Leitz Lamphouse 50 - Maintenance Notes

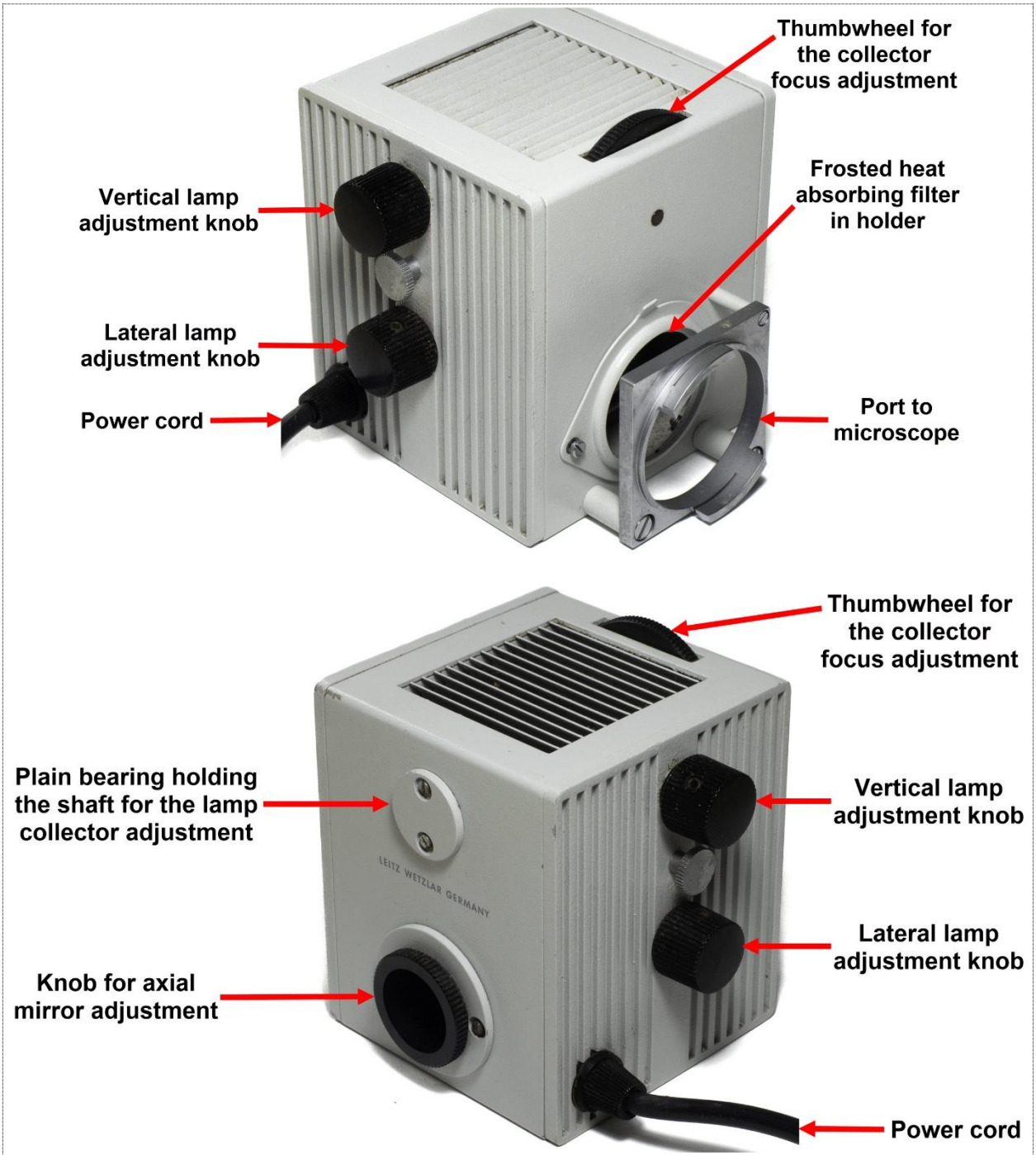

Figure 1: Lamphouse 50.

Leitz Lamphouse 50 was introduced in the early 1970s for some of the “grey era” microscopes with 170 mm tube length (for example, Ortholux II and Dialux, but not for Orthoplan.) It uses a 12V 50W halogen lamp that is powered by an external power supply unit. The lamphouse has a simple axially (along the optical path) adjustable concave mirror behind the bulb, a simple focusable aspherical collector lens and a frosted heat (infrared) absorbing glass filter. The bulb position can be adjusted laterally (sideways in the optical path) and vertically (up and down.) The lamphouse appears quite robust as it is almost

entirely manufactured of metal, only the control knobs are plastic. It connects to the microscope's illumination port by a bayonet mount. The top of the lamphouse has a grid for venting heat from the lamp. The lamp adjustment knobs are on the lamphouse's left side but can, if desired, easily be moved to the right side (only some rather simple rerouting of the lamp wires would be required).

Scope

These maintenance notes describe the disassembly and reassembly of the Leitz Lamphouse 50 including a few maintenance actions.

Grease

It's not unusual to find that lenses and filters in microscope lamps have become hazy after several years of use. The reason is most probably that non-metallic materials in the lamphouse, for example, plastics, paint, or lubricants, slowly emit low-volatility compounds and a fraction of these will condense on the lens surfaces and eventually cause the haze. Normally, it is a very slow process, but in a lamphouse it will be considerably accelerated because of the heat generated by the incandescent bulb.

Does the haze on the collector matter? In the default configuration where Lamphouse 50 is equipped with a heat absorbing filter that is frosted any added collector haze will not be damaging. However, for those who are Köhler illumination purists (and have replaced the heat absorbing filter with a clear, unfrosted filter) any haze may indeed matter depending on the severity and the user's purpose.

Can the haze formation be avoided or at least minimized? The best remedy is of course to avoid the problematic materials. In the case that grease can't be avoided, then the remedy is to choose a grease with minimal outgassing of low-volatility components. It is generally assumed (probably more based on assumptions and faith than on empirical evidence) that greases that are rated as high temperature greases fulfil this requirement. High temperature greases can also be expected to age more gracefully than "regular" greases.

The only parts that require lubrication in Lamphouse 50 are the lamp and collector focus adjustment mechanisms. Due to the combination of time (half a century) and heat you will most probably find that the grease in your Lamphouse 50 has degraded into a resin- or glue-like solid. After thorough cleaning, I have (with my fingers crossed) chosen to regrease the moving parts with Super Lube Multi-Purpose Synthetic grease with Syncolon, NLGI grade 2, which is rated for use up to 232°C (450°F.) Feel free to use any other high-temperature grease that you trust.

Maintenance Notes

1. Clean the heat absorbing filter.

Halogen lamp bulbs emit a lot of infrared, or "heat", radiation that is beamed through the microscope specimen where the concentrated heat may negatively affect or even damage the specimen. The purpose of a heat absorbing filter is to absorb and remove most of the IR radiation from the light before it reaches the microscope. The filter (Figure 1) typically supplied with Lamphouse 50 is a combined heat absorbing and frosted filter. It is 2 mm thick with a 40 mm diameter and sits loose in a holder that can be moved sideways to take the filter out of the optical path. If desired, the frosted filter can of course be replaced with a clear 40 mm heat absorbing filter.

To clean the filter, turn the filter holder sideways out of the optical path and remove the filter. The filter is loose in the holder, be careful so it doesn't fall on the floor. Dip the filter in lukewarm water with some dishwashing liquid and while submerged gently clean it with a soft brush or cloth. Rinse the filter with tap water and dry it with a clean microfibre cloth.

2. The microscope port.

The lamphouse is attached to the microscope by a bayonet mount on the microscope port (Figure 1.)

The filter holder (Figure 1) is attached by a small screw attached to the front of the lamphouse. A small, lightly greased washer provides some space between the filter holder and the lamphouse to save the surfaces from grinding against each other.

The bayonet mount is solidly attached to the lamphouse with three screws. The screws go through white metal spacers (13 mm tall) that insulate the hot lamphouse from the microscope. The M2x20 screw on the top of the mount is directly attached to the lamphouse, while the two M4x25 screws below are attached to a common tapping plate on the inside of the lamphouse (Figure 2.)

The port needs to be removed from the lamphouse if the collector or the collector focus mechanism needs to be accessed for maintenance.

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Figure 2: The tapping plate with the two M4x25 screws that hold the bayonet mount.

3. Disassemble the lamphouse.

Disconnect the lamphouse from the power supply unit.

Remove the lamphouse from the microscope's bayonet mount by turning it ¼ turn counterclockwise (when viewed standing behind the microscope.)

Unscrew the M3 locking screws (Figure 3 and Figure 4) that hold the side panels of the lamphouse attached and remove the panels. One of the screws has a knurled knob, the other has a countersunk head.

The inside of the lamphouse is now accessible for changing of the halogen bulb, or for other repair or maintenance tasks (Figure 5.)

Remove the concave lamp mirror from the mirror mount on the backside of the microscope (Figure 1 and Figure 5.) Turn it back and forth by its knob while carefully pulling it out.

Check that the concave lamp mirror surface appears clean. If required, blow off any dust using a camera air blower, and/or carefully clean it with aqueous lens cleaning solution and cotton swabs. Be gentle with the cleaning, the mirror appears to be surface silver plated and may be vulnerable for scratches.

Figure 3: The right-side panel with its locking screw.

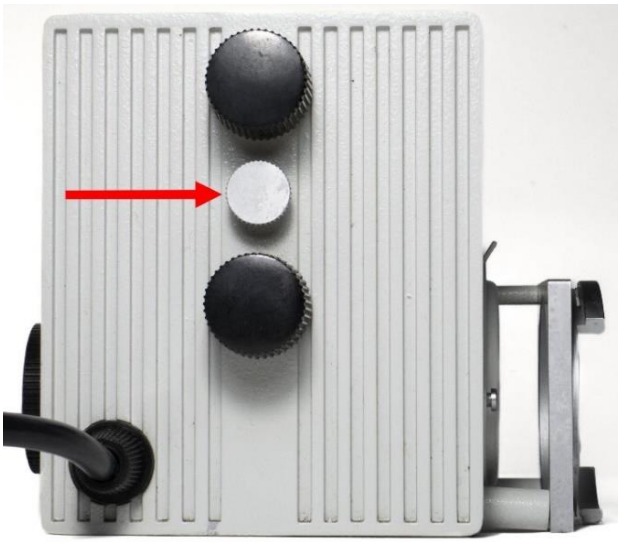

Figure 4: The left-side panel. The red arrow points to its locking screw knob.

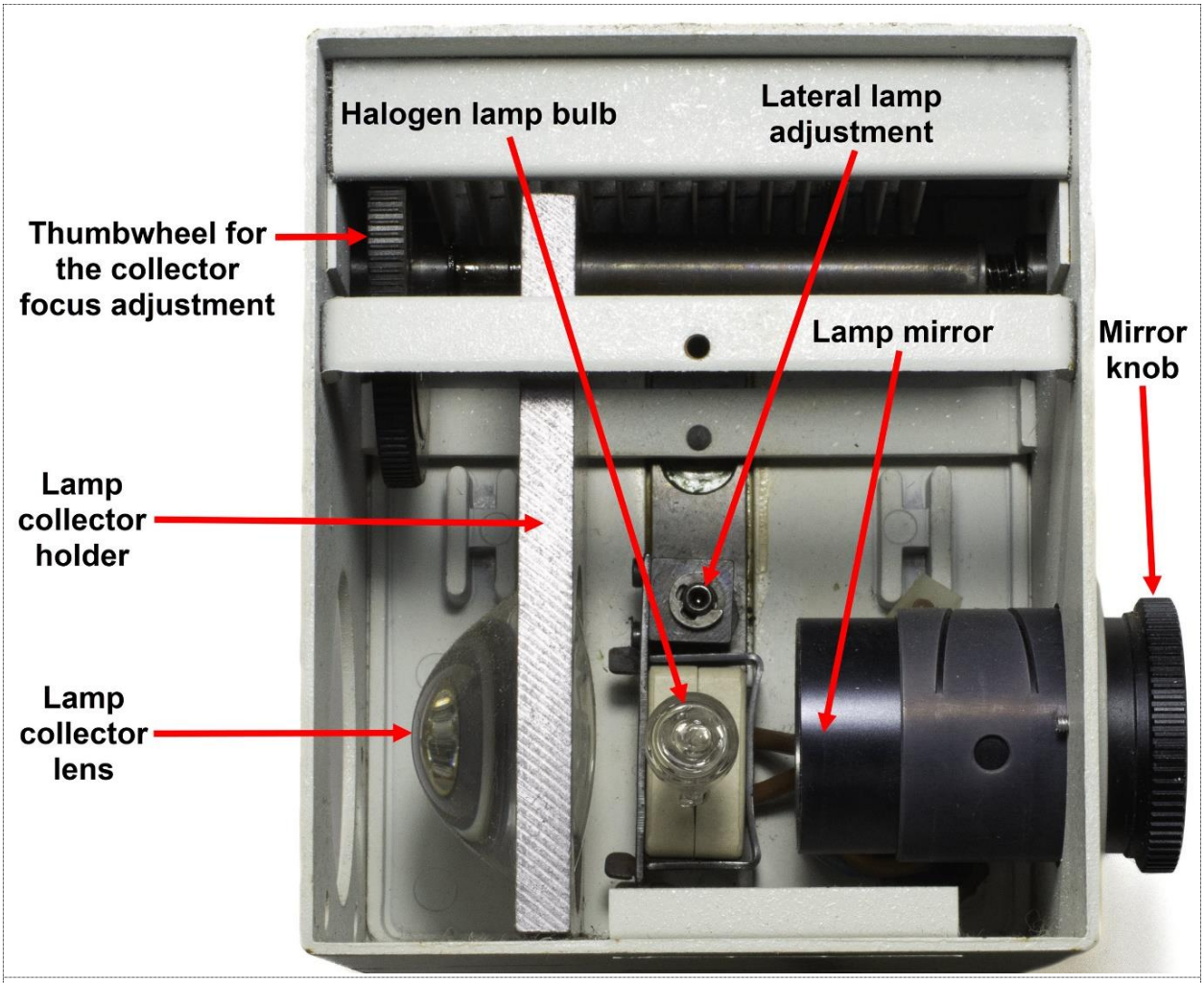

Figure 5: The interior of Lamphouse 50 after the right-side panel has been removed.

4. Disassemble and clean the lamp alignment mechanism.

During any work with the lamphouse be careful not to touch the halogen bulb with your fingers or contaminate it with foreign substances, like grease. Even traces of a contaminant may burn into the quartz glass and shorten the lifetime of the bulb.

A common problem with Lamphouse 50 is that the vertical and lateral lamp alignment mechanisms have become very sluggish due to old, hardened grease.

Figure 6 shows the inside of the left-side panel. The power cord can be left attached to panel through the grommet, but to access and grease the lamp alignment mechanism the electrical wires from the lamp holder must be disconnected from the terminal block (Figure 6.)

Remove the two M2x8 screws (yellow circles in Figure 6) that attach the lamp holder to the lamp adjustment mechanism. Carefully remove the holder with the lamp. This will provide access for disassembling and cleaning the adjustment mechanism (Figure 7.)

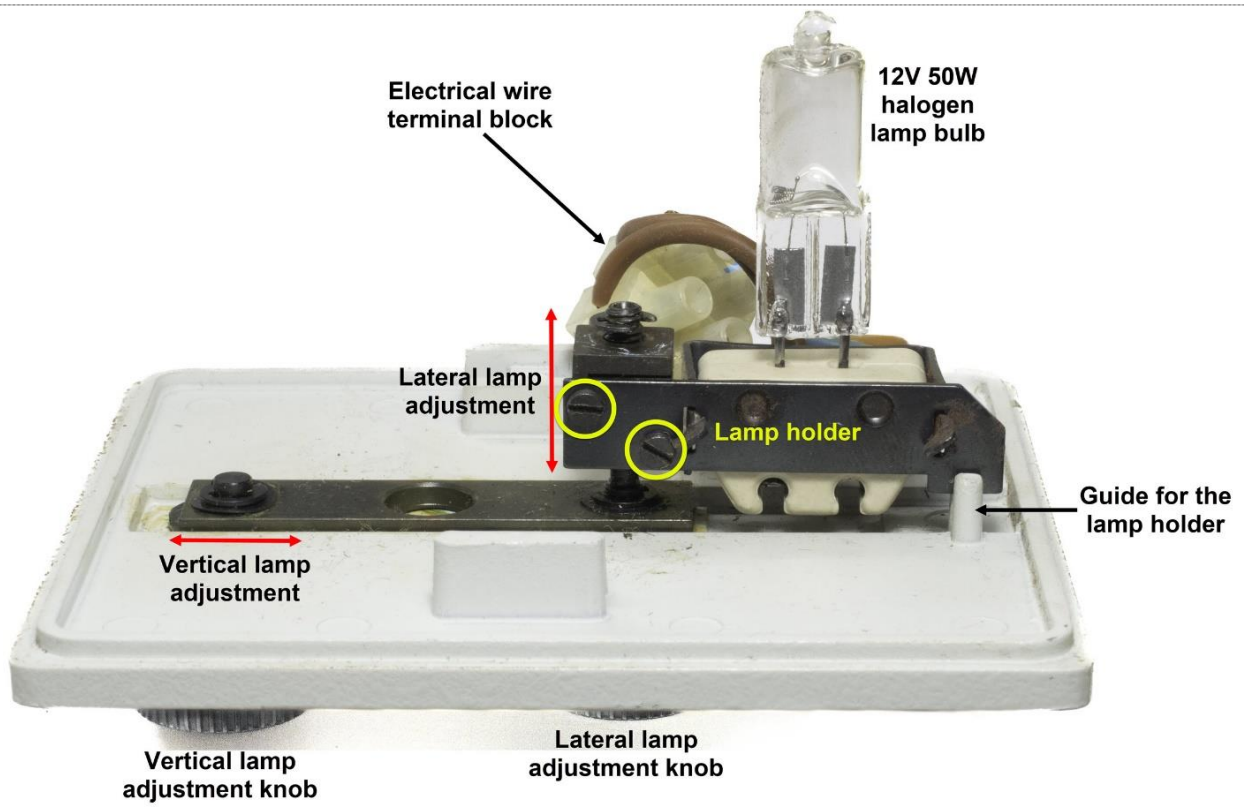

Figure 6: The removed left-side panel with the lamp bulb holder and the lamp adjustment mechanism.

Remove the two black plastic adjustment knobs on the outside of the lamphouse's left-side panel – the knobs are attached by M4 grub screws that require a 2 mm Allen key for removal. Then the mechanism can easily be disassembled; refer to Figure 8 for an exploded view of the parts. Be mindful when you pry off the three involved E-clips – when they suddenly release, they tend to fly away and disappear.

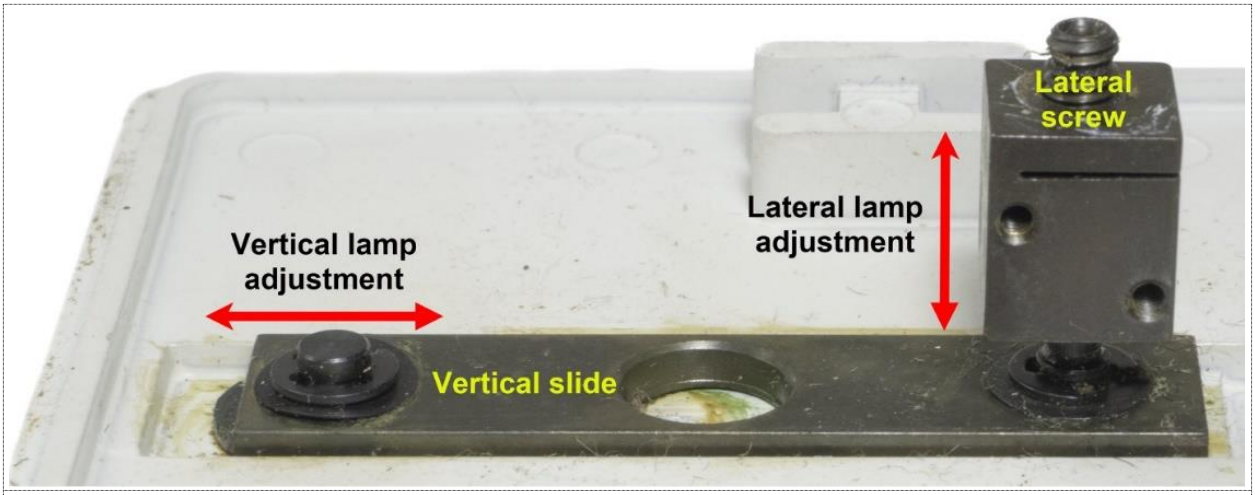

Figure 7: The lamp adjustment mechanism. The E-clips on top of the adjustment controls have been removed in this image.

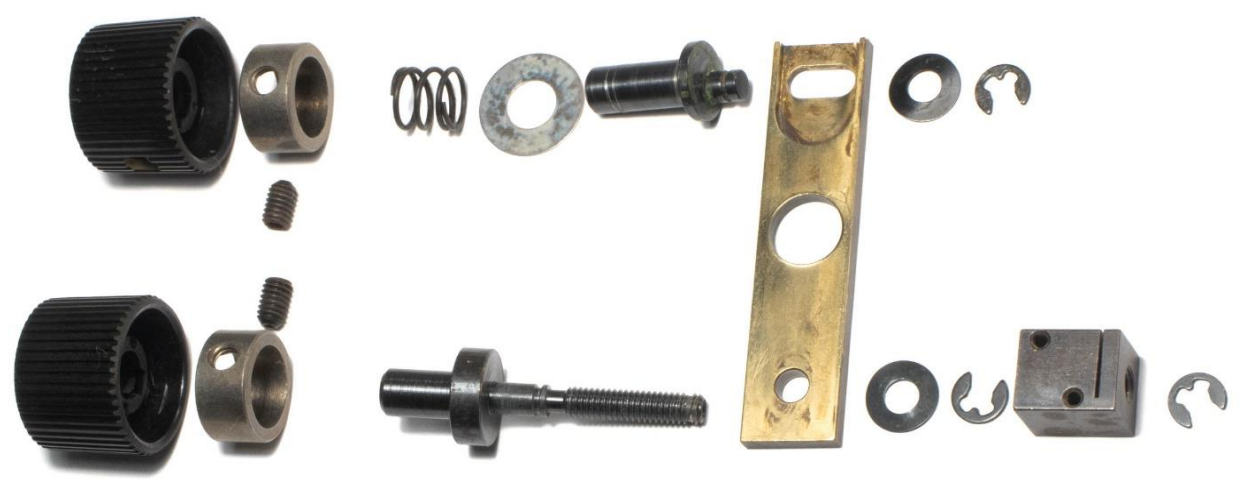

Figure 8: Exploded view of the lamp adjustment mechanism. The vertical adjustment parts on the top of the image, and the lateral adjustment parts on the bottom of the image. The vertical slide is the shared part.

The vertical adjustment parts are (Figure 8, top row, from the left side to the right side):

- Black plastic knurled knob with an M4 grub screw
- Steel inset with a thread for the grub screw
- Coil spring
- Steel washer (o.d. 14.0 mm, i.d. 6.5 mm, thickness 0.30 mm)
- (The lamphouse's side panel would go here, not included in Figure 8)
- The vertical adjustment axle
- The vertical slide (brass)
- Wave washer (o.d. 9.0 mm, i.d. 4.1 mm, thickness 0.2 mm)
- E-clip

The lateral adjustment parts are (Figure 8, bottom row, from the left side to the right side):

- Black plastic knurled knob with an M4 grub screw
- Steel inset with a thread for the grub screw
- The lateral adjustment lead screw
- (The lamphouse's side panel would go here, not included in Figure 8)
- The vertical slide (brass)
- Wave washer (o.d. 9.0 mm, i.d. 4.1 mm, thickness 0.2 mm)
- E-clip
- Lead nut
- E-clip

Clean all metal parts thoroughly with solvent (white spirit is recommended) including the slide on the inside of the left-side panel. The old grease will typically be difficult to remove and also require scraping with wood or plastic toothpicks. Pay attention to the thread of the lead screw, you may need to use a steel needle to remove solidified grease from the thread. Finish by scrubbing with a hard brush and warm water with dishwashing liquid, and dry thoroughly. Polish the brass slide with a suitable metal polish (for example, Autosol or Peek) and finish off by washing with a hard brush (for example, an old hard toothbrush) and warm water with dishwashing liquid. Soak the black plastic knobs over the night in water with dishwashing liquid, brush the knurled sides with a hard brush and dry the knobs thoroughly.

If the side panels are dirty, now is a good time to clean them. Wash them with a brush and warm water with dishwashing liquid. Let them dry completely.

5. Grease and reassemble the lamp alignment mechanism.

The vertical lamp alignment mechanism

Grease the underside of the vertical slide, the corresponding slide surface on the inside of the left-side panel, and the disc and the excentric knob on the inner end of the vertical adjustment axle (Figure 7.) Attach the vertical adjustment axle from the inside of the side panel and cover it with the vertical slide (positioned properly.) Attach the wave washer (greased) over the axle's excentric knob on to the slide. Lock the axle and slide by attaching the E-clip to the groove on the top of the axle's excentric knob. Attach the shiny steel washer and then the coil spring (greased) over the axle on the outside of the side panel. Attach the black plastic knob including the steel inset and the grub screw. Before tightening the grub screw push the knob down as far as it goes against the coil spring.

The lateral lamp alignment mechanism

Grease and attach the lateral adjustment lead screw from the outside of the side panel. Attach the wave washer (greased) over the threaded end that sticks out through the vertical slide. Lock the lead screw with an E-clip in the groove just above the wave washer (this may be difficult.) Thoroughly grease the thread of the lead screw and attach the lead nut turned the proper way as in Figure 7. Attach the last E-clip to the thread close to the tip of the lead screw. Some lead screws may not have a groove for the E-clip, in those cases the clip should be attached over the threads 2 mm below the tip. The E-clip limits the lateral adjustment range for the lamp - if the clip is attached too close to the tip of the lead screw, the lamp holder may be able to slip out of the lamp holder guide (Figure 6.) Attach the black plastic knob including the steel inset and the grub screw.

Attach the lamp holder with its two M2x8 screws to the lead nut. Check that both alignment mechanisms work as expected and that the lamp holder stays within the confines of the lamp holder guide. Adjust the E-clip and/or the lamp holder screws, if required.

Reattach the electrical wires from the lamp holder to the terminal block.

6. Disassemble and clean the lamp collector and its focus mechanism.

The lamp collector consists of a single aplanatic lens attached in an aluminum holder (Figure 5.) The collector holder with the attached focus shaft (Figure 9) moves axially along the focus lead screw that is turned by the focus adjustment thumbwheel on the top of the lamphouse (Figure 1 and Figure 5.) A screw head in the bottom of the collector holder (Figure 9) runs in a groove in the bottom of the lamphouse to prevent the holder from swerving. The ends of the focus lead screw are anchored by simple (plain) bearings in the front and back sides of the lamphouse (Figure 10 and Figure 11.)

Figure 9: The lamp collector with its holder and the focus shaft.

Figure 10: The lamphouse front. The arrow points to the tip of the focus lead screw.

Figure 11: The lamphouse backside. The arrow points to the plain bearing that holds the rear tip of the lead screw.

If not already done, remove both side panels (Figure 3 and Figure 4) from the lamphouse (refer to subsection 3) and also remove the microscope port (refer to subsection 2.)

Turn the collector control's thumbwheel to move the collector as far as it goes away from the microscope port (i.e., as far as it goes to the right as shown in Figure 12.)

Remove the E-clip that is attached on the lead screw (Figure 12.) It may be somewhat tricky, but try to first partly release the clip in its groove using a wide screwdriver to push down on the clip's both ends, and then pry off the clip from its other side using a small screwdriver.

Turn the collector control's thumbwheel to move the collector as far as it goes the other way, i.e., all the way towards the microscope port.

Remove the plain bearing for the lead screw from the backside of the lamphouse (Figure 11 and Figure 12) – the bearing is attached with two M2x4 screws, each with a 5.0x2.7x0.2 mm washer. Also collect the three black washers (one wave washer and two regular washers) that sit between the bushing and the focus shaft. Be prepared that the washers may be stuck and hidden in old hardened grease and therefore difficult to find.

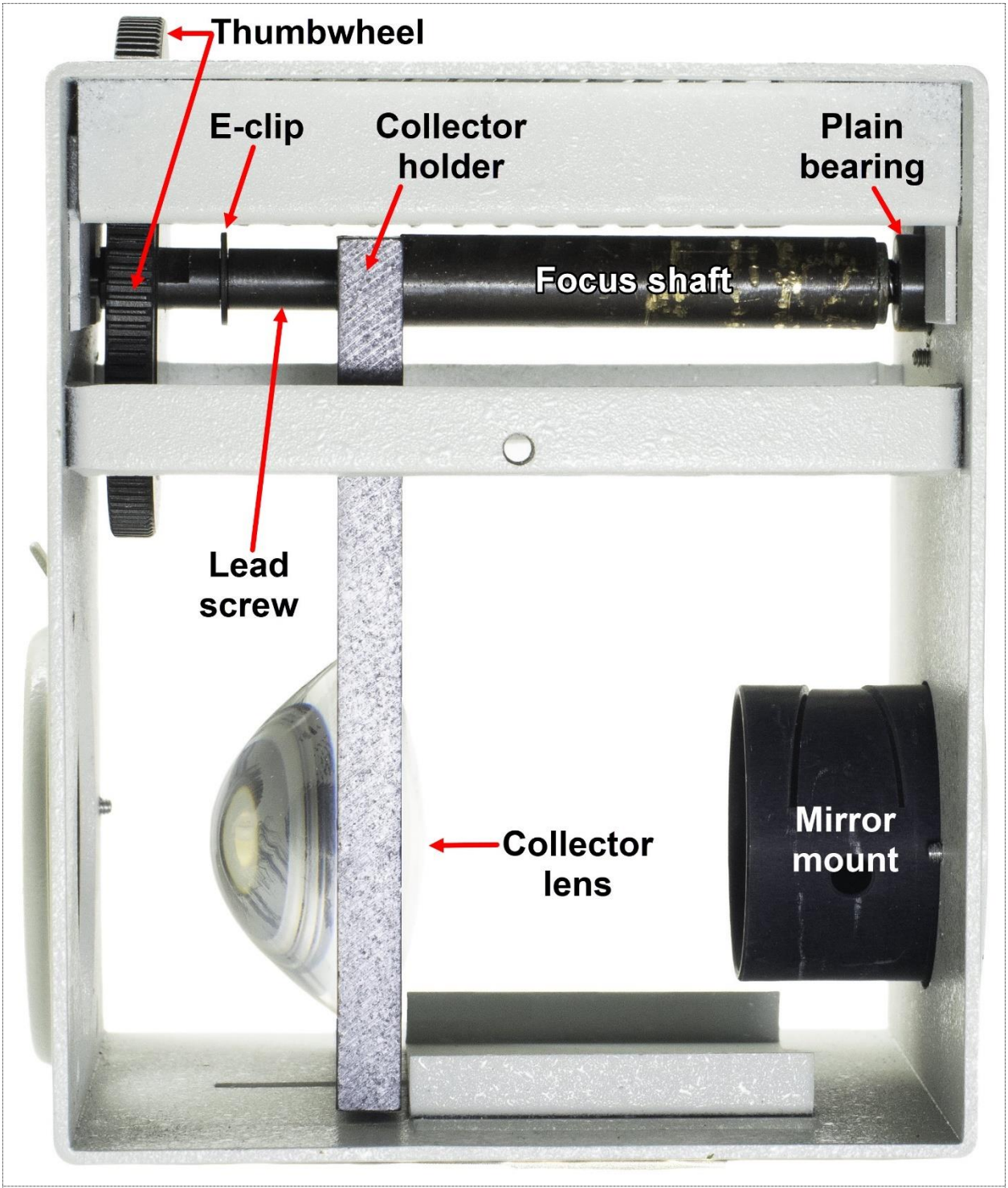

Figure 12: The collector focus control mechanism after the side panels and the microscope port have been removed.

With the bearing out of the way the collector focus mechanism is now loose in the lamphouse. It must however be further disassembled before it can be taken out of the lamphouse.

Move the collector holder to the right (if viewed like in Figure 12) to release the tip of the lead screw from its hole in the front of the lamphouse (Figure 10.) If needed, provide space by putting the end of the shaft through the empty bearing hole. Turn the thumbwheel slightly back and forth to release it from the end of the lead screw and remove it from the lamphouse.

Unscrew the focus shaft with the lead screw from the collector holder (Figure 12.) Use long-nose pliers to get a good grip around the shaft but avoid excessive squeezing that may deform the shaft. Be prepared that this may be difficult, mainly due to the very constrained space for the pliers. Once released, pull out the shaft with the lead screw through the bearing hole.

Remove the collector holder from the lamphouse taking care not to scratch the collector lens.

Unscrew and remove the lead screw from the focus shaft.

Figure 13 shows the parts of the collector focus control (except the collector holder.)

Figure 13: Exploded view of the lamp collector focus mechanism.

From the left side to the right side:

- *Black plastic collector focus control thumbwheel*
- *The focus lead screw, with a triple-start thread that fits a corresponding inside thread in the focus shaft*
- *E-clip to limit the focus range of the lamp collector*
- *The focus shaft, outside thread that fits the collector holder, greased inside triple-start thread*
- *Two black steel washers, greased (o.d. 9.0 mm, i.d. 4.2 mm, thickness 0.08 mm)*
- *Wave washer, greased (o.d. 9.0 mm, i.d. 4.1 mm, thickness 0.17 mm)*
- *Plain bearing, greased, attached to the backside of the lamphouse (Figure 11) by two screws and two small washers*

Thoroughly clean the focus lead screw, the focus shaft, the washers, and the plain bearing with solvent (white spirit is recommended.) The old grease may be difficult to remove and also require scraping with wood or plastic toothpicks. Pay extra attention to get the threads clean. Let the cleaned parts dry.

If the lamphouse is dirty, now is a good time to clean it. Remove any items still attached to the lamphouse (e.g., the mirror adjustment mount.) Wash the lamphouse with a brush and warm water with dishwashing liquid. Let the lamphouse dry completely.

7. Clean the collector lens.

The easiest way to clean the collector lens is to use a basic lens cleaning protocol on the lens while it is attached in the collector holder.

Alternatively, the entire collector holder with the lens can be cleaned by putting it in a beaker with lukewarm water with some dishwashing liquid. While submerged, gently brush all surfaces with a piece of cloth or a soft brush. Be careful not to scratch the lens. Rinse the holder and the lens with tap water and then thoroughly a couple of times with isopropanol to displace any water left in the narrow space between the holder and the lens (this is to avoid corrosion.) Leave the holder with the lens to dry in the air.

More laboriously, cleaning can be done after the lens has been removed from the holder. Refer to Figure 14 that shows the parts of the collector after it has been disassembled. The lens is held in the

collector holder by a retaining ring; the ring sits in a groove in the holder. Below the lens is another retaining ring, it is thinner and has a wavy appearance. It functions as a spring that keeps the lens tightly pushed against the first retaining ring.

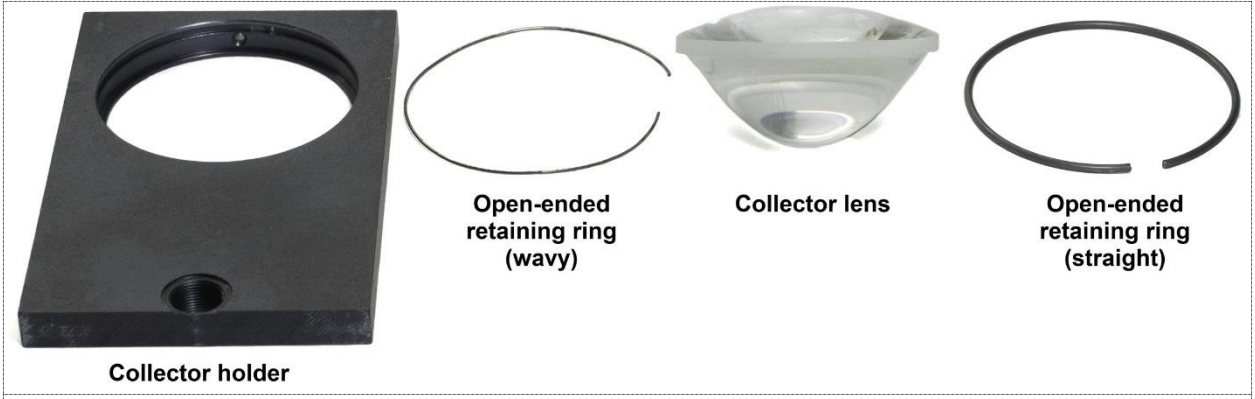

Figure 14: The parts of the disassembled collector.

To remove the lens, you will need to remove the retaining ring that holds the lens in the holder. To remove the retaining ring, you will need to release the pressure from the lens by pushing the lens down against the wavy retaining ring below it.

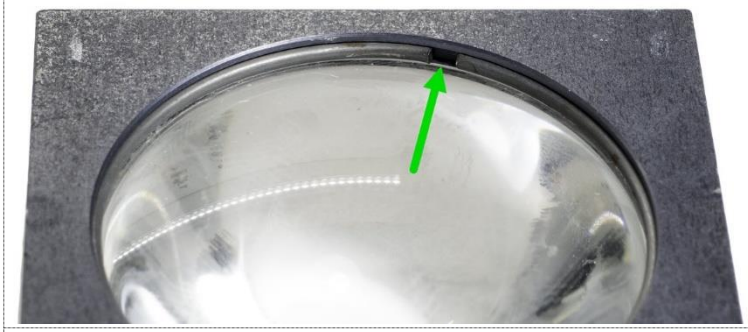

Figure 15: The collector lens and the retaining ring in the lower end of the collector holder.

Therefore, attach the collector holder in a vise - the less convex ("less bulging") side of the lens should face up and you should have access to the retaining ring (Figure 15.) With a piece of a clean cloth or with a glove as protection push the lens down against the wavy retainer ring below; the lens will move by barely 1 mm, but that's enough to free the retaining ring above the lens from the pressure. While still holding down the lens, use a sharp and strong steel needle (for example, a dental scaler) to pry off one of the ends of the retaining ring (the green arrow in Figure 15 points towards the retainer ring ends.) Releasing the end of the retaining ring may be difficult and require some force. Usually one end is easier to release than the other, so it may make sense to try with both ends. Also be very careful not to scratch or nick the lens. Once one of the ends of the retainer ring has released from its groove, it is easy to remove the entire ring from the holder. The lens is now loose and can be removed for cleaning.

Clean the collector lens using your preferred lens cleaning protocol.

Reassemble the collector by reversing the steps above. Be sure to insert the lens turned in the correct way in the holder – the most convex side ("largest bulge") should face downward when the lens is put into the holder. Again, push down the lens when you attach the straight retaining ring above it. Then make sure that the entire ring has gone all the way down into its groove in the holder.

8. Grease and reassemble the lamp collector and its focus mechanism.

Before reassembling the collector and the focus mechanism you will need to decide whether you wish to grease the lead screw or leave it ungreased. Greasing it will make the focus settings very smooth and pleasant, leaving it ungreased will ensure that the mechanism doesn't get stuck in case the grease disappoints by again solidifying sometime within the next 50 years. (I have tried out how it feels, and indeed, even without grease the collector focus mechanism works quite smoothly.) If you choose to use grease, then apply it on the following surfaces: The threads of the focus lead screw and the focus shaft, the washers, and the inside of the plain bearing.

Screw the focus lead screw all the way into the focus shaft (refer to Figure 13 for the parts).

Put the collector holder into the lamphouse with the bulging side of the lens (Figure 9) pointing toward the microscope port. Position the screw head in the bottom of the holder (Figure 9) in the groove in the bottom of the lamphouse.

Put the lead screw with the inserted shaft through the lamphouse's bearing hole and screw the shaft's tread into the collector holder's thread. Use long-nose pliers to tighten the shaft to the holder so it doesn't release later during normal use. (Depending on the size and shape of the pliers it may be somewhat difficult to get a grip around the shaft.)

Attach the focus control thumbwheel over the tip (the left tip in Figure 13) of the lead screw and then put the tip into the hole in the front of the lamphouse (above the microscope port.) It may help to turn the lead screw to move it within the shaft into a more comfortable position.

Attach the three washers over the rear tip of the lead screw: First the two regular washers and then the wave washer. Attach the plain bearing (it may make sense to grease its inside even if you choose not to use grease between the lead screw and the shaft) to the backside of the lamphouse making sure that the axle tip properly fits into the bearing.

Move the lamp collector (using the focus control thumbwheel) as far as it goes away from the microscope port (i.e., to the right as in Figure 12) and attach the E-clip to the groove in the lead screw. It is difficult to reach, so you will probably need to use long-nose pliers. Make sure that the clip goes all the way down into the groove. Be careful not to scratch the collector lens.

Check that the collector moves freely through the entire range when the focus control thumbwheel is turned.

Attach the microscope port to the lamphouse using the three screws and spacers described in subsection 2.

Clean the heat absorbing filter and attach it in its holder in the microscope port.

If not already done, reconnect the electrical wires to the terminal block on the left-side panel (Figure 6.) Attach both side panels to the lamphouse (refer to subsection 3.)

Attach the mirror in the mirror holder on the backside of the lamphouse.

Perform a final check that the lamp works as expected.

9. Change and align the halogen lamp bulb

For instructions on changing and aligning the halogen bulb, refer to section References below.

Always keep halogen bulbs completely clean and protect them from any fingerprints, contamination, and dirt. Always handle halogen bulbs wrapped in tissue, never touch the bulb with your fingers.

Lamphouse 50 is designed for 12V 50W halogen lamp bulbs. The bulb type should be T3, where "T" indicates "tubular" shape and "3" is the bulb diameter in 8ths of an inch, in this case 3/8 inch (or 10 mm), and the base should be G6.35, where "G" is the code for a bipolar bulb with 1 mm thick pins, and "6.35" is the distance in millimeters between the pins. The size and shape of the filament has however some relevance for implementing a strict Köhler illumination. Furthermore, the maximal ranges of the lamphouse's vertical and lateral adjustments put some restrictions on the optimal distance between the lower end of the bulb base and the filament.

Unfortunately, I haven't been able to find any official filament or bulb specifications provided by Leitz for Lamphouse 50. Searching the Internet one can however find some more or less anecdotical information about supposedly suitable bulb makes and models. The "Osram 64610 HLX 50W 12V" halogen bulb is one example, but similar bulbs from other manufacturers are also identified. The larger halogen bulb manufacturers typically issue data sheets that include the filament size, shape, and position parameters.

It's important to understand that while regular halogen lamps have average lives of 1000-2000 hours, the specialized scientific halogen bulbs (like the above mentioned Osram bulb) that often are used in high-end projectors and laboratory or medical equipment only have average lives of 50-100 hours. These specialized bulbs are brighter than the regular bulbs and also provide a somewhat colder light (approx. 3350K vs. 3200K.) The life of the specialized halogen bulbs can be extended by running them at slightly lower voltage than the nominal (one rule-of-thumbs says that a 5% voltage reduction will double the life), but this of course also decreases the light intensity and color temperature. Avoid reducing the voltage by more than 30% as this has been reported to jeopardize the bulb's halogen regenerative cycle resulting in an increasing darkening rate of the bulb envelope.

A general international trend is that halogen bulbs are being phased out due to energy saving and global warming concerns. Probably halogen bulbs for scientific use will remain available for several more years, but one should still expect steadily increasing scarceness and costs.

Leitz Lamphouse 50 and other halogen lamphouses from this period were powered by quite heavy and bulky PSUs (power supply units) that typically provided AC current. Today power efficient, lightweight and inexpensive "switching" PSUs are available, but they all supply DC current. This raises the question if there are any significant differences for the bulb life if 12V halogen bulbs are run on AC or DC. Unfortunately, I haven't so far been able to find any unambiguous or clear answers.

There is room for some creative 3D printer modifications of Lamphouse 50 to retrofit it for LED illumination.

References

Leitz Lamphouse 50 is described in the following brochure:
Ortholux II - Instructions