

## **Caring for Borg Objectives**

### **General Care**

The objective used in a Borg telescope is a high-quality, precision polished piece of optical craftsmanship which can be easily maintained for years of excellent service with just a bit of extra care:

- ◆ Keep your optics covered when not in use to protect it from dust and potential scratches.
- ◆ Do not cap your telescope if it has been subjected to dew formation or if you have brought a cold telescope into a warm room. Instead, let the OTA temperature equalize and give it time to dry out completely before capping it.
- ◆ For long term storage, keep desiccant with the objective to avoid mildew formation in humid climates or apply continuous mild heat.
- ◆ Do not use common compressed air cans to remove dust. The high pressure and/or propellant may cause damage to the optics or coatings.
- ◆ For the Series 80 tubes, the objective cell is threaded into an insert attached to the tube. Overtightening the cell can cause the insert to break loose when the cell is later unscrewed. If this occurs, you may attempt to reattach the insert with an appropriate adhesive for non-absorbing materials. Otherwise a replacement tube may be ordered from Hutech.
- ◆ For the Borg 76ED (Series 80 tube) and the Borg 100ED (Series 115 tube), the objective cell is mounted directly into the front end of the tube. Avoid tightening the tube ring mounting clamp excessively, particularly when it is close to the objective as this may deform the lens cell and cause astigmatism. Only moderate pressure is necessary as Borg OTA's are designed to be very light. Use only recommended tube holders as other brands of holders may be designed for telescopes of slightly smaller tube size.
- ◆ The Borg 125ED and 150ED lens cells are mounted with friction fitted hoods. Do not attempt to grasp the objective by the hood section or you may drop the OTA.

## Field Collimation (Borg 100ED and higher)

If your refractor has been subjected to rough handling or vibration during shipping or transporting of the OTA, the lens may have become de-centered and will require recollimation. However, Borg 100ED, 125ED (including F2.8), and 150ED objectives are designed to allow users to easily recollimate their instruments without the need for sending it back to the factory.

To determine if your refractor requires recollimation, the recommended method is the standard "star test". Observe a moderately bright star in good seeing at a high elevation angle if possible and use a good, high power eyepiece (no diagonal if possible). Place the star at the center of the field of view, and bring the star to precise focus so that the star's diffraction rings can be plainly seen. If they appear centered, no further adjustment is necessary. If you observe asymmetry in the pattern, rotate the eyepiece to insure that the effect is due to the objective and not the eyepiece. If the pattern does not rotate with the eyepiece, then the distortion is due to the objective and the collimation procedure below should be followed.

Note that if you observe the slightly defocused images of the diffraction pattern, they will not appear symmetrical at the inside-focus point when compared to the outside-focus point. This is normal for Borg refractors.

### Adjustment Points

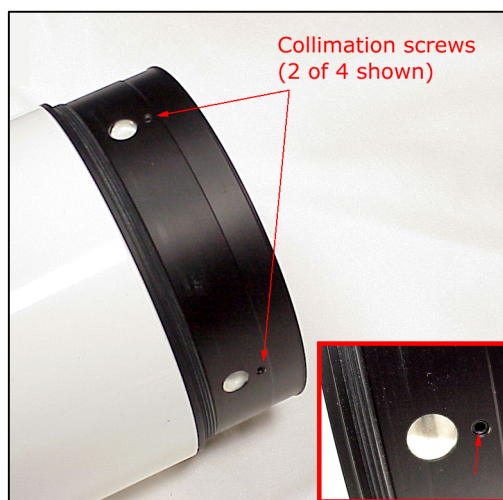
The lens cell adjustments consist of 4 hex screws, set 90 degrees apart around the edge of the objective cell as shown in the figure at right. Screw pairs (180 degrees apart) move one of the objective elements using a push/pull arrangement -- turn one of the pair clockwise to push while turning the opposing screw the same amount counterclockwise to pull.



Recollimation consists of adjusting each push/pull pair of screws while observing the diffraction

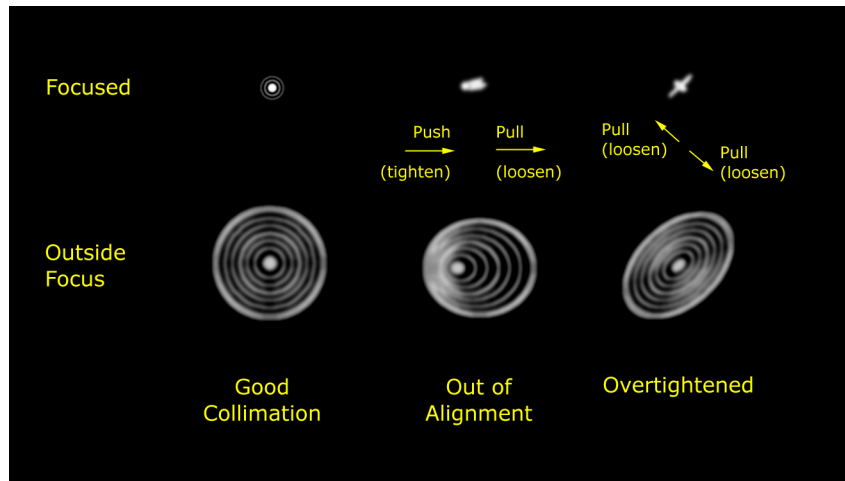
pattern of a star or other point source under high magnification until a perfect diffraction pattern is observed. Two hex wrenches are provided with each Borg 100ED and 125ED scope for this purpose. The Borg 150ED has slotted collimation screws.

In the case of the series 80 tube assembly for the 100ED OTA, the sliding dew shield must be removed to expose the collimation adjustment screws. This is accomplished by unscrewing one of the retaining rings on either end of the dew cap. In the figure at left, the retaining screw on the eyepiece side of the dew cap is shown detached. Once the retaining ring has been detached, the hood can be removed or pushed out of the way to allow access to the collimation screws.



### Collimation Adjustment Procedure

1. Select a moderately bright point source as a target. This may be a star on a night of good seeing, or an artificial pinpoint source such as the reflection of a small light from a distant sphere (e.g. ball bearing). Note that good seeing is essential! Target stars should be high in the sky, and artificial sources should be positioned so the light path avoids thermal gradients.
2. Center and view the source with a high quality eyepiece and without a diagonal if possible. Back-end optics must not degrade the image. Use a high magnification (250x to 400x is recommended). If a diagonal is used, it may degrade the image and also complicates the procedure described below.
3. If the source presents a perfect in-focus image with circular and concentric diffraction rings, no further adjustment is necessary.
4. If the star has a "tail" like a comet or the diffraction ring is not present, collimation is necessary. Pull (unscrew) the adjustment screw on the side of the tail of the image while pushing (screwing in) the screw on the opposite side as shown in the diagram below. If the tail is not aligned with one pair of screws, proceed in small steps alternately adjusting first one pair of opposing screws, and then the other until a perfect concentric set of diffraction rings is visible.



5. If the image has a two or four-way symmetry distortion (a cross in the extreme situation), the collimation screws are too tight and should be slightly loosened as shown in the diagram above. Proceed in small steps, loosening opposing adjustment screws an equal amount, until the diffraction rings are round.
6. When a good image has been achieved, gently check to insure that all four screws are tightened enough. Leaving them too loose will cause misalignment to occur easily. However, do not overtighten these screws. Overtightening will distort the lens as described in step 5.

Hints:

1. If your telescope is subject to seasonal temperature extremes, you may wish to check collimation each season. In extremely cold temperatures, the lens cell may compress the lens excessively, while in very high temperatures, the lens may be too loose in the cell.
2. You may find that using a slightly defocused image (outside the focus plane, away from the objective) may make it easier to do the collimation adjustments. In this case, using a colored filter (e.g. deep yellow Wratten #12) may make it easier to see the concentric rings in the image.