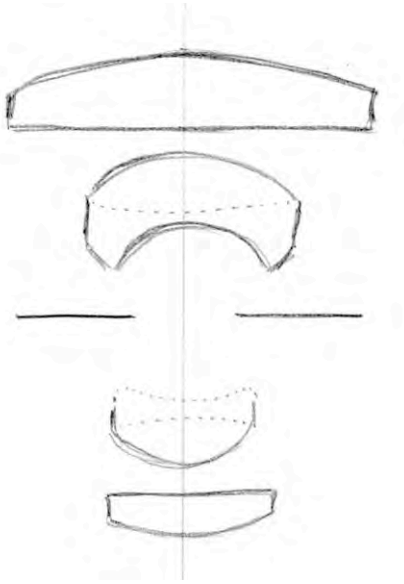
Zeiss Biotar 58mm f/2 Disassembly – Semi Automatic Style for Exakta

An adventure in lens repair by K. Rhoads

This is the story of Biotar 4427070, a lens with a troubled past, described on eBay as "in good shape but could probably use a professional cleaning." The release was stuck, the aperture blades were clean but binding, the cocking mechanism would not reliably cock, the front assembly was not concentric with the rear assembly, a ding in the focusing ring left wipe marks on the aperture ring, focusing was stiff and gritty, the bayonet tabs were bent, and there was fungus in the lens. On eBay, that's what passes for "good shape."

The Biotar is described in various places as originating in 1911 or 1932, as a variant of a Voigtlander Petzval design. It is also described as a 6-element "double Gauss" design. While I did not perform a complete disassembly, my guess is that this is a semi-symmetrical design: convex-plano objective, achromat doublet, aperture blades, achromat doublet, plano-convex rear element.



The Biotar is praised by Wrotniak as having "a large following of photographers who describe its imaging as 'deeper,' 'more three-dimensional,' or simply 'better' than that of most other lenses … Indisputably, Biotar's imaging is slightly softer than Tessar's, while not degrading the perceived image sharpness, and this may be the reason that so many photographers (including myself) like it a lot." (http://www.wrotniak.net/photo/exakta/lenses.html)

Part 1: The Focus & Release Assembly

Remove the release button with four screws. Can lubricate this unit without further disassembly. Clean and then graphite lube. Be sure the action is smooth, and reassemble.

Focus to infinity, set to f/4, and mark the way the lens should rejoin before separating. Mark the position of the top of the focus barrel at infinity with a line on the aperture ring. From the back of the lens, remove the thick spanner ring (thickest and furthest outside of the 3 visible spanner rings).

If this spanner ring is too tight the auto aperture mechanism will bind and not close down, especially for wider apertures (may have to back off later). The lens will come apart into 2 main components, the **lens** assembly and the **focus/release** assembly. A spacer ring around the lens assembly is loose and can fall off the assembly (an important item for attaining precise infinity focus later).

Observe the release/focusing assembly, with the inner helical ring in place. Note that the cocking mechanism moves a quarter circle (running from about 10 to 2 o'clock in the above photo), then pops out a pawl. On release the pawl pops back in.

Don't perform the following separation if at all possible. To separate the **release** assembly from the **focusing** assembly, remove the **focus stop screw**, a large black pan head screw inside and screw off the focusing assembly by turning counterclockwise—the helical drives up until it dethreads (when it is

approximately flush with the top of the focusing assembly), and then you continue unthreading the focus assembly from the release assembly. So, two sets of threads were unscrewing, and then just one. Even though the helicals will rethread in many ways, those helicals must go back together with particular threads meshing with their matching grooves. You're in for hours of trouble trying to get the helicals back together, and timed correctly with the focusing mechanism.

So you separated them anyway. Another spacer ring (silver side to front) will fall out of the focus assembly if you invert it (likely also important for precise infinity focus later). The shutter release assembly is still operational. Clean the mechanism and buff the aluminum at this point. Don't allow any protrusion to catch while buffing! Cleaning the cocking mechanism leaves it unlubricated and gritty feeling—relube it without further disassembly by forcing your lube (molykote) in.

As mentioned, the inner aluminum helical will (reverse) screw up and out when it gets flush to the top of the focusing ring. It can be painful getting it back together, so clean and lube it. After experimenting with Molykote and graphite I switched to Nyogel 701 which worked pretty well. Probably should use NyoGel Helical 744 if I had it. The helical will screw back in (with effort and patience, and from the top, not the bottom). Note that the helical pushes out toward the front of the lens as you turn the lens to closer distances. On reassembly, the rear of the focus assembly should almost hit its stop in the back of the release assembly. That's your best indication you got the appropriate meshing of the helicals.

The trick is to set the inner aluminum helicals at a certain point and then use the spanner wrench to hold the inner helical with its two grooves matching and meshing the upright posts on either side of the inside of the release assembly, while you turn the outer focusing ring clockwise to screw the helicals on and down. You can see the rigid posts (at 1 and 7 o'clock) and the rotating aperture cocking post (at rest at 8 o'clock) in the next photo.

Here's the trick to reassemble the release and focus units: you have to reassemble the release unit and the focusing unit WITHOUT the inner aluminum helical tube in place. Screw the focusing unit on all the way (clockwise) until it stops, and then unscrew it a scootch so the index mark matches infinity. Using this as a reference point, unscrew the focusing ring one full turn plus a little (go past infinity to the 2.5 meter mark, which is a point a little more than one full counterclockwise turn from your reference point). Now drop the helical tube into place, aligning its two grooves so they will mesh with the release unit's two alignment posts, and keeping the aperture cocking post within visibility at all times (you can see a special cutout for its action at the bottom of the helical tube). The helicals are reverse threaded, so nudge them CCW. Just start to screw the helical into place (a fraction of a turn, just where you hope it will start). Now place your

spanner wrench in the slots of the helical tube which accept the posts, and “focus” the focus ring down (clockwise). If all goes well the helical tube will catch its threads at precisely the right point but your spanner will keep it “stationary” as the focusing ring turns clockwise. You will likely repeat this step several times. It helps to put your spanner in a vise so it acts as a third hand. If the helicals started at the right place, the rear portion of the focusing unit should just meet its stop point at the rear of the release assembly as you approach the infinity mark. Now check to see if the focus stops (cutouts) are positioned appropriately by viewing through the screw hole (the black flat head stop screw you removed earlier). The cutout should stop as you reach the extremes of the focus ring (infinity and .5m) If so, put the focus stop screw back in place. Whew! The big question is whether you got those helicals started at the perfect point, so that the lens focuses correctly at infinity. May have to go back and repeat this procedure, experimenting with points to either side of that magic “1 full turn plus a little more to the 2.5 meter mark” point. (Note: at the 2m mark, the lens hits infinity focus too soon; at the 3m mark, everything looks good until you try to focus at infinity, and realize it can’t be reached because the elements are not close enough to the film plane).

This was a difficult reassembly; my helicals didn’t want to thread at 2.5m, but were glad to thread at 2m and 3m. I finally marked the top of the helical tube at what would be infinity for ease of doing the alignment, and kept on trying. At one point I thought I had success but I noticed the lens was hitting infinity just a bit before the infinity mark was reached – and realized I had left out one of the two spacer rings (the one that is around the lens assembly). Put it back in and it hit infinity exactly. So, it’s likely that these spacer rings fine-tune the focusing setting (different dimensions used for fine tuning the infinity focus, and when the ring around the lens assembly was zero dimension, true infinity came early at the 15m mark).

To rejoin the lens assembly with the release/focus assembly at this point, there is a linkage between the two. Don’t “straddle” the linkage units on each other, that’s not how it works. The grooved linkage of the lens ass'y is moved aside by the cocking tab and caught by the cocking pawl. The linkage from the lens assembly merely needs to be to one side of the cocking tab as it negotiates its quarter turn, to be caught by the cocking pawl. Check to see that the infinity reference and the aperture reference line up. Thread the “hefty” spanner ring back on by hand (to make sure it’s threaded correctly) then tighten with spanner wrench. If the cocking mechanism binds, or if f/16 snaps down with much more authority than f/2.4, this spanner ring is probably too tight, back it off.

One way to tell if the lens is sufficiently deeply seated in its focusing mount is this: On infinity, the space between the front of the focusing ring and the back of the raised portion of the engraved aperture ring is 3 to 3 1/2 mm, depending on whether you measure to the base or the top of the raised aperture ring. (I advised you mark this position at the outset.) If the lens is together wrong, that space will be wider.

Part 2: The Optical Assembly

It’s easiest to access the front 2 elements with the lens assembled. The Carl Zeiss Jena nameplate ring screws off. Note where it sits relative to the shutter release (the ‘a’ in Jena lined up with the release on mine). Now to remove the nameplate ring. After many unsuccessful attempts to unscrew it with various aids, I had to place six drops of penetrating oil on the threads around the perimeter (deposit then immediate wipe up) and let it sit a couple of hours. Then a rubber leg tip caught the ring and reversed it out, about 4 turns CCW. (Be certain that the rubber leg tip or rubber cork--or whatever--doesn’t touch the front element of the lens!) Once the nameplate ring is off, clean away any penetrating oil. Now the front ass'y is ready to come out – mark positions before unscrewing it, so you can return it to factory specs. Once the front ass'y is out, remove the spanner ring around the front element – about 3+ turns and it’s off. (This ring was loose in my lens, needed to be tightened down another 1/8 turn on reass'y). Now you have access to all the element surfaces of the front lens assy. Go after them with 2 alcohol swabbings to get rid of the fungus. The front of the aperture blades are also accessible at this point. I left them alone as they were clean. Reassembly of the front lens ass'y is simple.

To access the rear lens assembly, it’s probably easiest to separate the lens ass'y from the focus ass'y first (although not necessary). Now separated, unscrew the innermost spanner of the 3 spanner rings visible from the back. The rear lens element will fall out. Immediately mark it for direction; it’s curves are subtle (the moderately convex side faces the back, the flat side faces forward). You also have access to the back surface of the next highly convex lens element inside; leave it in place if you can. Clean these and reassemble. On reass'y, check infinity.

Final infinity adjustments: Infinity focus can vary after a mere disassemble/reassemble of the main assy’s. On one reass’y, infinity was perfect. On the next, it arrived early at 15m, indicating that the elements are further back than they should be. Hitting infinity correctly is controlled by the spacer ring that sits around the lens ass'y, but also by the bottom (fragile) portion of the focus assembly, which is easily bent. Bending it forward can help make certain true infinity isn’t reached too soon. Also, the tightness of the large spanner ring holding the main assy’s together will affect where infinity focus is. Sneak up on the final tightening, testing the focus as you tighten the main spanner ring.

The photograph on the webpage: “BJ’s Requested Recipes” was taken with this very lens after it was repaired.