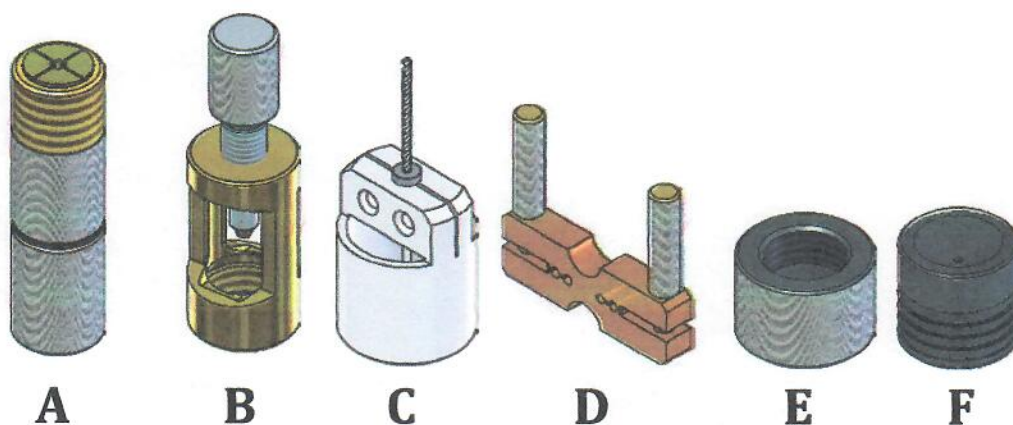


1.6mm Rotor Tools

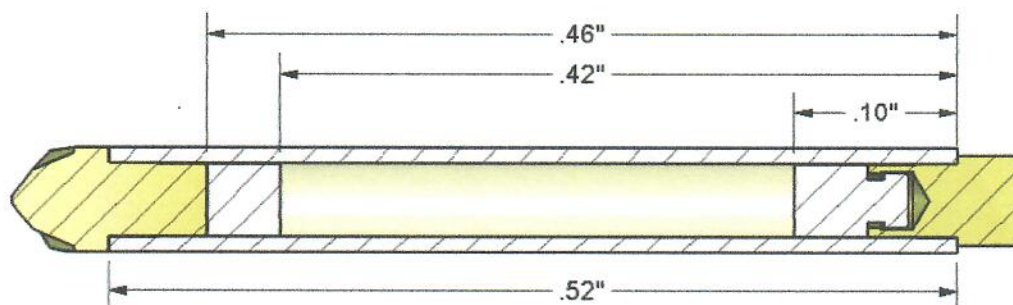
PhoenixNMR
2/11/2016

1.1 Components in Rotor Tool Kit

Item	Description	Quantity
A	Collet Chuck Assembly	1
B	Press Rod Assembly	1
C	Tamper Assembly	1
D	Clamp Assembly	1
E	Jam Nut	1
F	Sample Funnel	1



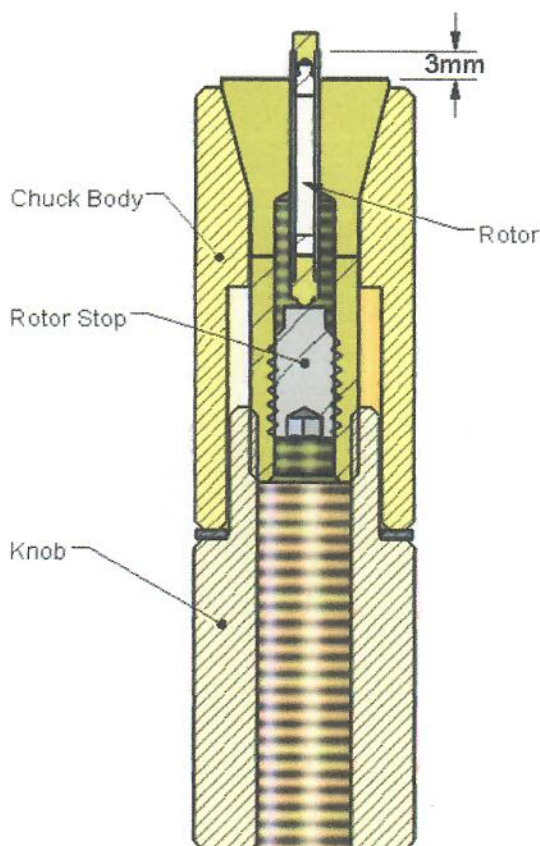
1.6mm Rotor Dimensions



1.2 Loading the Collet Chuck Assembly

The Collet Chuck Assembly holds the rotor assembly while manipulating the rotor: inserting top sample spacers, drive tips, and/or packing and unpacking the sample.

1. Place the rotor assembly into the collet, drive tip first, until it contacts the rotor stop at the bottom of the collet. Make sure that enough of the rotor sleeve is sticking out of the collet, ~3 mm. If it is not, adjust the Rotor Stop by turning it with a 5/64" Hex-driver inserted through the bottom of the knob.
2. While holding the chuck body, turn the knob to draw the collet into the chuck body. Continue turning the knob until the rotor assembly is firmly held in place. Note: You may need to place your finger on the collet/rotor assembly to prevent the collet from spinning inside the chuck body while turning the knob.



1.3 Removing the Top Cap – Method 1

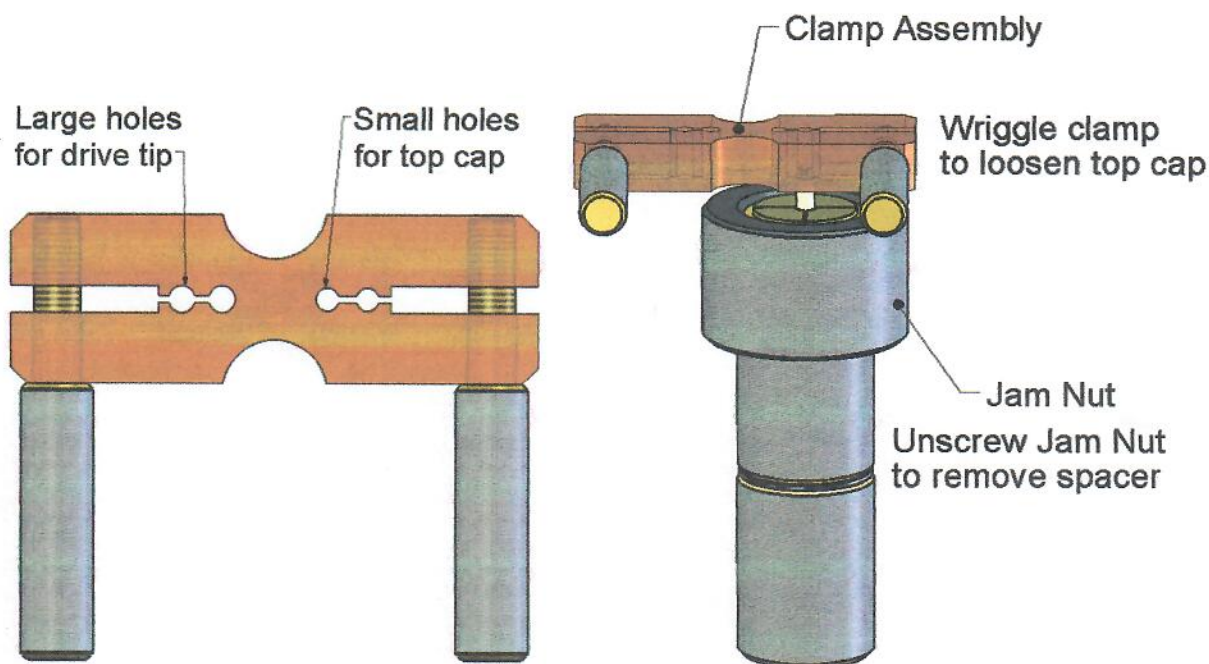
The top cap can be removed by using the jam nut and clamp assembly.

1. After the rotor assembly has been properly loaded into the Collet Chuck Assembly, screw the Jam Nut onto the end of the Collet Chuck Assembly. The threads of the Jam Nut should be at the top, closest to the collet. Continue screwing the Jam Nut onto the Collet Chuck Assembly until the end of the chuck body is exposed.
2. Fit the clamp assembly over the top cap. The clamp should fit over as much of the head of the top cap as possible. You may need to loosen the Clamp Assembly knob first in order for the clamp to fit over the top cap. **Note:** One end of the clamp has large holes for removing the drive tip. The smaller holes are used for removing the top cap.
3. Tighten the Clamp Assembly knob until it firmly grasps the top cap.
4. Unscrew the Jam Nut until it makes contact with the Clamp Assembly.
5. While holding the assembly *vertically* (to prevent the spilling and loss of the rotor contents) wiggle the clamp assembly back and forth.



Do not wiggle the clamp assembly by more than 1/8 turn in either direction. Wiggling the clamp assembly by more than 1/8 turn may shear the cap.

6. Slowly unscrew the Jam Nut by $\frac{1}{2}$ turn. This will force the Clamp Assembly, with the top cap and attached sample spacer, away from the rotor assembly and Collet Chuck Assembly.
7. Repeat Steps 5 and 6 until the Clamp Assembly and top cap and spacer are free of the rotor assembly.



If the clamp slips off the top cap, either tighten the clamp more tightly or use Method 2 for removing the top cap.

Removing the Top Cap – Method 2

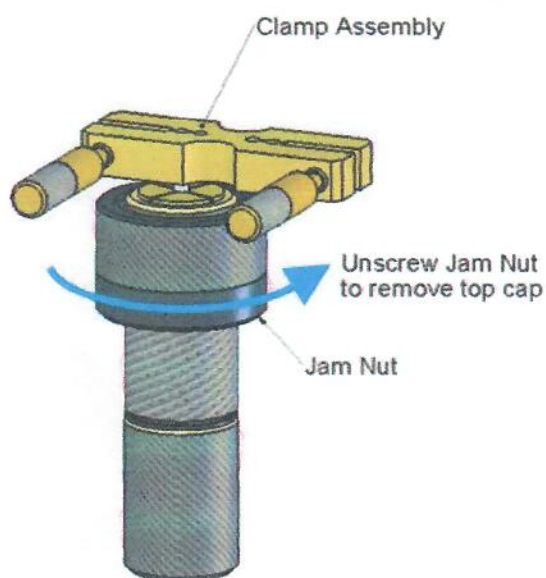
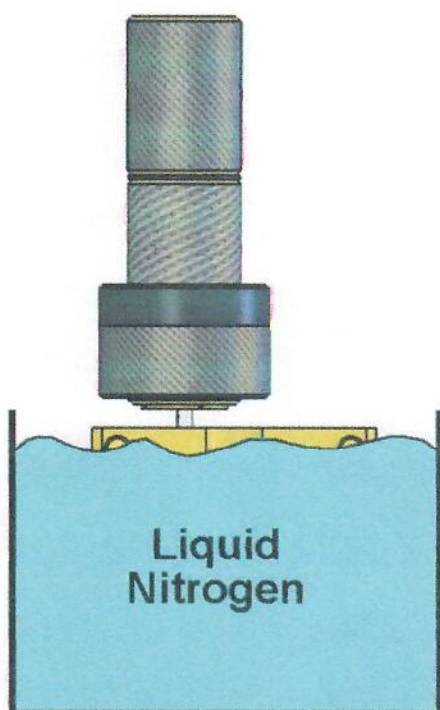
Due to variances in tolerances, the top cap may fit very tight in the rotor sleeve. The following method can be used on difficult-to-remove top caps.

This alternative method requires the use of liquid nitrogen. Care should be taken when using liquid nitrogen. Prolonged exposure of liquid nitrogen to bare skin may cause burns.

1. After the rotor assembly has been properly loaded into the Collet Chuck Assembly, screw the Jam Nut onto the end of the Collet Chuck Assembly. The threads of the Jam Nut should be at the top, closest to the collet. Continue screwing the Jam Nut onto the Collet Chuck Assembly until the end of the chuck body is exposed.
2. Fit the clamp assembly over the top cap. The clamp should fit over as much of the head of the top cap as possible. You may need to loosen the Clamp Assembly knob first in order for the clamp to fit over the top cap. Note: One end of the clamp has large holes for removing the drive tip. The smaller holes are used for removing the top cap.
3. Tighten the Clamp Assembly knob until it firmly grasps the top cap.
4. Invert the entire Collet Chuck Assembly (with attached Clamp Assembly) and dip the Clamp Assembly only into a bath of liquid nitrogen. Try not to dip the rotor sleeve in the liquid nitrogen.

5. Leave the Clamp Assembly in the liquid nitrogen bath until the assembly reaches temperature equilibrium, for example, less bubbling of the liquid nitrogen.
6. Turn the Collet Chuck Assembly upright and begin unscrewing the Jam Nut until it contacts the Clamp Assembly.
7. Continue unscrewing the Jam Nut until the Clamp Assembly, top cap and sample spacer are free of the rotor assembly.

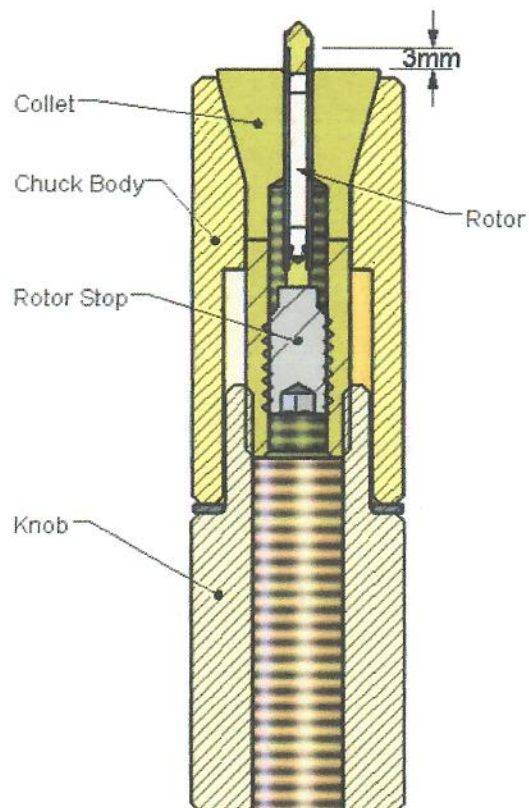
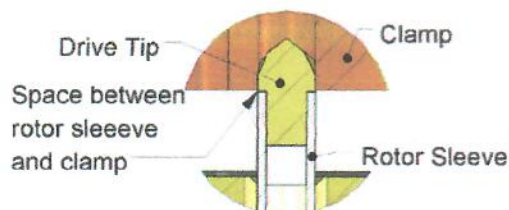
Method 2



1.4 Removing the Drive Tip

Drive tips are removed similarly to the top sample spacers.

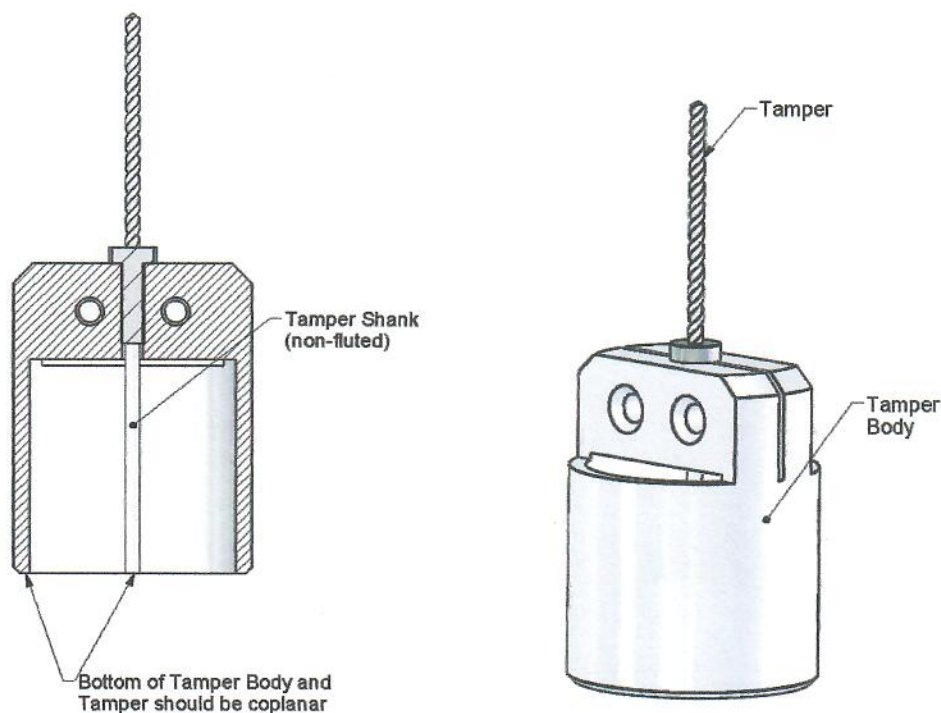
1. Insert the rotor assembly into the Collet Chuck Assembly **with the drive tip sticking out of the collet**. Make sure that enough of the rotor sleeve is sticking out of the collet, ~3 mm. If it is not, adjust the Rotor Stop by turning it with a 5/64" hex-driver inserted through the bottom of the knob. You may need to adjust the Rotor Stop if you are attaching a drive tip to a rotor sleeve without the top sample spacer in place.
2. Screw on the Jam Nut with the threads facing closest to the collet.
3. Fit the large-hole side of the Clamp Assembly over the drive tip. The clamp should fit over as much of the drive tip as possible **without clamping onto the rotor sleeve**.
4. Tighten the Clamp Assembly Knob until it firmly grasps the drive tip.
5. Follow the steps, starting at Step 4, of "Removing the Top Cap – Method 1 or 2."



1.5 Packing the Sample

The Sample Funnel and Tamper Assembly are used to pack the sample.

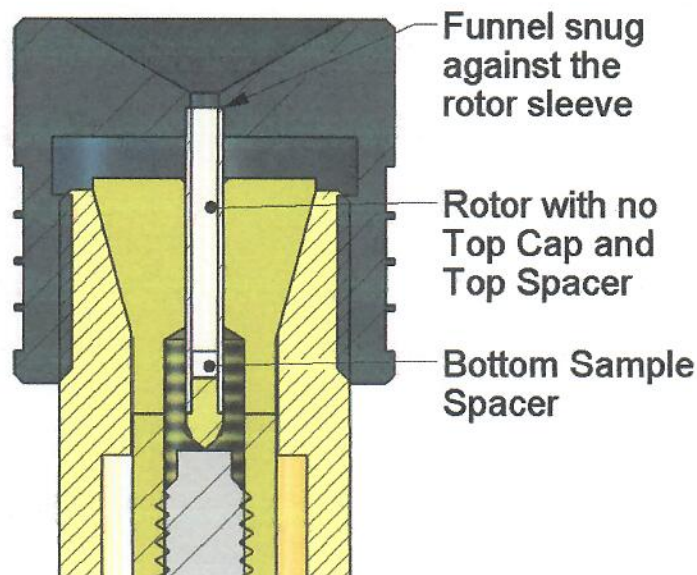
1. Make sure the rotor is properly loaded into the Collet Chuck Assembly before continuing. See "Loading the Collet Chuck Assembly."
2. If the Top Cap and Top Sample Spacer are not already removed, follow the instructions in "Removing the Top Cap."
3. Make sure a Bottom Sample Spacer is present inside the rotor. If not, place a Bottom Sample spacer in the rotor and push it all the way down against the drive tip with the Tamper.
4. For packing purposes, the shank (non-fluted) end of the tamper is used. Check that the tamper is properly positioned. Loosen the screws and place the Tamper Assembly on a flat surface. Push the bushing down onto the tamper body until it is fully seated. Push the tamper down until it contacts the same flat surface. Retighten the screws.



5. Screw the Sample Funnel onto the Collet Chuck Assembly. Note that there is an internal lip on the funnel. This should be *snug* against the top of the rotor sleeve to minimize any loss of the sample while packing.



Do not overtighten the funnel onto the chuck. The rotor sleeve has sharp edges and it may shear off the lip of the funnel.



In some cases, the rotor will not be centered properly enough for the funnel to mate with the rotor. If this happens, loosen the collet so that the rotor is loose. Attach the funnel and make sure the rotor fits in the counter-bore as you are screwing it down. When the rotor is positioned in the counter-bore, retighten the collet and continue screwing down the funnel.

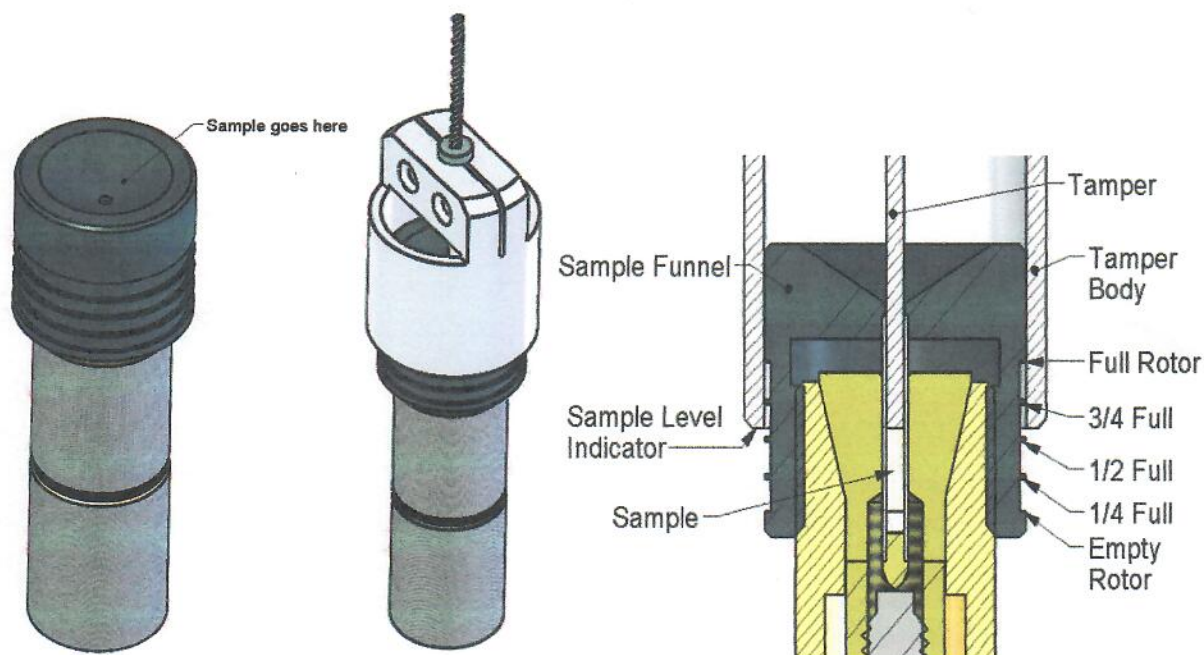
6. While holding the Collet Chuck Assembly *vertically*, place a small amount of sample in the Sample Funnel. Push the sample into the rotor or gently tap the knob of the Collet Chuck Assembly on a hard surface to allow the sample to enter the rotor.

Hint: It is better to pack the sample in several small increments rather than attempting to pack a large portion at one time.

7. Place the Tamper Assembly over the funnel, after loading each increment, and use it to compress the sample. Note the four indents on the Sample Funnel. When the Tamper Assembly is properly assembled, see Step 4, the bottom of the Tamper Assembly, relative to the indents, may be used as a sample level indicator when the tamper is inserted into the rotor sleeve.

*Hint: **Do not over-pack the sample!** An over-packed rotor will not allow the top cap to seat properly. This may cause the top cap to shear during spinning or cause unstable spinning from an unbalanced rotor.*

8. Repeat Steps 6 and 7 until the rotor is filled. The bottom of the Tamper Assembly should reach the highest top of the indents on the Sample Funnel.



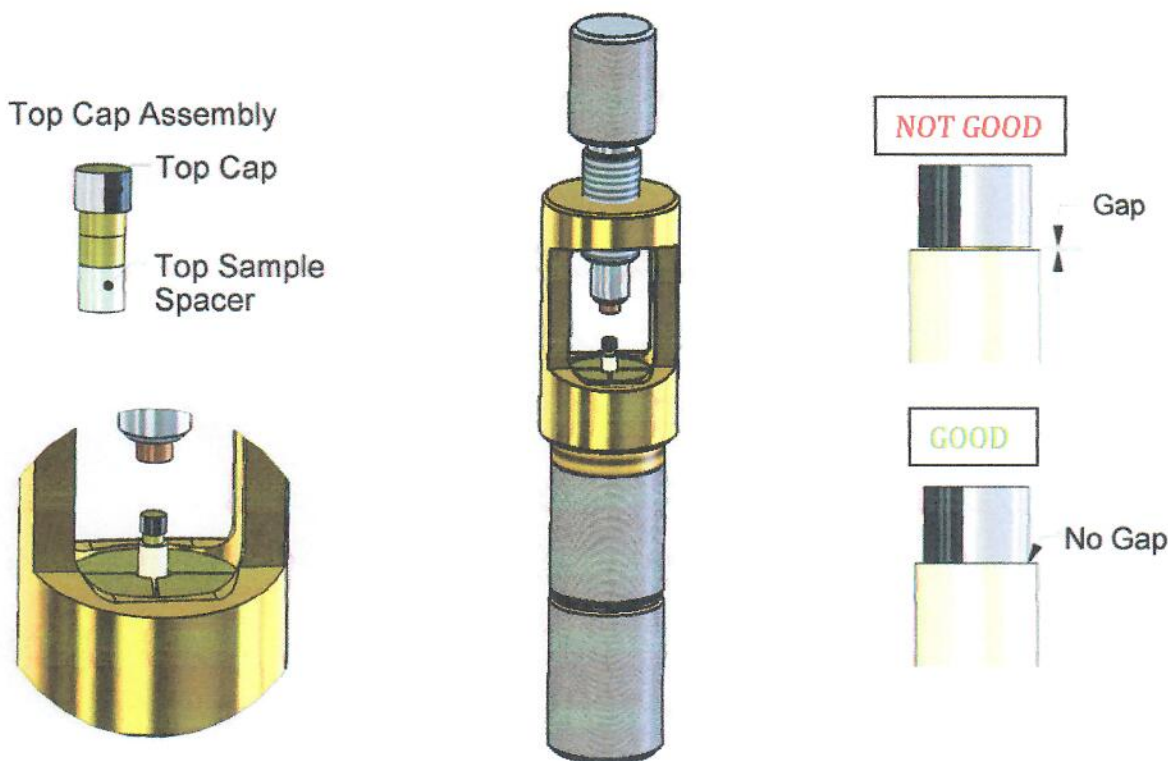
9. While still keeping the assembly vertical, unscrew the Sample Funnel, removing it from the Collet Chuck Assembly.
10. Immediately insert the top cap. See "Inserting the Top Cap."

1.6 Inserting the Top Cap

The Push Rod Assembly is used to insert the Top Cap (and attached sample spacer) into the rotor sleeve. Make sure the Sample Funnel is not attached to the Collet Chuck Assembly.

1. Make sure that a top sample spacer is attached to the top cap. Place the top cap loosely in the rotor sleeve. Approximately $\frac{1}{2}$ of the shaft should be able to fit loosely in the rotor sleeve.
2. Screw the Push Rod Assembly onto the Collet Chuck Assembly. You may need to partially unscrew the Push Rod knob in order to fully seat the Push Rod Bracket.
3. Screw in the Push Rod Knob so that the push rod presses against the top cap. Continue turning the knob until the top cap is fully seated on the rotor sleeve, i.e. no gap between the head of the cap and the end of the rotor sleeve.

Hint: Hold the assembly up to a light source. Look through the "window" of the bracket and inspect the top cap to ensure that there is no gap.



The top cap should seat properly with little effort. If the top cap does not seem to be seating properly, check for an overfilled sample. Remove some of the sample, if necessary.

4. Remove the Push Rod Assembly from the Collet Chuck Assembly.
5. Loosen the knob on the Collet Chuck Assembly to release the rotor from the collet. If the rotor does not come free immediately, hold the assembly by the chuck body and press the knob against a hard surface. The rotor should now be released.
6. The rotor packing is now complete and ready for adding the tach mark. See section 4.8.1 "Rotor Tachometer Marking" in the Probe Manual.

1.7 Inserting the Drive Tip

Drive tips are inserted similarly to the top cap.

1. Place the rotor sleeve in the Collet Chuck Assembly with the end you intend to attach the drive tip sticking out, ~ 3 mm to 5 mm.
2. Loosely insert the drive tip into the rotor sleeve. Approximately $\frac{1}{2}$ of the drive tip shank should be able to fit loosely in the rotor sleeve. Try to make the drive tip as straight, visually, as possible with respect to the rotor sleeve.
3. Screw the Push Rod Assembly onto the Collet Chuck Assembly. You may need to partially unscrew the Push Rod knob in order to fully seat the Push Rod Bracket.

4. Screw in the Push Rod Knob so that the push rod presses against the drive tip. Continue turning the knob until the drive tip is fully seated on the rotor sleeve, i.e. no gap between the head of the drive tip and the rotor sleeve, the same as with the Top Cap.



Hint: Hold the assembly up to a light source. Look through the "window" of the bracket and inspect the drive tip to ensure that there is no gap.

The drive tip should seat properly with little effort. If the drive tip does not seem to be seating properly, check for debris between the drive tip and rotor. The debris could be sample trapped between the two parts. Sometimes the sharp edge of the rotor will shave off a piece of the drive tip shaft and become trapped between the two parts. This is normal and should not cause any concerns regarding integrity of the assembly or spinning problems. Clean out any debris and reseal the drive tip.

1.8 Unpacking the Sample

Unpacking the rotor is accomplished by using the other end of the tamper.

1. Remove the top cap from the rotor. See "Removing the Top Cap."
2. Insert the fluted end of the tamper and twist it to drill out the sample from the rotor in small increments.
3. Occasionally, tap the tamper over a small container to remove the sample trapped on the flutes.
4. Occasionally, invert and tap the rotor (and Collet Chuck Assembly) over the container to empty out any loose sample.
5. Repeat Steps 2 through 4 until the entire sample contents are removed from the rotor.

Optional: You can remove the tamper from the tamper body to remove the sample. Some users prefer this method.

