

Procedure for replacing the micrometer and drive shaft inside a Mk IV Brewer spectrophotometer

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Introduction

As the micrometer within a Mk IV Brewer spectrophotometer ages the grease coating on the internal threads begins to break down, causing friction to the micrometer rotation. This condition can eventually cause the micrometer to function erratically due to excessive wear. Erratic micrometer behavior is evidenced in failed HG calibrations and is usually accompanied by a coating of fine, black dust on the micrometer barrel. If the instrument operates too long without a rebuild or replacement of the micrometer, the micrometer can become stuck at its minimum end position. Once the micrometer has become stuck, the stepper motor will continue to turn and damage to the brass micrometer drive gear can result. The drive gear may become warped and then will cause unsmooth micrometer rotation, which compromises the certainty of the mercury line calibration.

Equipment

Mk IV Brewer spectrophotometer

Hex wrench set (English sizes)

Replacement micrometer (or Krytox lubricant to rebuild old micrometer)

Replacement micrometer drive gear

C-clip pliers (if brass drive gear is to be replaced)

Purpose

This Standard Operating Procedure (SOP) outlines the NUVMC technique for removing and replacing a micrometer and micrometer drive gear in a Mk IV Brewer spectrophotometer.

Procedure

1. If the Brewer is still running in schedule exit the schedule by pressing the Home key when the message "Press Home to abort schedule" appears on the computer screen.
2. Place a protective cover on the quartz dome on the top of the Brewer outer cover.
3. Remove the Brewer outer cover by loosening the four latches and lifting the cover up. Never remove the cover during inclement weather and try to pick the driest, wind free day possible.
4. Remove the black spectrometer cover by loosening the two latches and pulling the cover back. Never remove the cover during inclement weather and try to pick the driest, wind free day possible. DO NOT TOUCH THE MIRROR OR DIFFRACTION GRATING WITH FINGERS OR ANY OTHER OBJECT. DO NOT ATTEMPT TO CLEAN THE MIRROR OR DIFFRACTION GRATING IF ACCIDENTALLY TOUCHED AS THIS WILL CAUSE ADDITIONAL HARM TO THE OPTICAL SURFACES.
5. Locate the micrometer assembly inside the spectrometer. The micrometer barrel has a scale measured in millimeters engraved on its side. Observe and record the default position on the micrometer dial in millimeters.
6. Locate the vertical spring that provides pressure between the brass micrometer drive gear and the white, nylon gear attached to the micrometer barrel. The upper end of

the vertical spring is attached to the drive gear bearing housing via a hex head bolt. Remove the 5/64" hex head bolt from the drive gear bearing housing and let the spring and the bolt fall out of the way. They will still be attached to the chassis of the spectrometer box.

7. Manually rotate the micrometer to the zero position. Locate the 7/64" hex head micrometer clamp screw. It is oriented in a vertical position. Note the approximate position of the micrometer in the clamp before removing it. Loosen the screw completely and slide the micrometer assembly toward the mirror to remove it from the clamp. Sometimes the micrometer is held tightly in the clamp. A small screwdriver can be used to pry the clamp open while the micrometer is slipped out. Do not pry the aluminum too hard as it might snap.
8. Determine if the micrometer needs to be replaced with a new unit or if a re-greasing to the internal threads is appropriate. If the micrometer tip has excessive wear, or if the micrometer has been operated too long without proper lubrication, it is better to replace it. Also check for binding between the inner and outer shell of the micrometer which may result if the unit became jammed too many times. If it is decided that the unit should be replaced proceed to step 10. To rebuild the old micrometer proceed to step 9.
9. Rotate the micrometer toward larger numbers until the internal threads begin to expose. Continue rotating the outer barrel until the micrometer separates into two pieces. Use a clean cloth to wipe away old grease on the threads of the micrometer barrel. Apply a thin layer of Krytox lubricant to the internal threads and join the two halves of the micrometer together. Rotate the micrometer to the minimum end position for reinstallation into the Brewer. Now skip to step 14.
10. With the micrometer removed, locate the diode blocking barrel mounted on the back of the micrometer and note the approximate position of the barrel with respect to the white, nylon micrometer gear. Loosen the 0.05" hex head set screw and remove the barrel diode blocking barrel from the micrometer.
11. Locate the collar attached to the white, nylon gear. Loosen the 1/16" hex head set screw and remove the nylon gear assembly from the old micrometer.
12. Place the nylon gear assembly onto the new micrometer, oriented so that the black collar is toward the back of the micrometer and the white gear is toward the micrometer tip. Tighten down the 1/16" hex head set screw to lock the assembly in place.
13. Position the black diode blocking barrel into place on the back of the replacement micrometer in the approximate position as it was on the old micrometer. Tighten the 0.05" set screw to lock the barrel in place.
14. With the etched numbers on the micrometer barrel oriented so that they can be easily viewed, slip the micrometer assembly back into the clamp in approximately the same position as it was before. The SOP "Procedure for correctly positioning the

micrometer inside a Mk IV Brewer spectrophotometer" should be followed upon completion of this SOP.

15. If it has been determined that the brass drive gear needs replacement due to warping, proceed to step 16. If the drive gear is not to be replaced proceed to step 24 to finish up the procedure.
16. The brass drive gear has a bearing on the mirror end of the spectrometer and is connected to a stepper motor at the diffraction grating end of the spectrometer. Locate the bearing housing pin and retaining C-clip at the mirror end of the drive gear. Remove the retaining C-clip carefully using a pair of small C-clip pliers and place it somewhere safe. It is easy to lose the C-clip while trying to remove it because it is so small.
17. Slide the bearing housing off of the pin. The mirror end of the micrometer drive gear will now be unsupported.
18. Remove the micrometer drive gear by pulling it out of the stepper motor cog at the diffraction grating end of the gear. Be careful not to drop the collar off of the mirror end of the drive shaft. Notice that on the mirror end of the drive shaft there are two collars. The little collar is free to come loose once the bearing housing is removed from the system. During operation the little collar sits flush with the bearing. The larger collar is held in place with a flat head set screw. On the grating end of the drive shaft is a cog held in place with a 0.05" hex bolt. There is a rubber band type connector to mesh the cog on the drive shaft to the cog on the micrometer stepper motor.
19. Remove the hardware from the old drive shaft and mount it on the new shaft in approximately the same location. The old shaft can be rolled along a smooth surface such as a table top to determine if it is warped.
20. Insert the new drive shaft into the stepper motor cog hole and mate the rubber band to the two cogs.
21. While supporting the mirror end of the drive shaft with one hand, slide the bearing housing onto the pin with the other hand. The housing should be oriented so that the flush side of the bearing goes toward the drive shaft and the hole for the vertical spring should be closer to the bottom side of the instrument.
22. Replace the retaining C-clip on the pin. Be sure it sets properly in the groove.
23. Slide the large and small collars on the mirror end of the drive shaft until they are flush with the bearing. Tighten the flat head set screw to lock the collars in place.
24. Replace the vertical spring that provides pressure between the drive gear and micrometer gear into the bearing housing via the 5/64" hex head bolt.

25. Manually rotate the micrometer to be sure the new drive shaft is meshed with the drive gear.
26. Replace the spectrometer cover and secure both latches.
27. Replace the Brewer outer cover and secure the four latches, ensuring that the outer cover is mounted evenly all the way around the Brewer case. Remove the quartz dome protector.
28. To be sure that the new micrometer system is installed in the proper position, follow the most current SOP provided by NUVMC titled "Procedure for correctly positioning the micrometer inside a Mk IV Brewer spectrophotometer".
29. Enter an electronic comment (CM or CO command) describing briefly if the micrometer or drive gear were replaced or and any other observations made. Also enter an entry in the paper station log form.

For further information or advice concerning this SOP please contact the NUVMC at the University of Georgia at <http://oz.physast.uga.edu>