Crockett style hook, a Gizmo Geezer prop coupler, or some other preferred method of attaching the motor to the prop hook. Hold the prop and pull the forward end of the motor away from the loading stick/channel. Slide the loading stick/channel out of the fuselage.
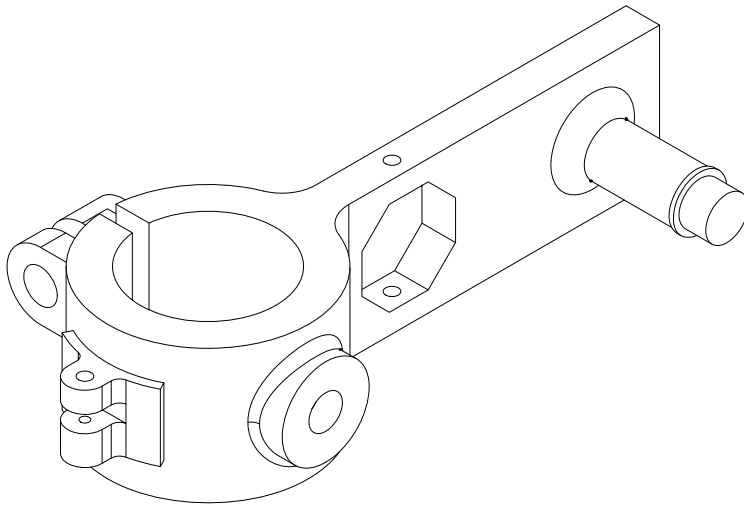
After your flight the motor is removed from the model's fuselage by simply pulling the motor peg.

It is possible to set up the torque meter for winding in the clockwise or counter clockwise directions. This can be useful for multi-motor models, or pushers. Use the appropriate torque tube and dial face setup and zero the pointer at top center on the dial face.
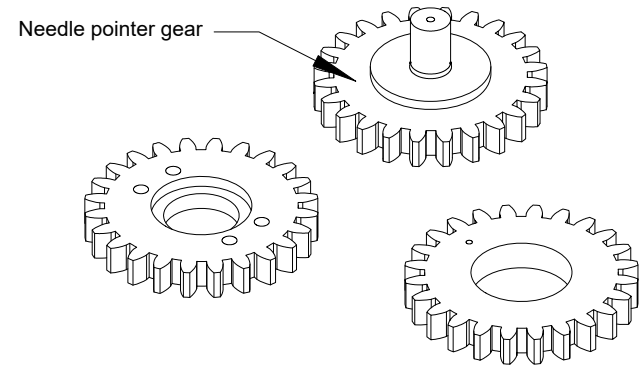
NOTES FOR THE 3D PRINTED PARTS

Needle pointer gear
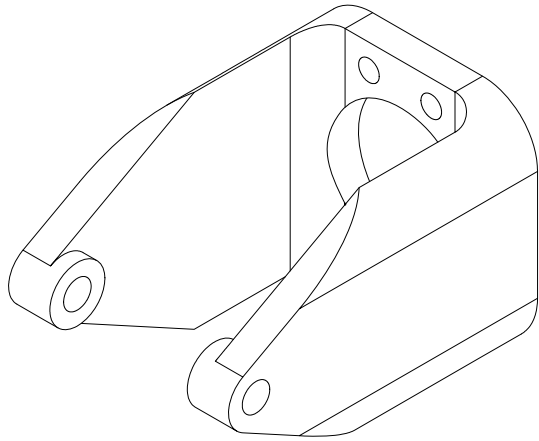
The motor anchor should be printed in this orientation. That provides the best strength based on the orientation of the filament lines as they are laid down during the printing process. It is recommended that supports be used.

When printing the gears, supports should be used for the needle pointer gear.

Selection of the filament material when printing the torque meter parts should be based on the torque range that will be used. For the higher torque ranges, it is suggested that carbon fiber filled polycarbonate filament be used.

Use supports when printing the backbone. Print orientation should be as shown to get the best strength from the filament lines.

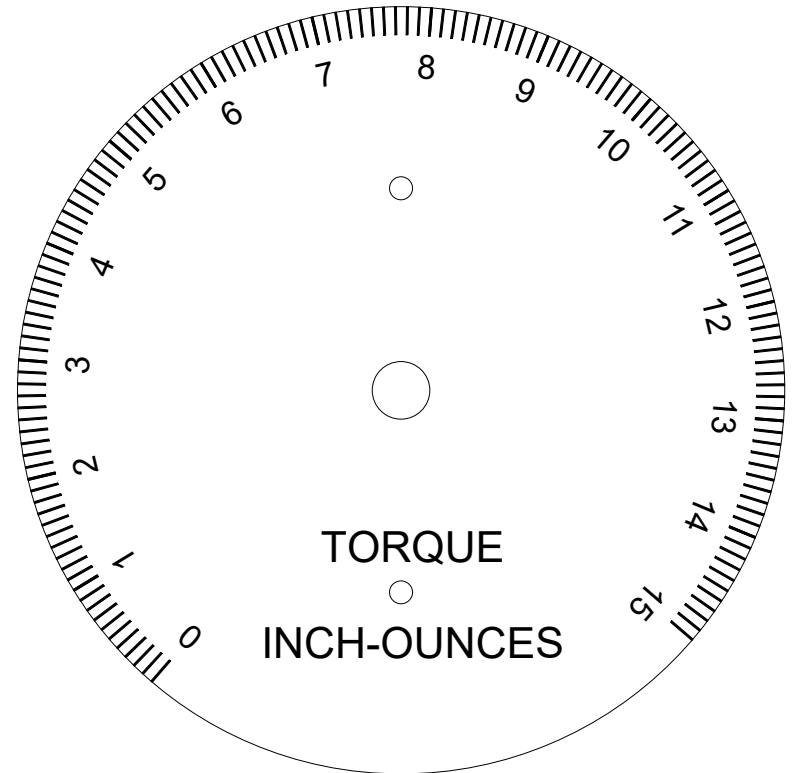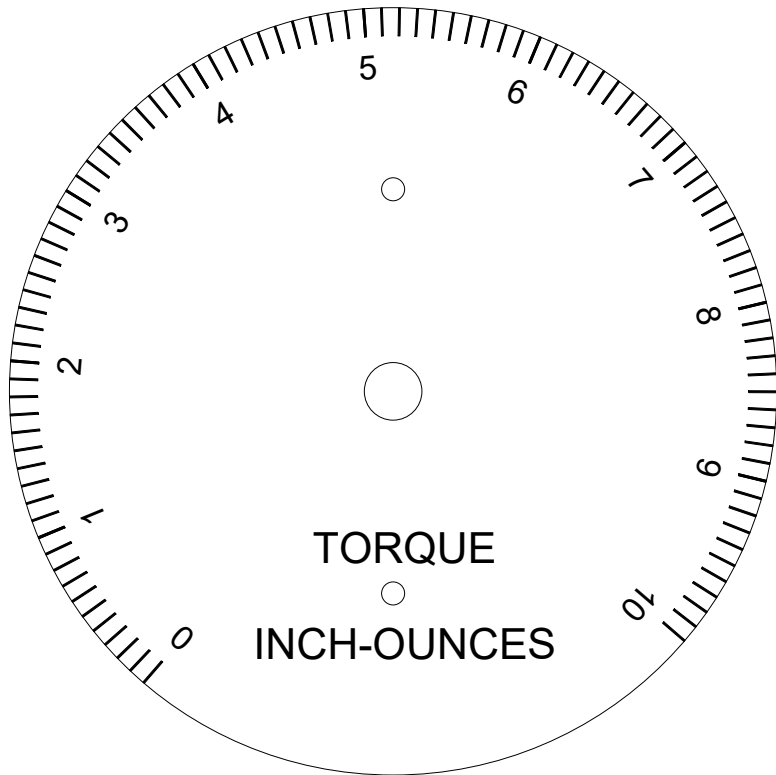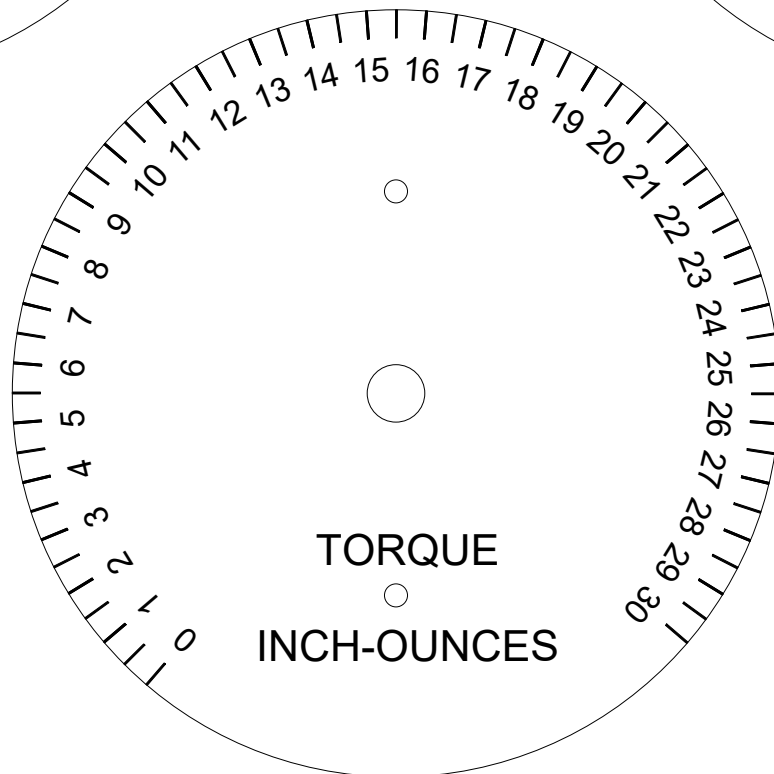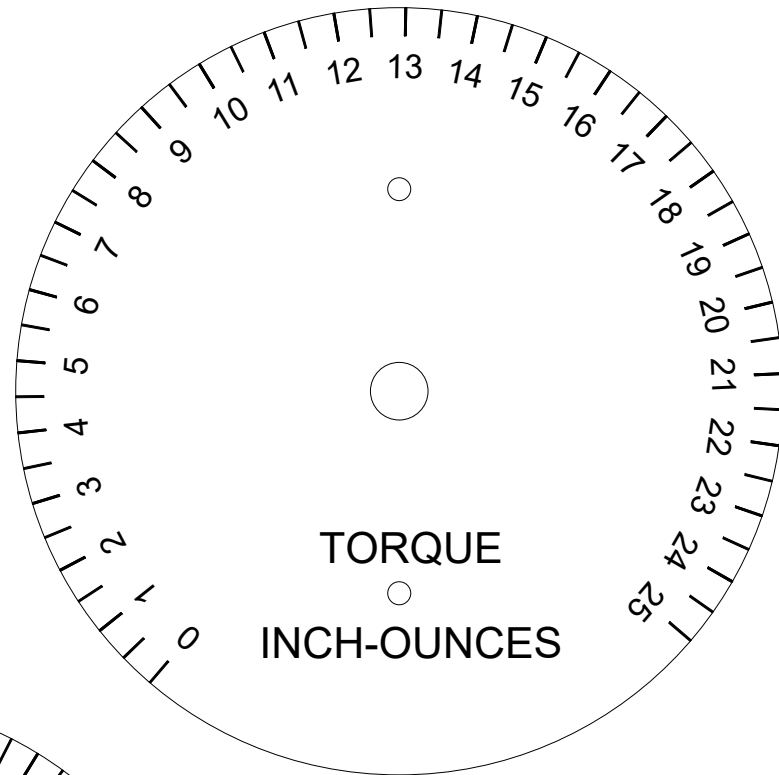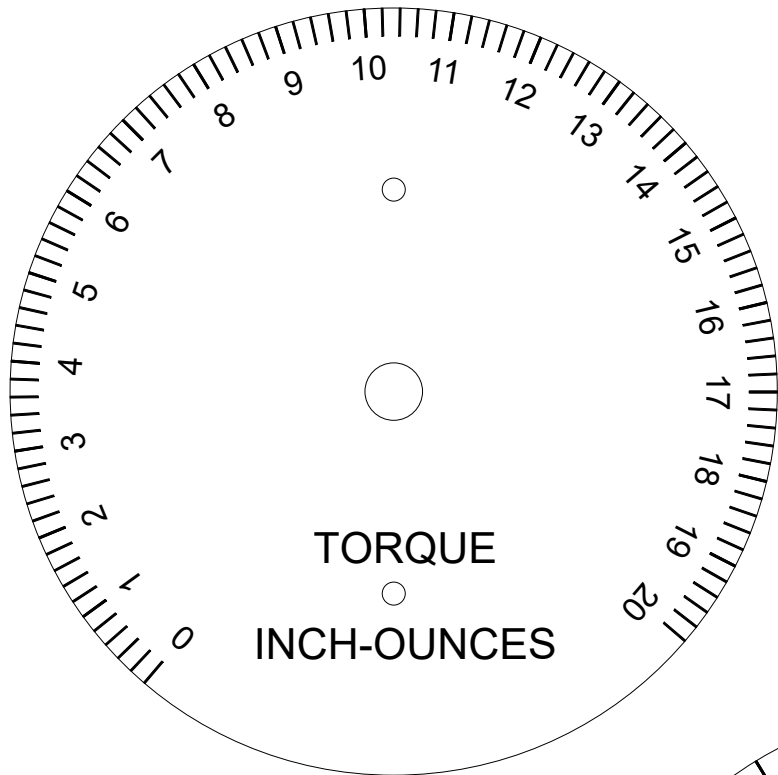# PARAMETERS FOR ALTERNATIVE TORQUE RANGES

	TORQUE TUBE LENGTHS		WIRE DIAMETER
10 INCH OUNCES		3.177 IN	.025 IN
15 INCH OUNCES		2.118 IN	.025 IN
20 INCH OUNCES		1.588 IN	.025 IN
25 INCH OUNCES		3.411 IN	.032 IN
30 INCH OUNCES		2.843 IN	.032 IN

TORQUE

INCH-OUNCES

TORQUE

INCH-OUNCES

TORQUE

INCH-OUNCES

TORQUE

INCH-OUNCES

TORQUE

INCH-OUNCES

PARAMETERS FOR ALTERNATIVE TORQUE RANGES
FOR WINDING CLOCKWISE OR COUNTER CLOCKWISE

	TORQUE TUBE LENGTHS	WIRE DIAMETER
10 INCH OUNCES	1.588 IN	.025 IN
15 INCH OUNCES	2.843 IN	.032 IN
20 INCH OUNCES	2.132 IN	.032 IN
25 INCH OUNCES	1.706 IN	.032 IN
30 INCH OUNCES	3.316 IN	.039 IN

TORQUE

INCH-OUNCES

TORQUE

INCH-OUNCES

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