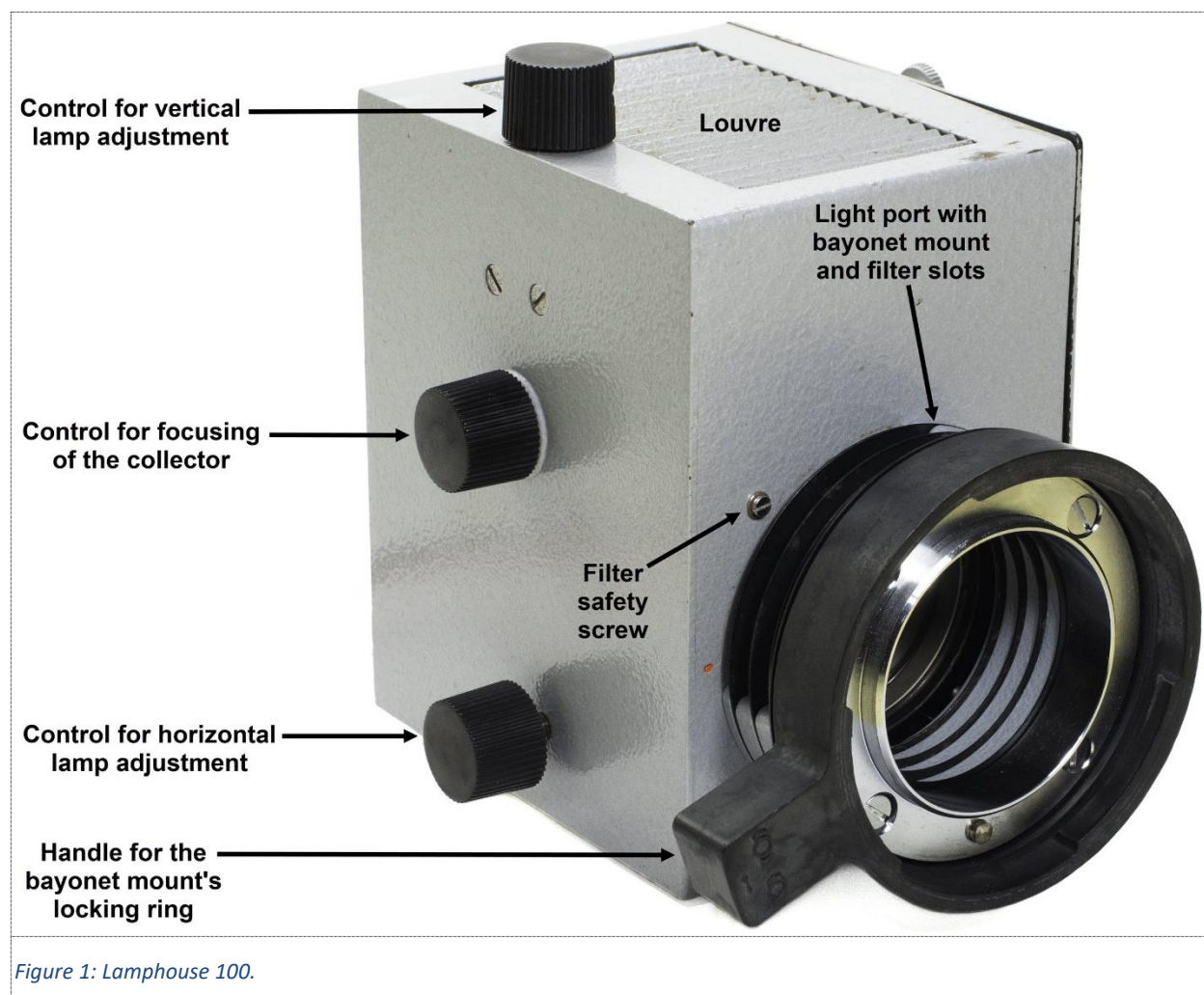


Leitz Lamphouses 100 and 100Z

Introduction

Leitz lamphouse 100 (most often called “lamp housing 100” in Leitz’ English printing) was introduced around 1965 to be used with Leitz’ new flagship microscope Orthoplan. Its bayonet mount was exclusive for the Orthoplan microscope, but soon various adapters and accessories (like mirror houses) emerged that allowed it to be used with other Leitz contemporary microscopes (Ortholux, Ortholux II, Dialux, etc.) Through the years it was manufactured in several configurations for use with different light sources, for example, 60W and 100W standard tungsten filament lamps, 100W halogen lamps, and a number of voltaic arc lamps (mercury and xenon.) A more advanced lamphouse 100 version designated lamphouse 100Z (presumably “Z” stands for German *Zentrierbar*, or centerable in English) provided alignment controls (horizontal and vertical adjustment and focusing) for the convex mirror behind the bulb.

The rugged lamphouse (Figure 1) is mainly made of metal parts. A louvre at the top of the lamphouse, an air vent in the lamphouse door (Figure 3), and the open lamphouse underside (Figure 5) provide for air convection to cool the lamp bulb. The air openings are shielded to prevent distracting stray light to leak out from the lamphouse.



The standard tungsten filament lamp bulbs (60 W or 100 W) sit in a lamp mount that is attached on the backside of the lamphouse. Halogen (12 V, 100 W) and arc lamp bulbs sit in other mounts that instead are attached into a baseplate ([Figure 5](#)) on the underside of the lamphouse. The lamp mount on the backside of the lamphouse is in these cases replaced with either a simpler focusable concave mirror (lamphouse 100 as in [Figure 2](#)) or the more advanced focusable and centerable concave mirror in lamphouse 100Z ([Figure 6](#).)



Figure 2: Lamphouse 100 with a focusable mirror on its backside.



Figure 3: Lamphouse 100 – view of the side with the removable lamphouse door.

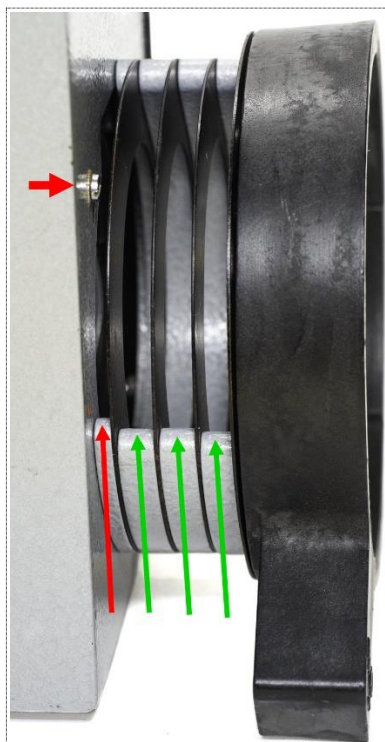
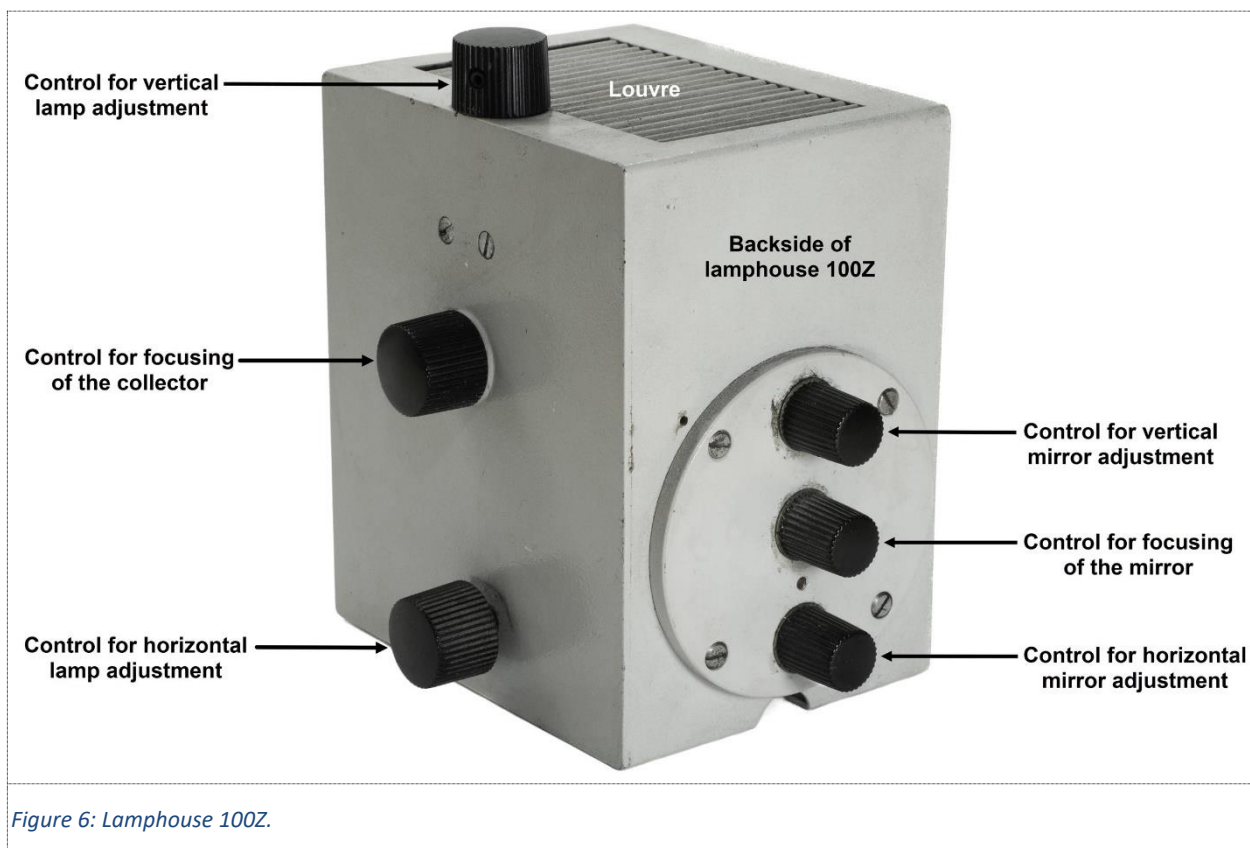


Figure 4: The filter slots in the light port.



Figure 5: Lamphouse 100 – view of the underside.



The light port (i.e., the interface between the lamphouse and the microscope, [Figure 1](#)) has a convenient bayonet mount with a black plastic locking ring, and there are also three 5 mm wide slots (the green arrows in [Figure 4](#)) for Leitz 50 mm filters. Both mounted and unmounted 50



mm filters ([Figure 7](#)) can be used. Suitable 50 mm filters of many kinds were manufactured by Leitz well into the 160 mm tube length era, but be aware that some of the later filter holders could be too thick (5½ mm or more) to fit into lamphouse 100.

A small screw can be seen in the lamphouse just next to the filter slots (see [Figure 1](#) and the short horizontal red arrow in [Figure 4](#).) I assume that its purpose is to prevent users from putting any filter into the narrow slot that is closest to the lamphouse (with a long vertical red arrow in [Figure 4](#).) The slot superficially looks like a filter slot, but if one actually tries to put a filter into it, the filter will only fall down into the inside of the lamphouse and disappear.

Figure 8 shows the focusable concave (i.e., not parabolic) mirror (a.k.a. reflector) that sits in a slide mount on the backside of some versions of lamphouse 100 (Figure 2.) After releasing a small grub (locking) screw in the side of the mount (indicated by the blue arrow in Figure 3) the mirror can be focused by pulling or pushing it back and forth in the slide. The mirror can however not be centered.

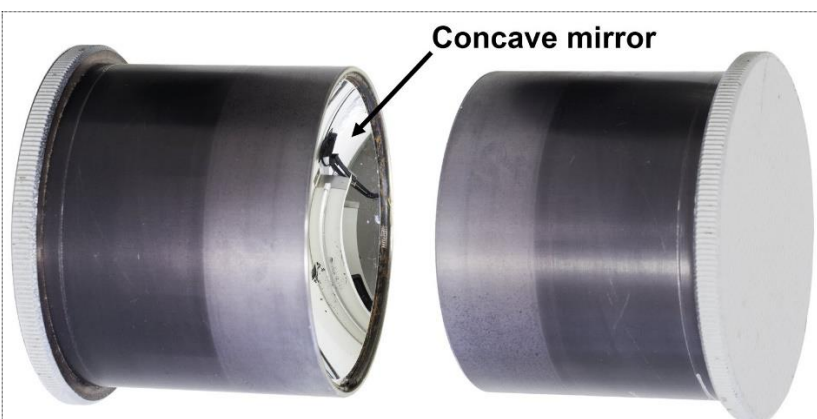


Figure 8: Views from different angles of the concave mirror after it has been removed from lamphouse 100.

Lamphouse 100 has a focusable collector that consists of two lenses in a metal case (Figure 9.) It seems that even the collector was offered in different versions; I have worked with one collector where the lens that faced the microscope was frosted, while another collector had normal clear lenses. Unfortunately, I don't know of any explicit Leitz instructions for the choice or proper use of these, but I guess that the clear collector would be required for applications where strict Köhler illumination is desired (i.e., where the bulb filament must be projected in the illumination path's conjugate focal planes), or at least in cases where bulb or mirror centering is paramount.

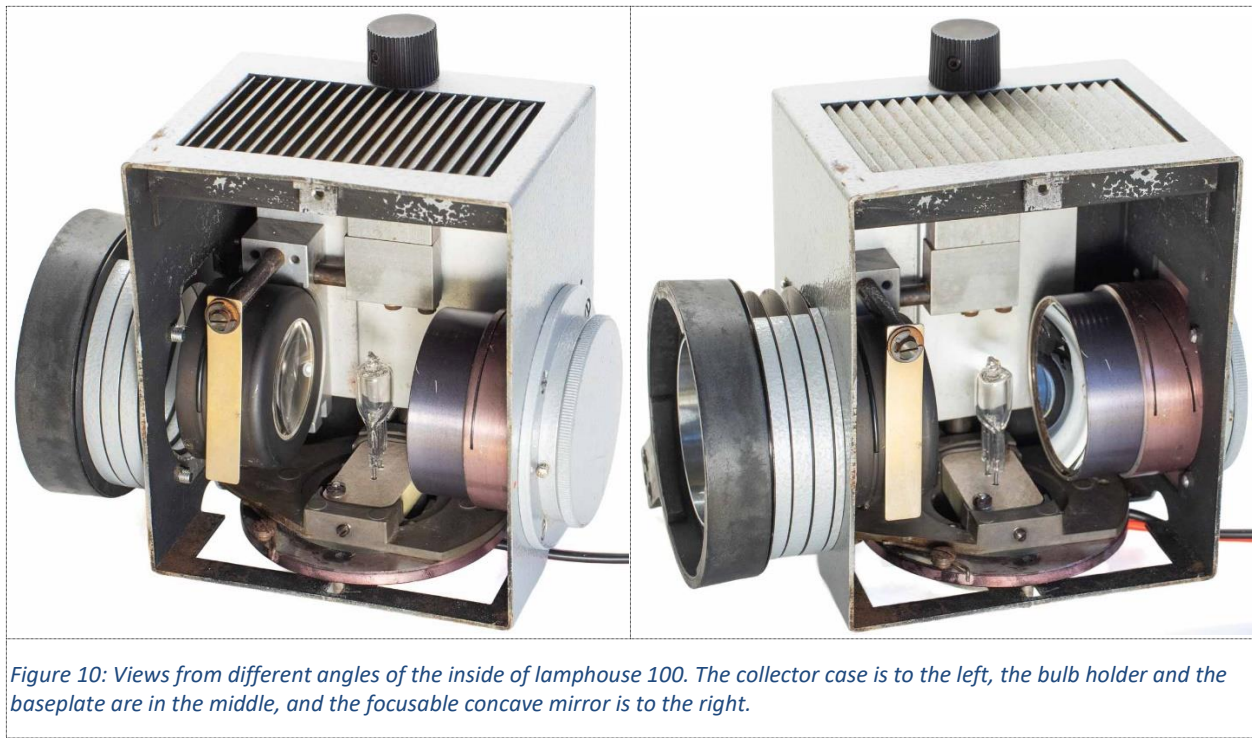


Figure 9: Views from different angles of a collector case after removal from lamphouse 100. The left image shows the side (with a frosted lens) that faces the microscope; the right image shows the side that faces the lamp bulb.

One side of lamphouse 100, the “door”, can easily be removed (Figure 3) for access to the inside components (Figure 10.)

An interesting feature is that the lamphouse is designed to allow the light port and the mirror to swap places – probably to accommodate both right- and left-handed users. This is illustrated by Figure 1 and Figure 6 where the lamphouse configurations cater to left-handed and right-handed users, respectively. The internal lamp alignment and condenser focus mechanisms are also designed and prepared to allow for this reconfiguration.

The images in these maintenance notes are from three lamphouses 100/100Z that were quite dirty and in rather bad shape with corroded, bruised or missing parts, sticky old grease, and cracked insulation of the electrical wires. The goal of the work was to combine the better parts into two functional lamphouses. The results are hardly any pretty museum exhibition pieces, but they are at least fully functional lamphouses that should last for several years (or until spare halogen lamp bulbs become extinct.)



Scope

These maintenance notes describe the disassembly and reassembly of Leitz lamphouses 100 and 100Z to perform a few maintenance tasks. Some lamphouse accessories are not mentioned (like the bulb holders for the various tungsten and arc lamps); the reason is simply that I didn't have them available. Here are some problems that may be encountered after many years of use (or storage in a damp basement):

Sluggish or even frozen collector focus adjustment, lamp adjustment and mirror adjustment mechanisms due to aged grease.

The inner lens surface of the collector may have become hazy due to long time use in proximity to the very hot lamp bulb.

Oxidized electrical wires and soldering, fractured or damaged wire insulation.

General accumulation of dust and dirt, corrosion due to high humidity or corrosive laboratory fumes.

Grease

A few components in lamphouse 100 require greasing and fortunately for adequate lubrication the choice of grease is not critical. However, lamphouses with powerful bulbs radiate a lot of heat which may cause certain materials, like plastics, paint, and grease, to emit vapors that eventually may condense as a hazy film on the collector's lens surfaces. This annoying phenomenon can be minimized 1) by choosing greases with negligible outgassing, and 2) by lubricating only where it really is necessary and then only using as little grease as possible. I'm not aware of any comprehensive survey of greases with documented low outgassing at elevated temperatures, but greases that are specified for high-temperature use can generally be expected to be suitable. I have chosen to use the ubiquitous Super Lube Multi-Purpose Synthetic Grease with Syncolon, NLGI grade 2, to grease the moving parts of lamphouses 100 and 100Z. Future generations will know whether this was a good choice.

Maintenance Notes

1. Preparations.

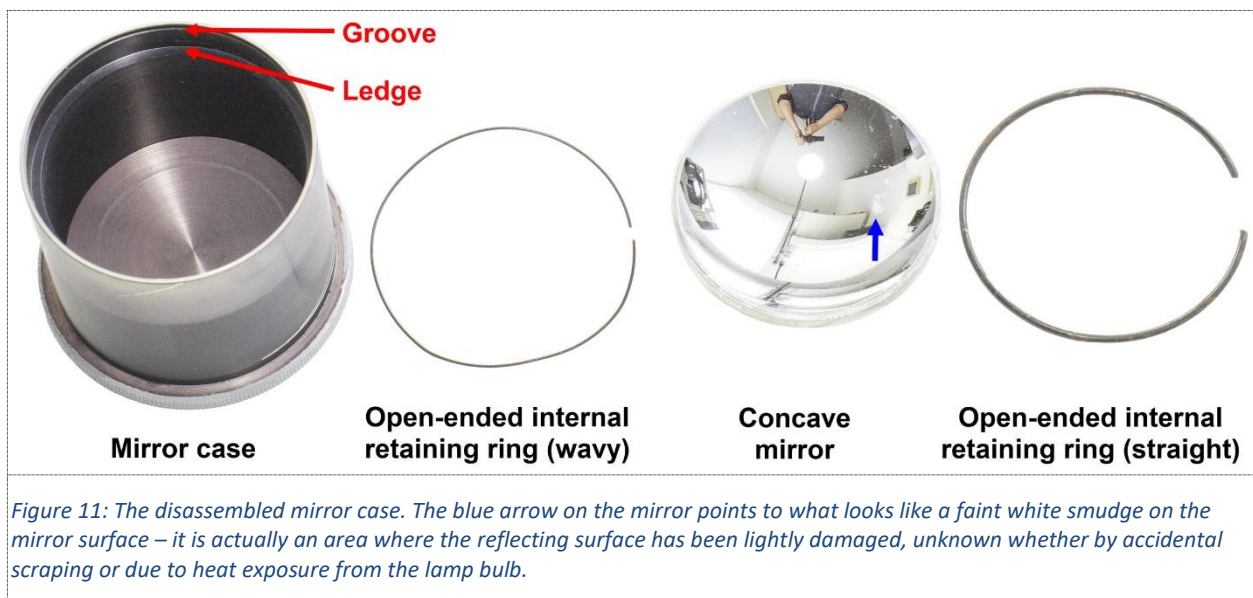
Disconnect the lamphouse cord from the power unit. Remove the lamphouse from the microscope. Remove all filters from the filter slots (Figure 4.) Loosen the knob for the removable side (the “door”) of the lamphouse (Figure 3) and remove it from the lamphouse.

2. The (simple) focusable mirror.

To remove the focusable mirror from the lamphouse (Figure 2 and Figure 8) first loosen the small grub screw in the side of the mirror mount (blue arrow in Figure 3) and then pull out the entire mirror case. It is easier to remove if it is turned simultaneously with the pulling.

Inspect and, if required, clean the mirror surface. The mirror is concave (rather than parabolic) and made of plastics. For a first surface mirror the mirror surface appears quite rugged, but it is still a good idea to treat it carefully. Don't worry if the mirror surface doesn't look optically impeccable (there may be, for example, scratches, specks, or patches where the reflecting layer is worn) - the quality requirements for lamp reflectors are relatively forgiving.

The mirror sits in a metal case; if required for thorough mirror cleaning, the case can be disassembled (Figure 11.)



To disassemble the mirror case, put it on the table with its mirror facing up. With a gloved finger, or using a clean piece of cloth as protection, carefully push down on the mirror (it will retract by less than 1 mm) to release it from the open-ended straight retaining ring that sits in a groove (Figure 11) just above the mirror. Holding the mirror depressed, use a sharp tool (e.g., a small screwdriver or a dental probe) to dislodge one of the ends of the retaining ring. With one end loose, the ring is easy to pull off from its groove. Carefully remove the mirror. Below the mirror is a wavy open ended internal retaining ring that loosely rests on a ledge in the case. The wavy ring acts as a spring that holds the mirror tight against the straight retaining ring.

Carefully clean the removed mirror with lukewarm water and dishwashing liquid.

Reassembly of the mirror case is straightforward, just reverse the steps above.

The mirror mount (Figure 12) that holds the mirror case in the lamphouse is attached by four M4x5 chrome plated screws. It is easy to remove, but there really isn't much to work with, so removing it should rarely be necessary except if one wishes to change the lamphouse from a right-handed to a left-handed configuration, or vice versa. Note that the open part of the slide should face downward – this is necessary to provide space for the bulb holder baseplate.

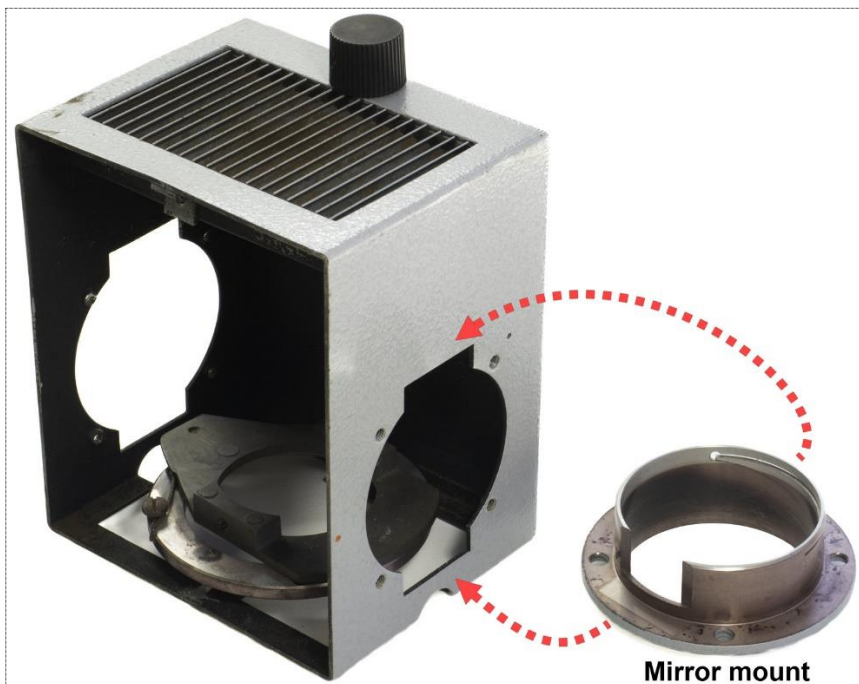


Figure 12: Lamphouse 100 showing how a removed mirror mount should be reattached.

It is best to leave the slide in the mirror mount unlubricated.

3. The (advanced) alignable and focusable mirror.

This more advanced alignable and focusable mirror comes with lamphouse 100Z and is attached to the lamphouse's backside (Figure 6.) If any of its three control knobs are sluggish or dysfunctional it will need to be disassembled, repaired as necessary, cleaned, and regreased.

Start by removing the four M4x4 chrome screws that attach the mirror carrier plate to the backside of the lamphouse. Remove the carrier plate together with the mirror (Figure 13.)

Remove all three black knobs on the carrier plate's outer side after loosening the M2.5x4 grub screws in the sides of the knobs. The grub screws require a 1.3 mm hex (Allen) key. Loosening the grub screws is good enough, there is no need to remove them from the knobs. Remove all washers that sit between the knobs and the mirror carrier plate. Remove the horizontal and vertical mirror alignment mechanism parts (Figure 14) and the mirror case with its focus adjustment parts (Figure 15) from the inside of the carrier plate.



Figure 13: The alignable and focusable mirror after removal from lamphouse 100Z.

To access and regrease the mirror focus axle the mirror must first be removed from the mirror case.

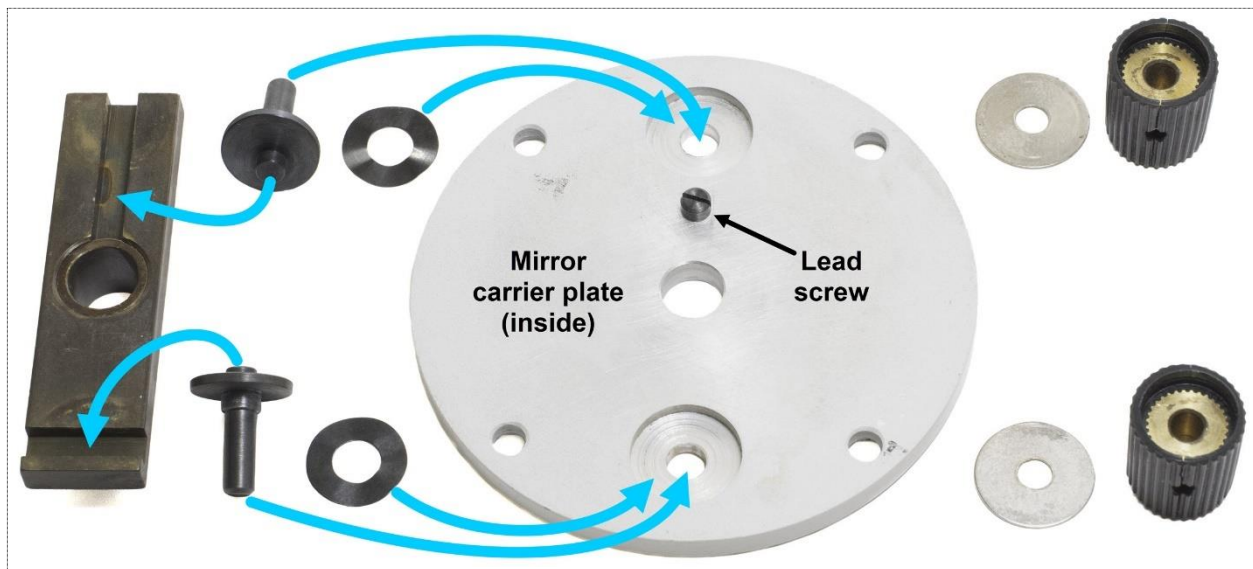


Figure 14: The mirror carrier plate with the disassembled mirror alignment mechanisms. The parts are (from left to right):

- The alignment slide
- The excenter pins (the upper for horizontal [lateral] mirror alignment and the lower for vertical mirror alignment)
- Wave washers (o.d. 13 mm, i.d. 6 mm, thickness 0.1 mm)
- Mirror carrier plate (inside facing up in this image)
- Chrome washers (o.d. 15 mm, i.d. 4.2 mm, thickness 0.5 mm)
- Knobs (for 4 mm axle, held by M2.5x4 mm grub screws with 1.3 mm hex heads)

The blue arrows indicate how the excenter pins and wave washers are assembled for the mirror alignment mechanisms.

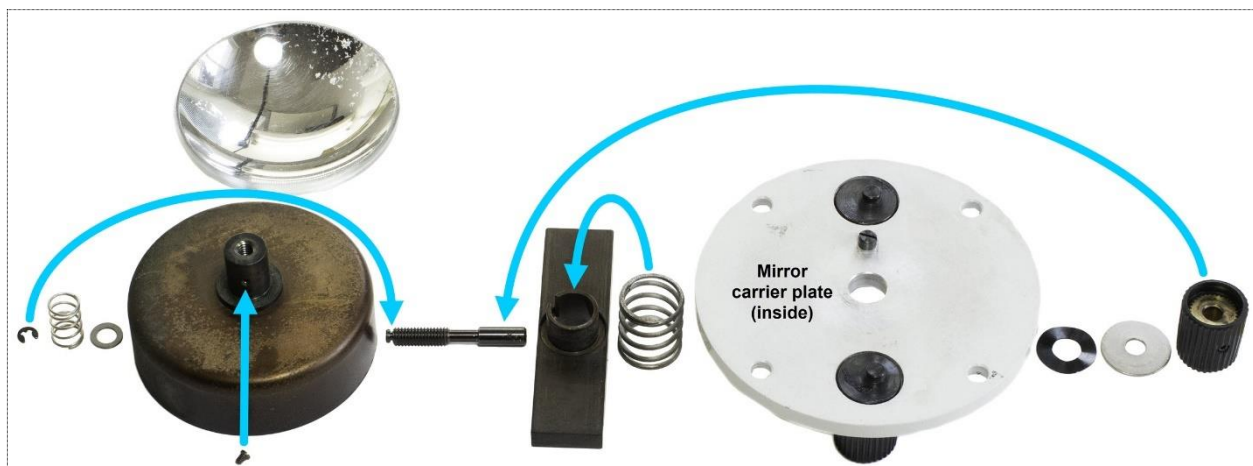


Figure 15: The mirror carrier plate with the disassembled mirror focus mechanism. The parts are (from left to right):

- E-clip, attached to the tip of the mirror focus axle
- Spring (small), 7 mm diameter, pushes the mirror against the retaining ring (not shown in this image) in the case
- Washer (o.d. 7 mm, i.d. 4.1 mm, thickness 0.4 mm)
- Mirror case (with the mirror above the case, and the M1.6x2 lead screw below the case)
- The mirror focus axle
- The alignment slide
- Spring (large), 14 mm diameter
- Mirror carrier plate (inside facing up in this image)
- Wave washer (o.d. 13 mm, i.d. 6 mm, thickness 0.1 mm)
- Chrome washer (o.d. 15 mm, i.d. 4.2 mm, thickness 0.5 mm)
- Knob (for 4 mm axle, held by a M2.5x4 mm grub screw with a 1.3 mm hex head)

The blue arrows indicate how some of the parts are assembled for the mirror focus mechanisms.

With a gloved finger, or using a clean piece of cloth as protection, carefully push down (it will retract by less than 1 mm) on the mirror in the case to release it from the open-ended straight retaining ring that sits in a groove (Figure 16) just above the mirror. Holding the mirror depressed, use a sharp tool (e.g., a small screwdriver or a dental probe) to dislodge one of the ends of the retaining ring. With one end loose, the ring is easy to pull off from its groove. Carefully remove the mirror. Below the mirror remove the 7 mm spring that presses the mirror against the retaining ring and the washer below the spring.

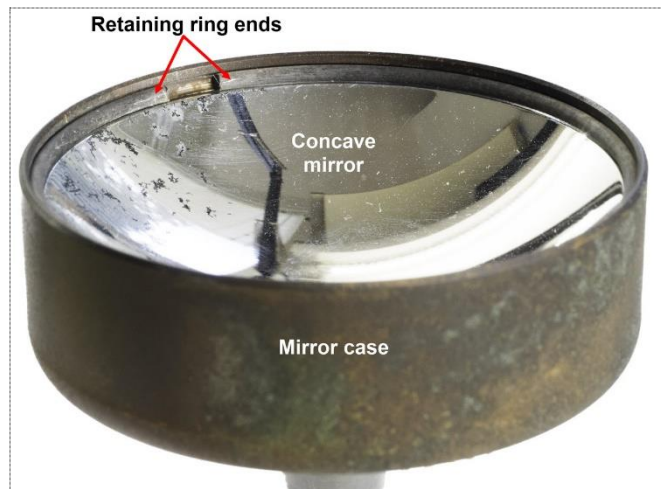


Figure 16: The alignable and focusable mirror after removal from lamphouse 100Z.

On the backside of the mirror case screw down the mirror focus axle as far as it goes; this will make the small E-clip on the axle's tip accessible for removal. Remove the E-clip with the help of a sharp tool, like a small screwdriver or a dental probe. Unscrew and remove the mirror focus axle from the backside of the mirror case.

The small M1.6x2 lead screw in the side of the mirror case stem (Figure 18) can be left attached. Its head runs in the groove of the alignment slide's shaft (Figure 21) which prevents the mirror case from turning when the mirror focus is changed.

Carefully clean the removed mirror with lukewarm water and dishwashing liquid.

Use white spirit to clean all mechanism parts from old grease.

We'll start the reassembly with the horizontal and the vertical mirror alignment mechanisms. Apply fresh grease to the sliding surfaces that are indicated with green arrows in Figure 17. Don't forget to also grease the rims of the mirror carrier plate's depressions that will rub against the sides of the excenter pins' discs.

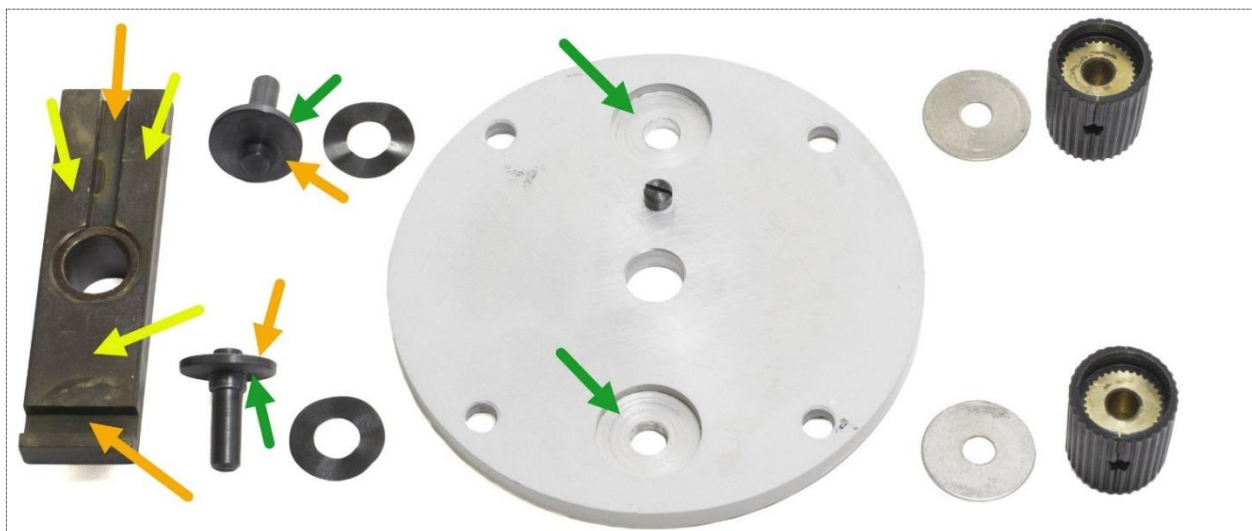


Figure 17: The mirror carrier plate with the disassembled mirror alignment mechanisms. The arrows show the various surfaces for application of fresh grease.

Put the wave washers into the greased carrier plate depressions (Figure 14) and then put the excenter pins over the washers. With one finger hold down on the excenter pins on the inside of the carrier plate and attach first the chrome washers and then the knobs over the axles. To avoid axial play, press the knobs against the excenter pins with your fingers and use a 1.3 mm hex (Allen) key to tighten the grub screws in the knobs. Check that the knobs turn freely.

Next, reassemble the mirror case. If you have removed the tiny M1.6x2 lead screw from the mirror case stem, then reattach it now (Figure 15 and Figure 18.) Tighten the screw, but don't overdo it – the fine threads are prone to bruising. Grease the thread of the mirror focus axle (Figure 15) and screw it all the way down into the mirror case stem; only the smooth axle part should stick out from the stem (Figure 18.) Wipe off any excess grease from the axle.

On the inside of the mirror case put down the 7 x 4.1 x 0.4 mm washer over the mirror focus axle's thread and all the way down in the mirror case stem. Attach the small E-clip to the tip of the mirror focus axle. (The clip prevents the axle from being entirely unscrewed from the mirror case.) Attach the small (7 mm diameter) spring over the mirror focus axle thread and down to the washer (Figure 19 and Figure 20.) Unscrew the axle from the mirror case as far as it goes (this is to retract the axle tip from the inside of the mirror case.)



Figure 18: The backside of the mirror case.



Figure 19: The inside of the mirror case.



Figure 20: The inside of the mirror case (closeup.)

Put the clean mirror back into the case with its concave (reflecting) side facing up. With a gloved finger, or using a clean piece of cloth as protection, carefully push down the mirror against the spring as far as it goes into the case. Attach the retaining ring over the mirror and into its groove on the inside of the mirror case – make sure that the ring snaps completely into the groove (Figure 16.)

Grease the sliding surface (yellow arrows in [Figure 17](#)) of the alignment slide. Grease the discs and the pins of the excenter pins, and also grease the grooves of the alignment slide (orange arrows in [Figure 17](#).) Attach the alignment slide over the inside of the mirror carrier plate making sure that both of the excenter pins and the lead screw go snugly into the alignment slide's grooves.

Lightly grease the inside of the shaft of the alignment slide and put the large (14 mm diameter) spring over the shaft ([Figure 21](#).)

Attach the mirror case into the greased shaft of the alignment slide and against the large spring ([Figure 13](#)) - make sure that the case's lead screw goes into the slot in the side of the shaft. Unless the mirror case is manually held down, the spring will push out the case from the shaft.

Put the combined mirror case and carrier plate on the table with the mirror facing down. Grease the last wave washer's both sides and attach it over the hole for the mirror focus axle on the outside of the carrier plate. Loosely attach the last chrome washer over the wave washer. Push down the mirror carrier plate with your hand against the spring as far as it goes against the mirror case (still making sure that the case's lead screw is in the slot in the side of the shaft). At the base of the mirror focus axle (that we left fully unscrewed) you will see the shoulder ([Figure 23](#)) where the axle changes its diameter from 4.0 to 2.7 mm ([Figure 22](#).) Still pushing down on the carrier plate, screw down the axle until the shoulder moves down to approximately 1 mm below the upper surface of the chrome washer ([Figure 24](#).) This adjustment is necessary to prevent that the axle's shoulder gets stuck on the washer when the mirror focus anytime later will need to be adjusted. Attach the knob over the axle and while pressing it down against the mirror case on the table tighten its grub screw with a 1.3 mm hex (Allen) key. Now you can release and let go of the carrier plate.

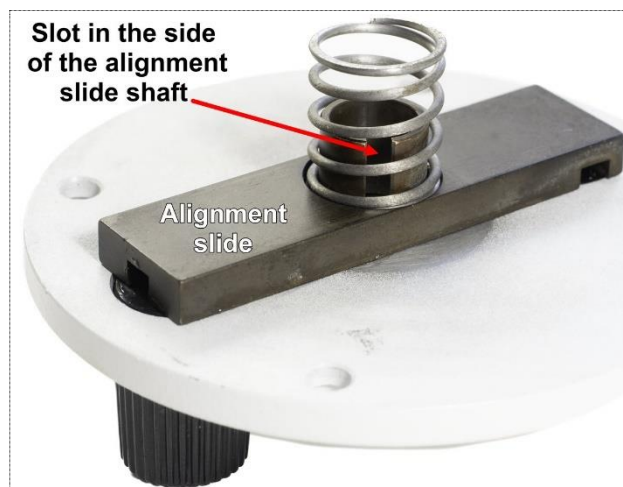
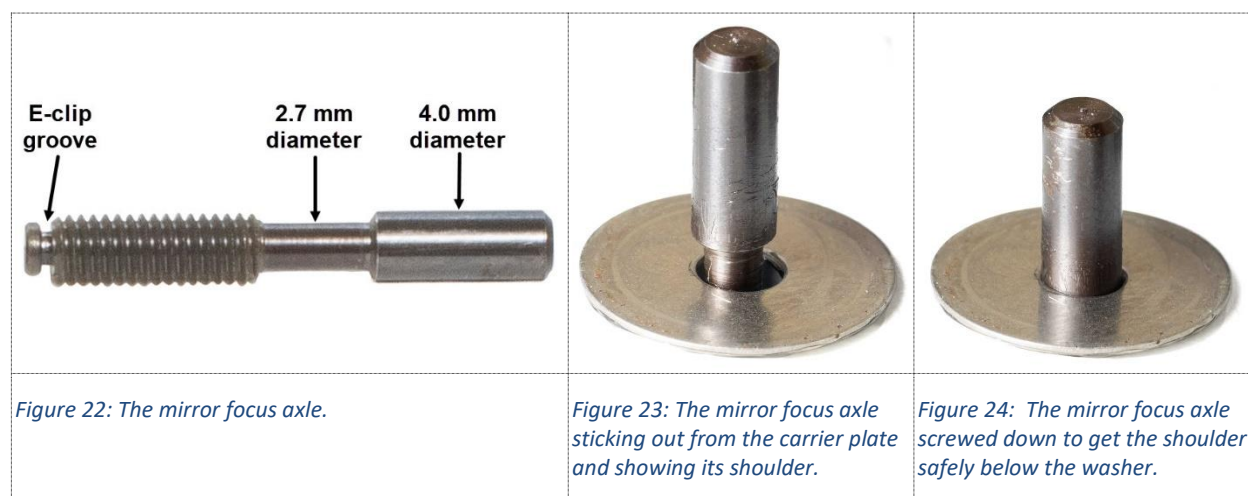


Figure 21: The backside of the mirror case (partly assembled.)



Check that the mirror focus control and both the vertical and horizontal alignment controls work smoothly and as expected.

4. The collector.

The collector case (Figure 9, and on the left side of the lamphouse in Figure 10) sits inside the lamphouse clamped in the collector holder by a spring (Figure 25, and brass colored in Figure 10.) The collector case can be removed after pivoting the spring off from the case. The outside of the case has an open-ended external retaining ring (Figure 9) in a groove. The retaining ring fits into another groove in the lamphouse's collector holder (Figure 25) which ensures that the collector is held properly aligned in the optical path. The collector holder actually has two similar grooves – this makes it possible to attach the collector case for both the left-handed and the right-handed lamphouse configurations (as mentioned in section [Introduction](#) above.)

The collector case is rather soft and flexible. When you hold it in your hand, even a moderate squeeze over the sides may slightly deform the circumference and make the tightly fitting spacers and the large lens to get stuck in the case.

Inspect the collector case's external lens surfaces and, if required, clean them using your preferred lens cleaning protocol. Note that clean lens surfaces are less critical for the collector type that has a frosted lens.

Normally, the internal lens surfaces should not need any cleaning, but, if required, they can be accessed for cleaning after disassembling the collector case.

To disassemble the collector case into its components (Figure 26), put it on a clean cloth on the table with its open side (with the large lens) facing up. With a gloved finger, or using a clean piece of cloth as protection, carefully push down on the large lens (it will retract by less than 1 mm) to release it from the spacer and the open-ended straight retaining ring that sits in a groove (Figure 26) in the case just above the lens. Holding the mirror depressed, use a sharp tool (e.g., a small screwdriver or a dental probe) to dislodge one of the ends of the retaining ring. With one end loose, the ring is easy to pull off from the groove. Carefully (to avoid scratching the large lens below) remove the 5 mm metal spacer. The large lens is now loose in the case and can be removed. Remove the wavy open-ended internal retaining ring that rests on the tapered metal spacer below and then carefully remove the tapered metal spacer. Now the small lens is loose and can also be removed from the case.

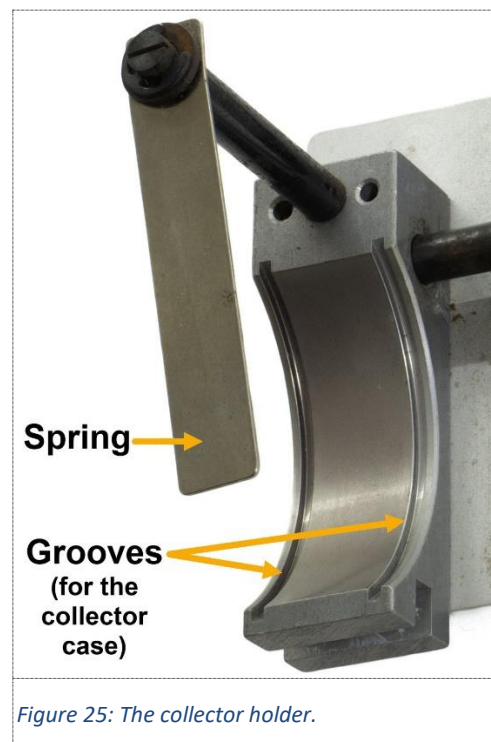


Figure 25: The collector holder.

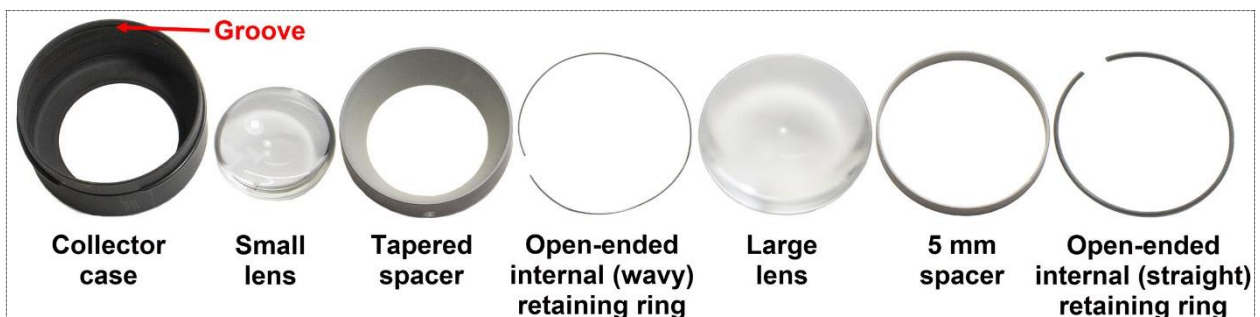


Figure 26: The disassembled collector case.

The *large* lens' external surface is convex, while its internal surface is almost flat. The *small* lens' external surface is concave, while its internal surface is convex. If the collector is of the frosted kind, then the frosting will be on the large lens' flat internal surface.

Clean the lenses as required.

Reassembly of the collector case is straightforward, just reverse the steps above. Make sure that the convex (bulging outward) surface of the *small* lens faces toward the inside of the case and that the flat surface of the *large* lens also faces toward the inside of the case. After attaching the last (straight) retaining ring make sure that it has gone down completely into its groove on the inside of the case.

Reattach the collector case in the lamphouse's collector holder. Turn the case so its open end (with the large lens) faces toward the lamphouse's light port and fit the case's external retaining ring into the outer of the holder's two grooves (i.e., the groove that is closest to the lamphouse's light port, [Figure 25](#).) Swing back the spring over the collector case to hold it fixed in the collector holder.

5. The halogen bulb holder.

The halogen bulb holder must be removed from the lamphouse anytime the bulb is exchanged, if corroded wiring or damaged insulation requires repair, or if the bulb and collector adjustment mechanisms need to be accessed for maintenance.

The halogen bulb holder is attached to the lamphouse's baseplate and held in a fixed position by a black M3x8 grub screw with a pointed tip ([Figure 27](#).) Loosen the grub screw and pull out the bulb holder ([Figure 28](#)) from the underside of the lamphouse.



Figure 27: The inside of lamphouse 100 with the halogen bulb holder in the baseplate.



Figure 28: The halogen bulb holder. The yellow arrow indicates the indentation for the grub screw.

Before doing anything else, remove the bulb from the holder. Remember never to touch the halogen bulb with your fingers, keep the bulb clean, and only handle it wrapped in tissue or a piece of clean cloth. Also be gentle with the bulb when pulling it out from the holder or putting it back again; avoid as much as possible to bend the pins as this may crack the brittle quartz envelope.

To access the wiring in the halogen bulb holder unscrew the four M3x15 screws with countersunk heads (indicated with green circles in Figure 29) and remove the case (Figure 30) from the bulb holder bottom (Figure 31.)

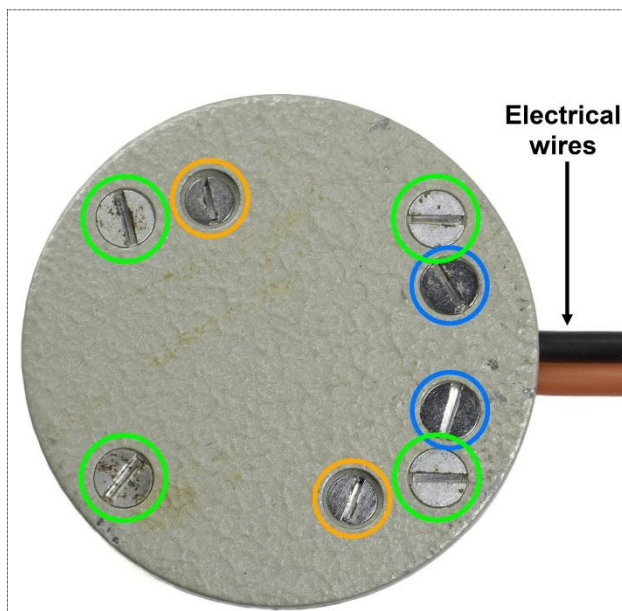


Figure 29: The bottom (underside) of the halogen bulb holder.

Green circles: Screws attaching the case to the bottom.

Orange circles: Screws attaching the socket to the bottom.

Blue circles: Screws attaching the cable clamp to the bottom.

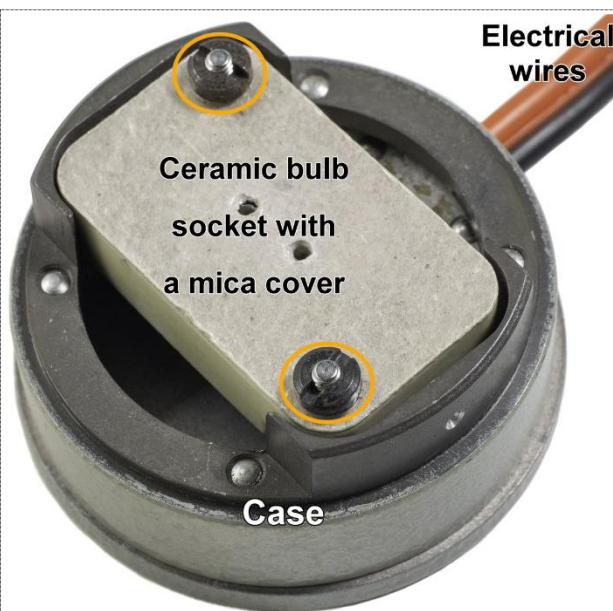


Figure 30: The halogen bulb holder.

Orange circles: Nuts for the screws that attach the socket to the bottom.



Figure 31: The halogen bulb holder after the case has been removed.

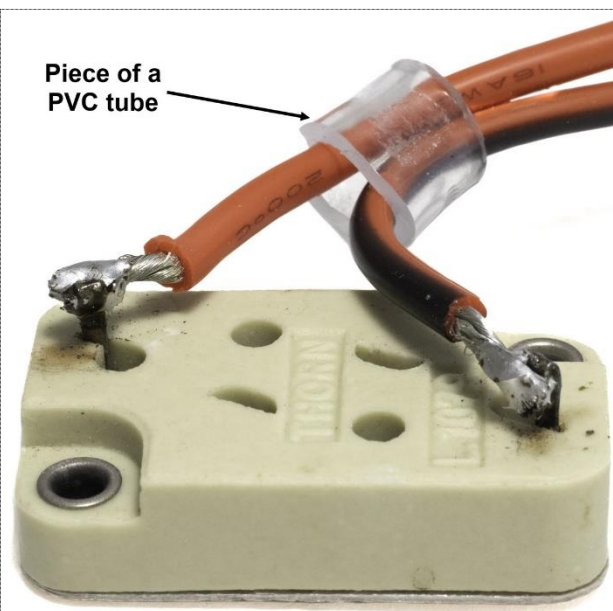


Figure 32: The socket viewed from the underside. (Yes, my soldering is pathetic.)

Remove the two M2.5x24 screws with countersunk heads and the corresponding special nuts (indicated with orange circles in [Figure 29](#) and [Figure 30](#), respectively.) Just hold the nuts with any pliers, there is no need for a special spanner. Removing the screws will also release two 13 mm metal spacers that separate the bottom and the socket.

Remove the plain cable clamp ([Figure 31](#)) that is attached by two M3x10 screws with countersunk heads (indicated with blue circles in [Figure 29](#).)

If the old electrical wires are damaged use a soldering iron to remove and replace them. Be aware that the new wires and any connectors must be dimensioned to be able to carry the high current (up to 10 A) required for the halogen bulb. Push a piece of PVC (vinyl) tubing ([Figure 32](#)) over the wires within the cable clamp (as in [Figure 31](#)) to protect the wire insulation from the clamp's sharp edges.

Reattach the socket to the bulb holder bottom with the two M2.5x24 screws and the special nuts, also remember to attach the spacers over the screws. Don't overtighten the screws; the ceramic socket may be hard, but it is also brittle and will be exposed from a lot of heat stress from the halogen bulb. I suggest tightening the screws as much as possible while only holding the nuts with your fingers.

Arrange the wires with the PVC tube under the cable clamp and tighten its M3x10 screws moderately. The wires should be held safely, but without damaging the insulation.

Reattach the case to the bulb holder bottom. Don't yet attach the bulb holder into the lamphouse.

Attach the halogen bulb and power it up to check that it lights up.

6. The light port with the filter slots.

This section describes only the lamphouse's left-handed configuration, i.e., when the collector focus and bulb alignment controls are situated on the lamphouses left side (as in [Figure 10](#) and [Figure 33](#)) when the lamphouse is attached on the microscope. If your lamphouse is configured for right-handed users, like in [Figure 34](#), then you will need to mirror-revert the described work moments.

Remove any filters that may have been left in the light port's filter slots ([Figure 4](#).)

Start the disassembly of the entire light port by removing the three screws from the front of the light port's front. The screws indicated with green circles in [Figure 33](#) (and [Figure 34](#)) are M4x30 screws while the screw indicated with a yellow circle is a taller M4x45 screw. The fourth screw hole is empty as can be seen in [Figure 33](#) and [Figure 34](#). (If it wasn't empty, we would not be able to put any filter in the filter holders...)

With the three screws removed the light port falls apart into 10 parts ([Figure 35](#).)

There is no need to remove the "filter safety screw" ([Figure 1](#) and [Figure 33](#), but hidden behind the bayonet lock in [Figure 34](#)) from the lamphouse.

Clean the light port parts with a brush using warm water and dishwashing liquid. Let the parts dry completely.

Make any necessary repairs.



Figure 33: The left-handed configuration of the light port of lamphouse 100.



Figure 34: The right-handed configuration of the light port of lamphouse 100.

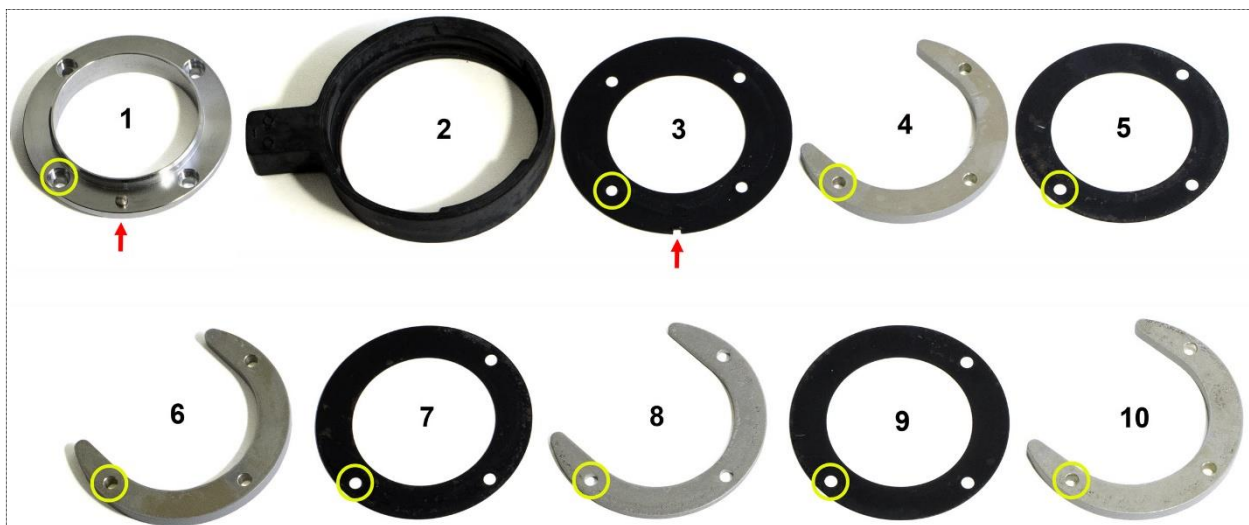


Figure 35: The components of the light port. The yellow circles indicate the screw holes that should be in port's lower left corner, the red arrows indicate features to note during reassembly.

After cleaning and perhaps repair, reassemble the 10 parts in the number order shown in [Figure 35](#); part no. 1 is the part that is furthest out from the lamphouse, and part no. 10 is the part that is closest to the lamphouse.

Start by putting part no. 1 (i.e., the attachment ring; note that the pin indicated with a red arrow should be at the bottom as shown in [Figure 35](#)) into part no. 2 (i.e., the bayonet lock; note that its handle should point straight to the left as in [Figure 35](#).)

Put the light port's three screws (two shorter M4x30, and one tall M4x45) loosely into the screw holes of part no. 1 to help keeping the parts together during the assembly – you will also need to hold the parts together with your hand when you manipulate them. The yellow circles in [Figure 35](#) and in [Figure 33](#) or [Figure 34](#) indicate the screw holes for the tall M4x45 screw. Similarly, the green circles indicate where the two shorter M4x30 screws belong.

Behind part no. 2 attach part no. 3 making sure that the small tab (indicated with a red arrow in [Figure 35](#)) goes into the groove on the backside of part no. 2. The tab is just a small piece of the black sheet metal that has been cut and bent to fit onto the groove. Its purpose is to limit the turning range of the bayonet lock (part no. 2.)

Proceed by assembling the remaining parts, let's call them "spacers" and "horseshoes". "Spacers" no. 5, 7 and 9 are identical. The "horseshoes" make up the slots for the lamphouse's filters; three of the slots (no. 4, 6 and 8) are 5 mm thick while the last one (no. 10) is only 2½ mm thick. The last one will be attached directly on the lamphouse.

Keep holding the parts together with one hand and attach the entire bunch to the lamphouse. Begin by screwing the tall screw (i.e., the M4x45 screw in the "yellow" screw holes) into the lamphouse and then take turns with the two other screws. Due to the length of the tall screw, its tip will reach deeper into the lamphouse. This is on purpose; the protruding screw is used to constrain the collector to prevent it from veering off from the optical path when the collector focus is changed.

Finish by tightening all three screws.

Check that the bayonet lock works as expected.

7. Remove the collector holder from the lamphouse.

If not already done, remove the collector case from the collector holder (refer to subsection 4.)

Unscrew the two black M3x16 screws (with green circles in [Figure 37](#)) and remove the collector holder ([Figure 36](#)) from the lamphouse. The screws are secured with brown lacquer or resin of some kind, and fortunately, they are still not too difficult to remove. Be sure to retrieve the metal washers (7.1 x 3.1 x 0.5 mm) below the screw heads.

With the collector holder out of the way, we now have access to the collector focus and lamp alignment controls ([Figure 38](#).)

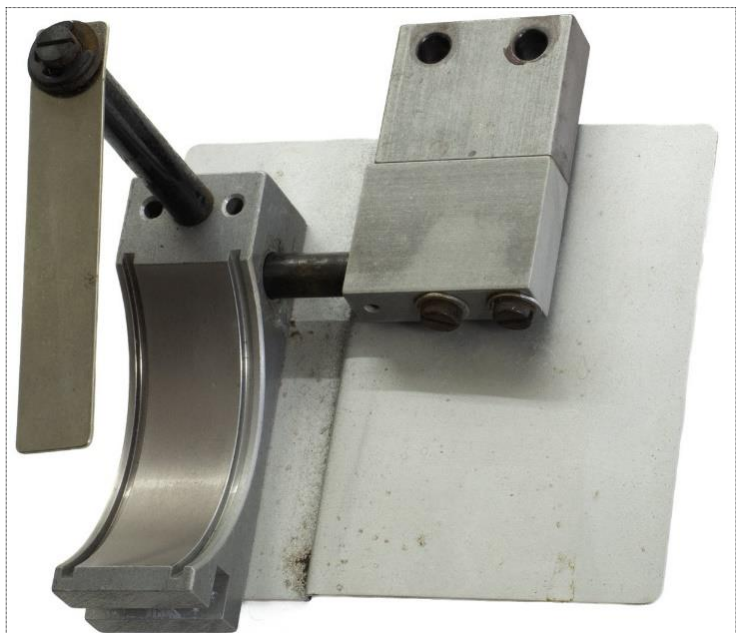


Figure 36: The removed collector holder.

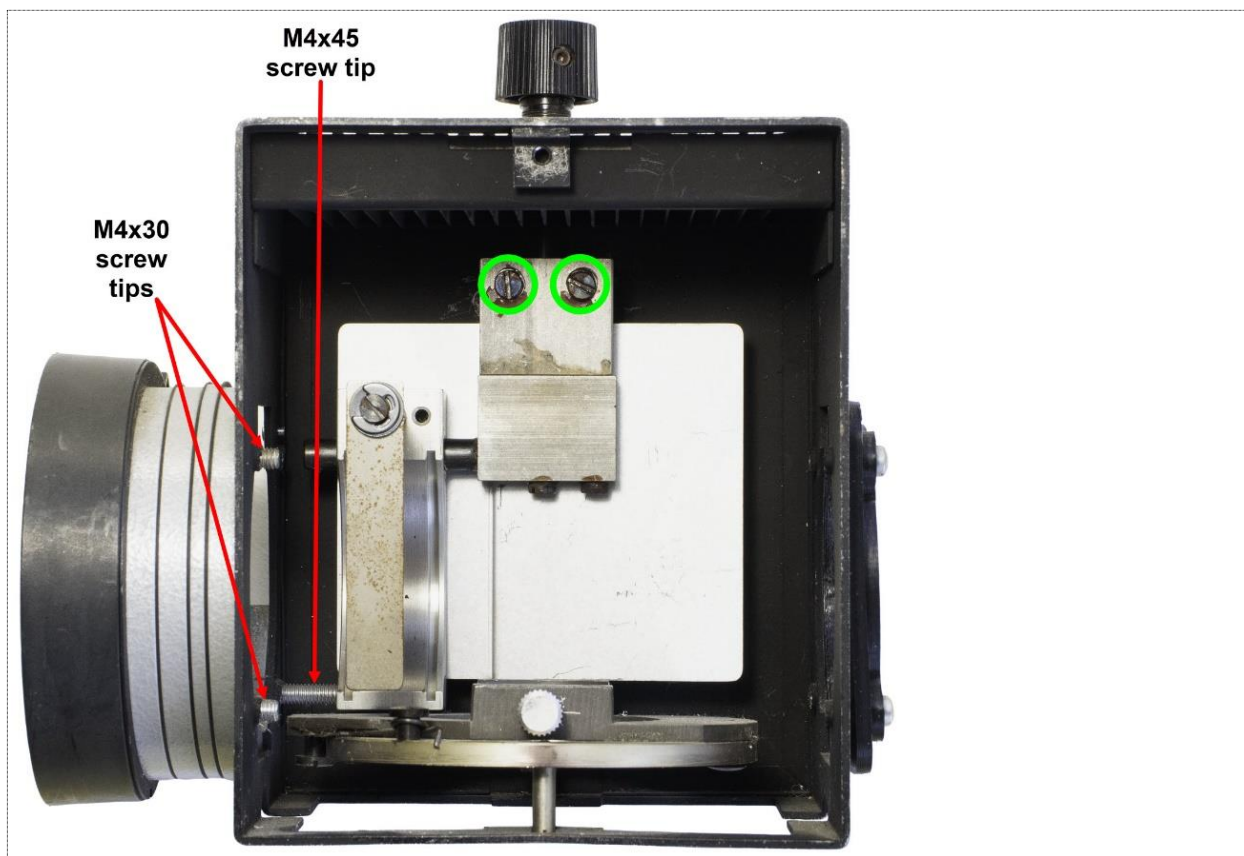


Figure 37: View of the collector holder in the lamphouse.

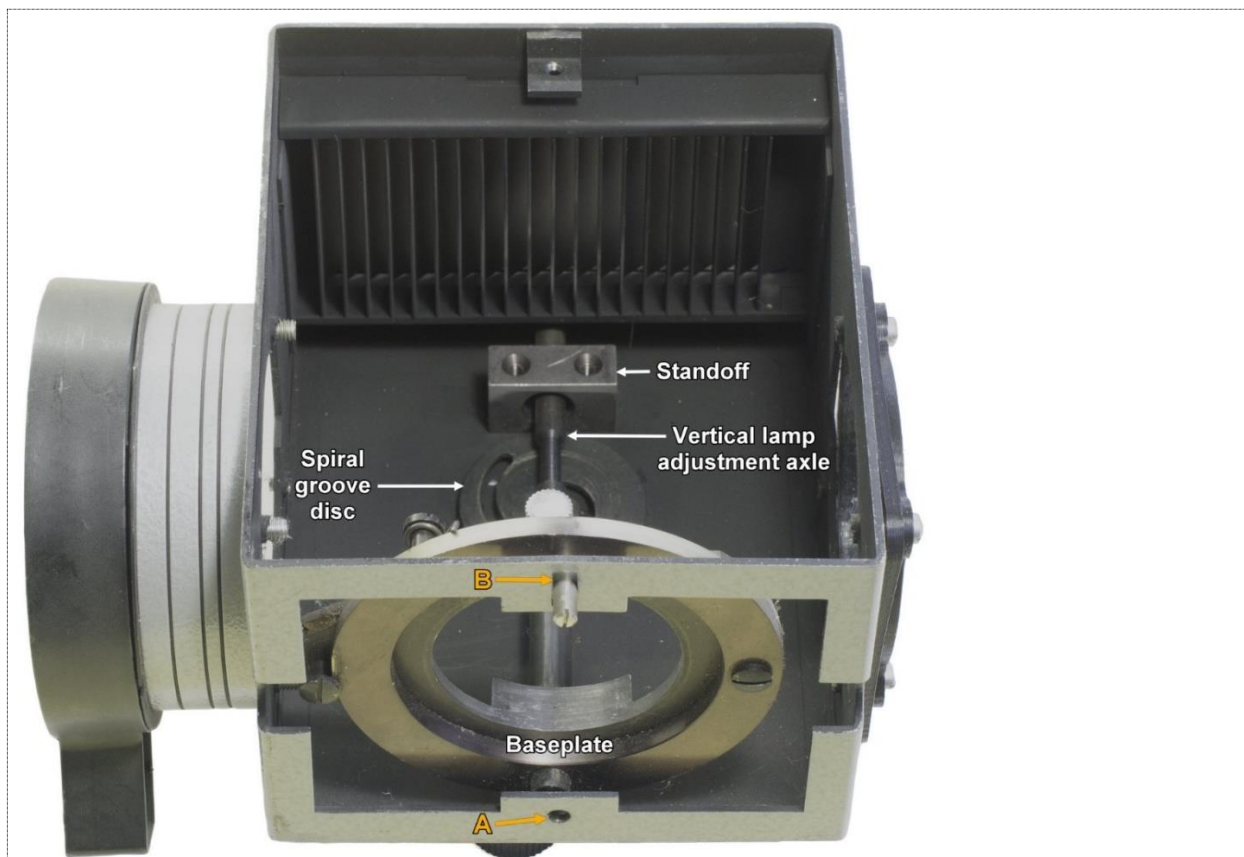
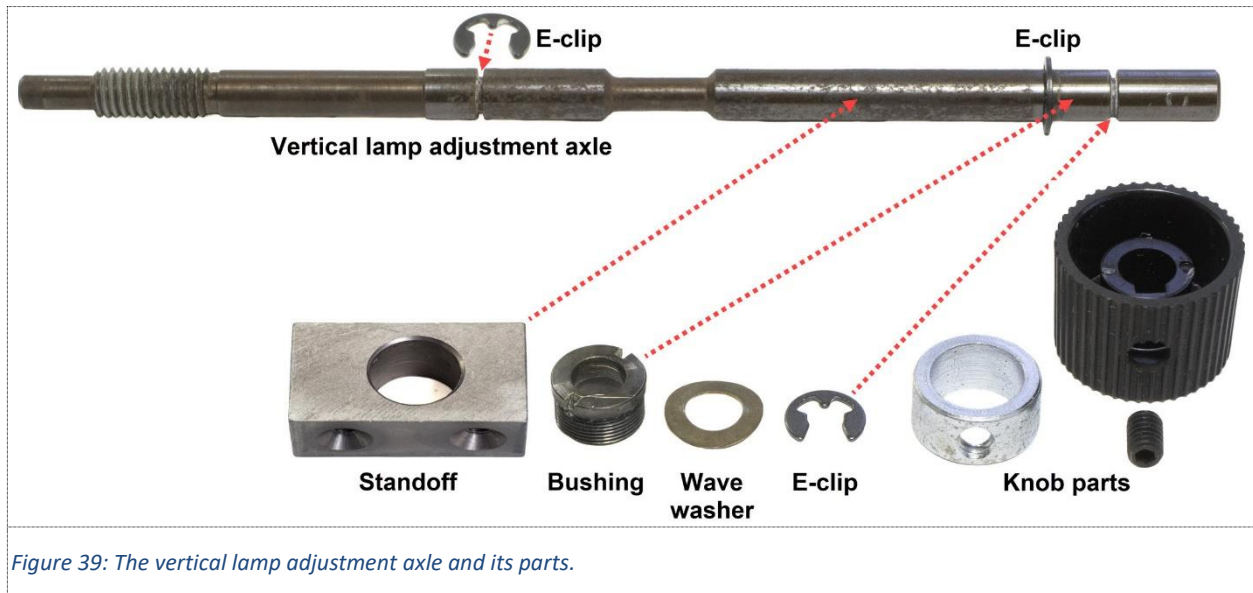


Figure 38: View of the inside of the lamphouse after the collector holder has been removed.

8. Disassemble and clean the vertical lamp adjustment mechanism

Vertical lamp adjustment is done with the knob on the top of lamphouse 100 (Figure 1.) Turning the knob moves the baseplate (Figure 38) with the bulb holder up or down; the vertical range is 5 mm. Refer to Figure 39 for the parts that pertain to the vertical lamp adjustment axle.



Begin the disassembly by removing the knob. Use a 2 mm hex key to loosen the black M4x6 grub screw in the side of the knob and remove the knob. Use a small screwdriver to pry off the 4 mm E-clip from the axle and then also remove the wave washer below. Use a suitable spanner (for example, a camera lens spanner; but be careful, the common camera lens spanners are prone to slipping) to loosen and remove the bushing from the top of the lamphouse. If the bushing is stuck, treat its thread with penetrating oil or white spirit solvent for a few hours, or even days, as required. Unscrew the entire axle to release it from the thread in the baseplate pipe (Figure 43 and Figure 44) and pull it out through the top of the lamphouse. The two remaining E-clips can be left where they are on the axle. Also leave the standoff (Figure 38) attached in the lamphouse.

With the vertical lamp adjustment axle out of the way, the baseplate can also be removed from the lamphouse.

Use white spirit to clean off any old grease from the axle parts (including the bushing) and from the thread on the inside of the baseplate pipe.

9. Remove the collector focus axle

Use a 2 mm hex key to loosen the black M4x6 grub screw in the side of the collector focus control knob (Figure 1) and remove the knob. Use a small screwdriver to pry off the 4 mm E-clip from the axle and then remove the wave washer below. Remove the collector focus axle from the inside of the lamphouse; refer to Figure 41 for an exploded view.

10. Clean the lamphouse case

If the lamphouse case is dirty and needs cleaning it should first be stripped bare (Figure 40) from all removable parts, i.e., from the light port, the mirror, the bulb holder (with the baseplate), any focus or alignment mechanisms, etc.



Figure 40: The bare lamphouse case after cleaning. Most of the remaining specks are rust.

Start the cleaning by wiping off any old grease using cotton swabs, tissue or pieces of cloth wetted with white spirit.

Different cleaning methods can then be tried depending on the type and degree of the grime and on how much time and effort you are willing to spend. My lamphouse cases were quite dirty with dust, something that looked like soot deposits, and some rust. To clean it, I treated the lamphouse case by putting it into an ultrasound bath with lukewarm water and dishwashing detergent. Each side of the case received a 5 min ultrasound bath treatment and then a good brushing with an old toothbrush. After a thorough rinse with warm tap water, I put the case in an oven at 170°F (75°C) for 3-5 hours to dry it and to be sure to evaporate any water hidden in gaps and crevices.

11. Clean, regrease and reassemble the collector focus control axle

Figure 41 provides an exploded view of the removed collector focus control axle. The inner end of the axle has a wide steel disc with a spiral groove. A pin (or actually a screw head) on the backside of the collector holder (Figure 42) sticks down into the groove. As the control is turned, the groove forces the pin, and with it the entire collector holder, to move sideways. The tall screw in the lamphouse's light port slides in the collector holder's lead groove (Figure 42 and Figure 51, and as described at the end of section 6 above) which together with the slider (Figure 51) restrict the movements to ensure that the collector focusing moves strictly along the optical axis.



Use white spirit to clean off any old grease from the axle parts and from the surfaces on the lamphouse that rub against the axle and its washer.

Grease the inside of the collector focus control axle disk (indicated with green arrows in [Figure 41](#)) -this is the surface that rubs against the inside of the lamphouse.

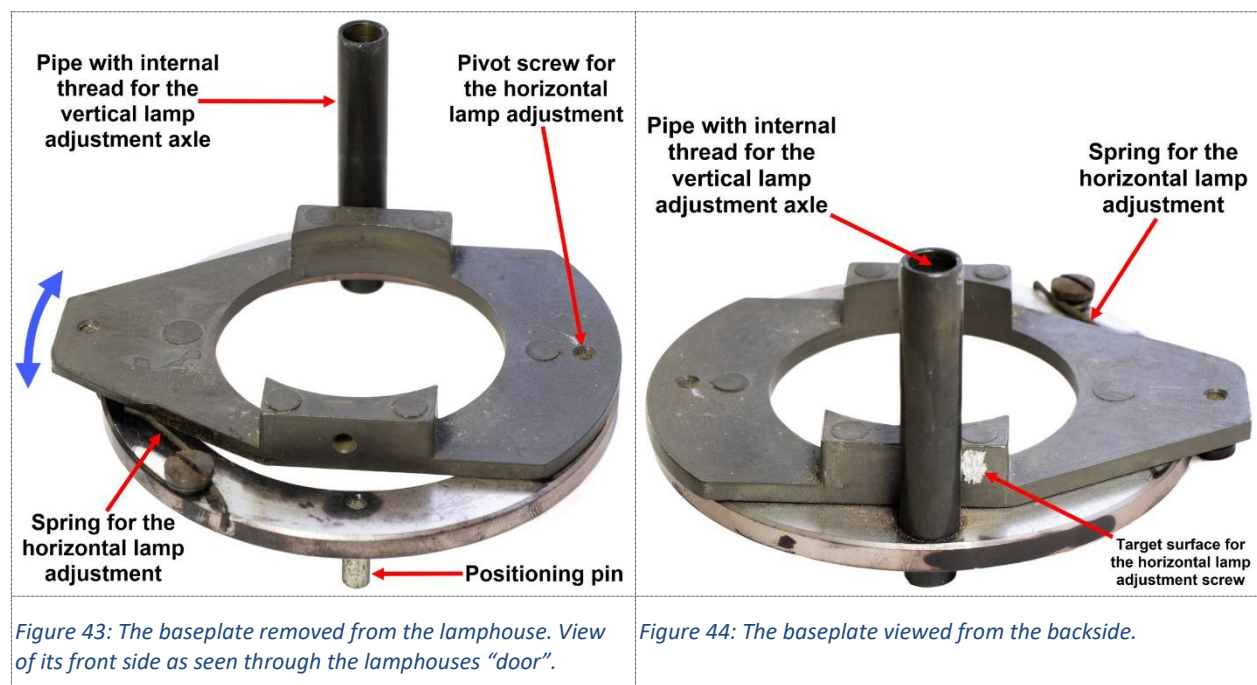
Attach the collector focus control axle from the inside of the lamphouse into its hole in the backside of the lamphouse. Grease both sides of the wave washer and put it over the focus control axle and down against the backside of the lamphouse. Lock the axle to the lamphouse by attaching the 4 mm E-clip into the narrow groove in the axle just above the washer.

Attach the knob to the axle and tighten the grub screw with a 2 mm hex key. (In case you have taken the knob apart for cleaning, then first put the knob bushing back into the inside of the knob, align the screw holes, and loosely attach the black M4x6 grub screw in the bushing thread.)

Check that the collector focus knob turns smoothly.

12. Check and regrease the bulb holder baseplate.

The bulb holder baseplate ([Figure 38](#), [Figure 43](#) and [Figure 44](#)) carries the bulb holder ([Figure 27](#)) and basically consists of two components, or “parts” ([Figure 45](#)); a “lower part” that is involved with the bulb holder’s vertical adjustment, and an “upper part” that is involved with the bulb holder’s horizontal (lateral, or sideways) adjustment. In one end of the baseplate the two parts are swiveling and attached by a pivot screw (indicated with the number “1” in [Figure 45](#) and with a green arrow in [Figure 46](#); see also [Figure 43](#) and [Figure 47](#)), in the other end is a screw with a wide head (indicated with the number “2” in [Figure 45](#) and with blue arrows in [Figure 46](#), [Figure 48](#) and [Figure 49](#)) that holds the parts joined together while still allowing the “upper part” to swivel horizontally (as indicated by the blue double-sided arrow in [Figure 43](#).) The horizontal lamp adjustment control ([Figure 1](#)), which really only is a simple screw, pushes on the side of the “upper part” (on the “target surface” in [Figure 44](#)) to move it horizontally. A spring ([Figure 43](#), [Figure 45](#) and [Figure 48](#), and also indicated with a red arrow in [Figure 46](#)) pushes back against the horizontal lamp adjustment screw from the opposite side of the baseplate.



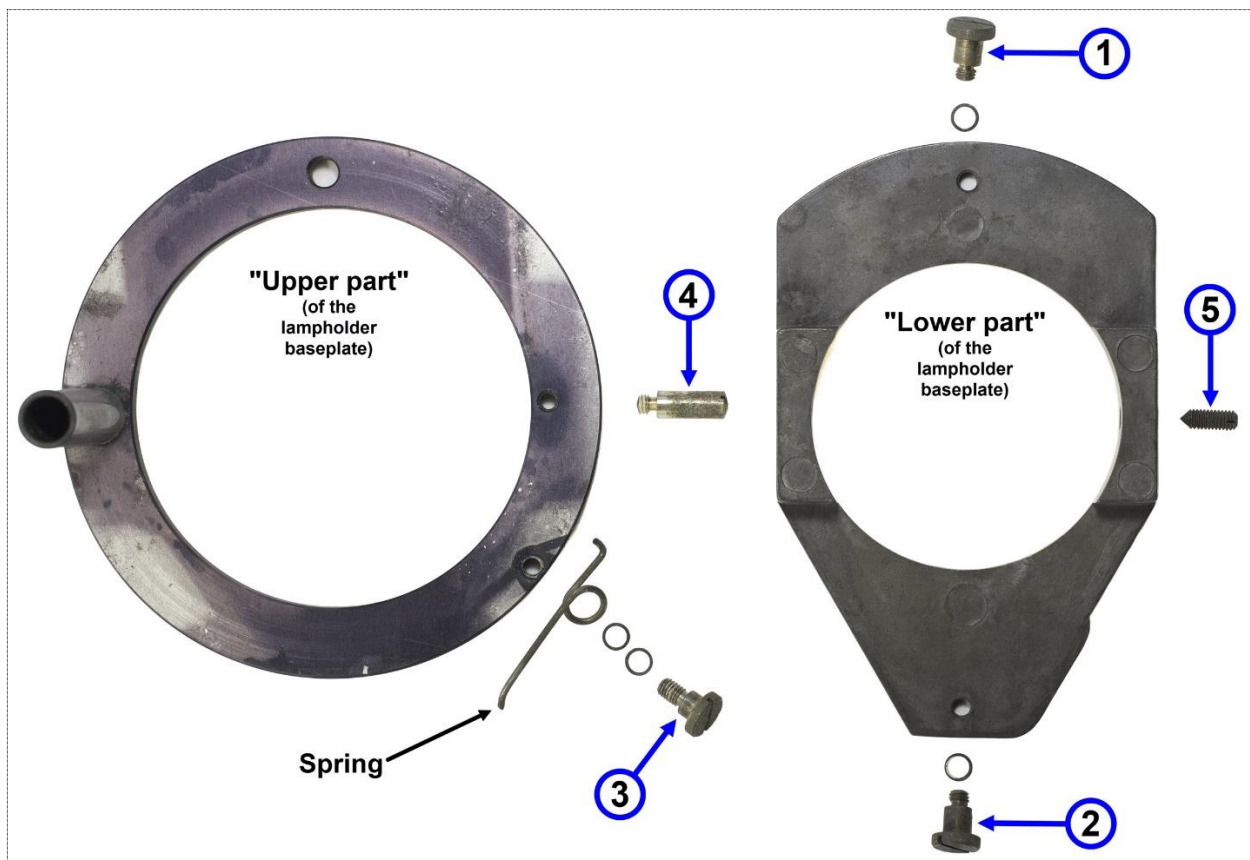


Figure 45: The lamp holder baseplate completely disassembled. Identification of the screws:

- 1: The pivot screw, M3, with a wide, greased shank, supplied with either a round nut or a very small washer (Figure 47)
- 2: M3 screw, with a wide shank, supplied with a very small washer
- 3: M3 screw, with a wide shank, supplied with two very small washers
- 4: Positioning pin, attached by a M3 thread. (Indicated by "B" in Figure 38.)
- 5: M3x8 grub screw with a pointed tip (also see Figure 27.)

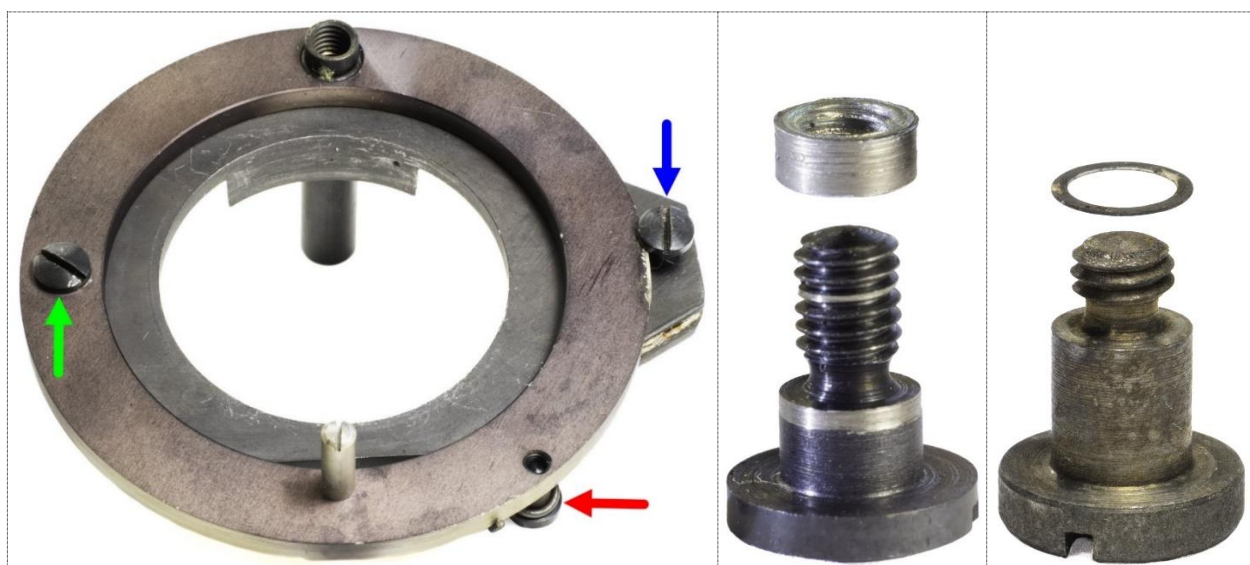
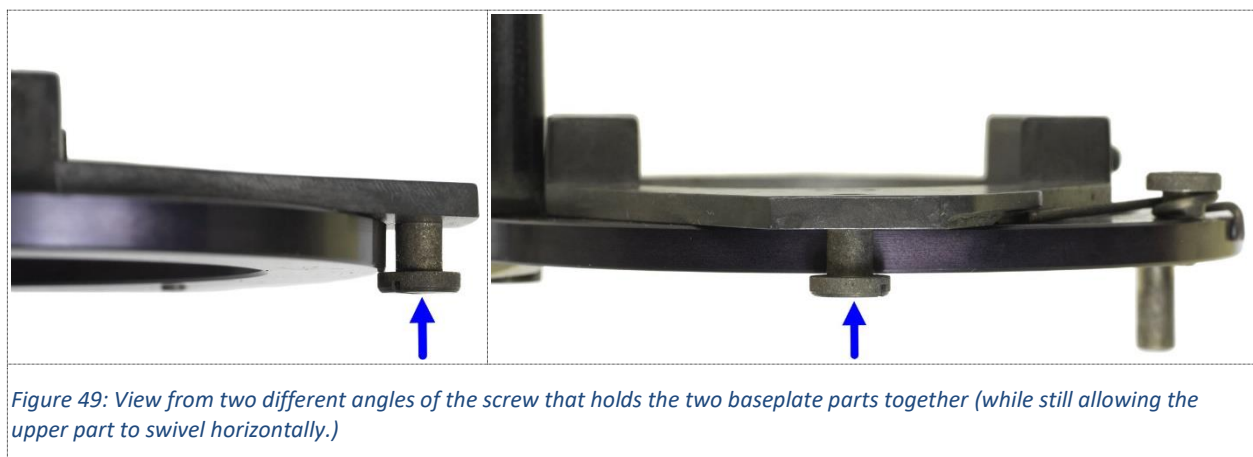
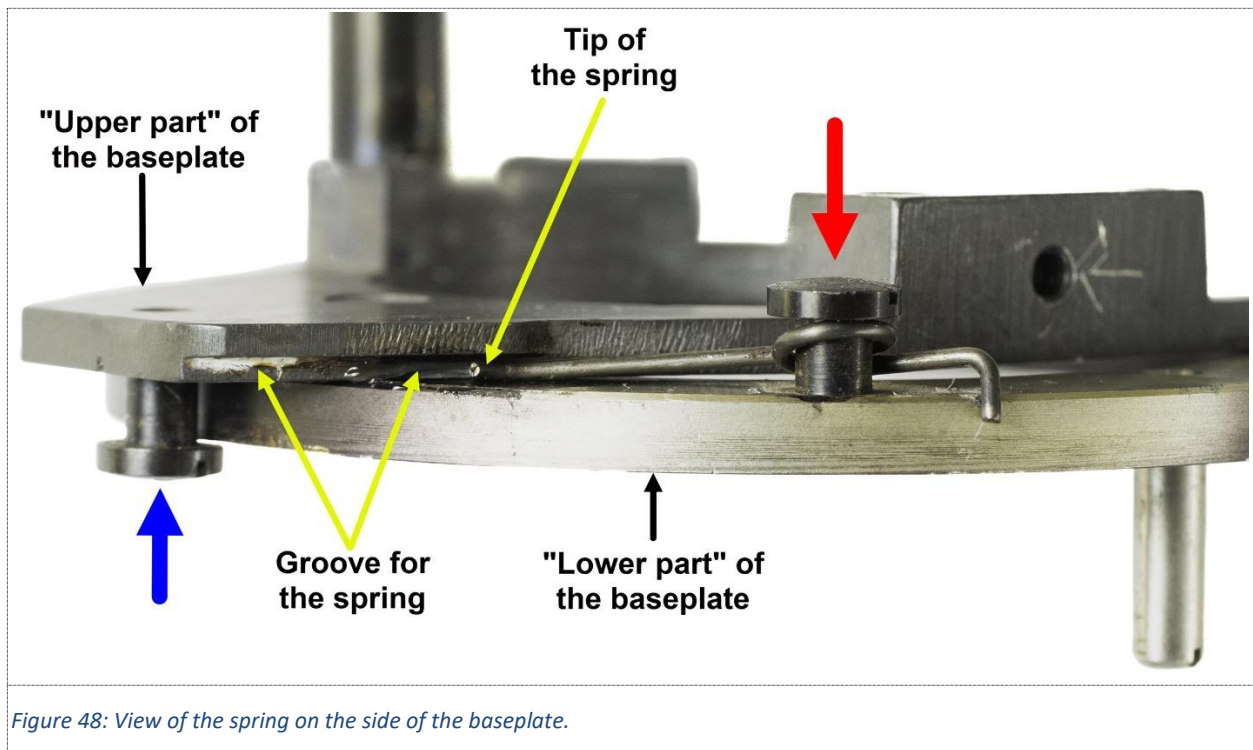


Figure 46: The baseplate viewed from the underside.

Figure 47: Two different pivot screw designs (closeup.)



If the horizontal movement of the baseplate (or more specifically, its “upper part”) feels sluggish you may need to remove and regrease the pivot screw (indicated with a green arrow in [Figure 46](#)) on the underside of the baseplate.

Unscrew the pivot screw (indicated with the number “1” in [Figure 45](#)) and be sure to also retrieve any nut or washer ([Figure 47](#)) that accompanies it. If there is a nut, it may either remain attached on the screw, or it may be left more or less hidden in the screw hole. If there instead is a washer, it will be very small (o.d. 4.0 mm, i.d. 3.0 mm, thickness 0.1 mm) and therefore easy to miss and get lost. The nut vs. the washer is important because it prevents the screw from being tightened so far that it would inhibit the horizontal bulb adjustment.

Pry off the tip of the spring ([Figure 48](#)) from the groove in the “upper part”, then the baseplate parts can be separated. There is no need to remove any of the other screws in the baseplate (indicated by the numbers “2” through “5” in [Figure 45](#).)

Use white spirit to clean the removed pivot screw, the nut (or washer), and the screw hole from old grease. Reattach the nut (or washer, if applicable) over the screw. Lightly grease the sliding surface on the inside of the “lower part’s” screw hole (but don’t grease the thread in the “upper part’s” screw hole.) Also apply some grease on the groove (Figure 48) along which the spring tip will slide. Recombine the two baseplate parts using the pivot screw including the nut or washer. Tighten the pivot screw well. Push back the tip of the spring into its groove (Figure 48.)

Check that the upper part swivels freely about the pivot screw and that the spring works.

13. Reassemble and reattach the vertical lamp adjustment mechanism

Make sure that the collector focus axle has been reattached as described in section 11.

Make sure that the two lowest E-clips still are attached on the vertical lamp adjustment axle (Figure 39.) Check that the E-clips are completely seated in the grooves. Don’t yet attach the upper E-Clip.

If you previously removed the standoff, reattach it to the backside of the lamphouse with its two M3x6 screws with countersunk heads.

Lightly grease the “target surface” (Figure 44) on the baseplate. This is the contact area where the tip of the horizontal lamp adjustment control pushes against the baseplate. The grease will reduce the wear from the tip scraping over the “target surface” as the baseplate moves up and down during vertical lamp adjustment.

Put the baseplate (Figure 38) into the lamphouse with its positioning pin in the hole in the bottom of the lamphouse (indicated by “B” in Figure 38.)

Grease the thread on the lower end of the vertical lamp adjustment axle (Figure 39.) Put the axle (with the thread down) through the hole in the top of the lamphouse, then further through the hole in the standoff, and screw it into the internal thread in the baseplate’s pipe (Figure 43.) Screw the axle down as far as it goes until it is stopped by the lowest E-clip. Let the lower tip of the axle (which sticks out under the baseplate) go into the rear hole in the bottom of the lamphouse (indicated by “A” in Figure 38.) The upper tip of the axle should stick out from the hole in the top of the lamphouse.

Grease the inside of the brass bushing (Figure 39) (avoid getting grease in the thread) and screw it down over the upper axle tip into the thread on the top of the lamphouse. Tighten the bushing with a suitable spanner just enough to make sure that it doesn’t release when the vertical lamp adjustment knob is turned.

Lightly grease both sides of the wave washer and put it over the axle tip on the bushing. Attach the last E-clip to the groove just above the washer. Make sure that the E-clip is completely seated in the groove.

Attach the vertical lamp adjustment knob to the axle leaving a small gap (perhaps ½ mm) between the lamphouse and the knob and tighten its grub screw with a 2 mm hex key. (In case you have taken apart the vertical lamp adjustment knob for cleaning, then first put the knob bushing back into the inside of the knob, align the screw holes, and loosely attach the black M4x6 grub screw in the bushing thread.)

Check that the vertical lamp adjustment knob turns smoothly and moves the baseplate as expected (the vertical range is 5 mm.)

14. Clean and regrease the horizontal lamp adjustment screw.

Leaving the knob attached, unscrew the horizontal lamp adjustment control (Figure 1) from the backside of the lamphouse. Use solvent (white spirit) to clean the thread from old grease. Also clean the corresponding inside thread in the lamphouse.

Apply a small blob of grease on the tip of the control axle/screw. The grease will soften the impact of the tip when it rubs against the target surface on the backside of the baseplate (Figure 44.)

Apply fresh grease to the thread. Screw the control all the way down in its threaded hole, screw it back by 5-10 mm and wipe off any excess grease below the knob.



Figure 50: The removed and disassembled horizontal lamp adjustment control.

Check that the horizontal lamp adjustment knob turns smoothly and moves the baseplate as expected (the horizontal range will be 4-5 mm.)

15. Reattach the collector holder.

The collector holder consists of two parts as shown in Figure 51. It seems that Leitz left the slider unlubricated, so we will also refrain from greasing it. But make at least sure that it is clean and that its surface is smooth.

Put the collector holder into the lamphouse. Let the tall screw (M4x45) that sticks out from the light port (Figure 37) go into the lead groove on the underside of the collector holder (Figure 42 and Figure 51.) Then let the small pin (actually it is a tall screw head) on the backside of the collector holder (Figure 42) find its way into the spiral groove (Figure 38) of the collector focus control. You will need to press down on the collector holder while turning the collector focus control knob back and forth until the spiral groove catches the pin. Keep holding the collector holder down so the pin doesn't slip out of the groove and attach the slider into the hole in the collector holder (Figure 51 and Figure 52.)

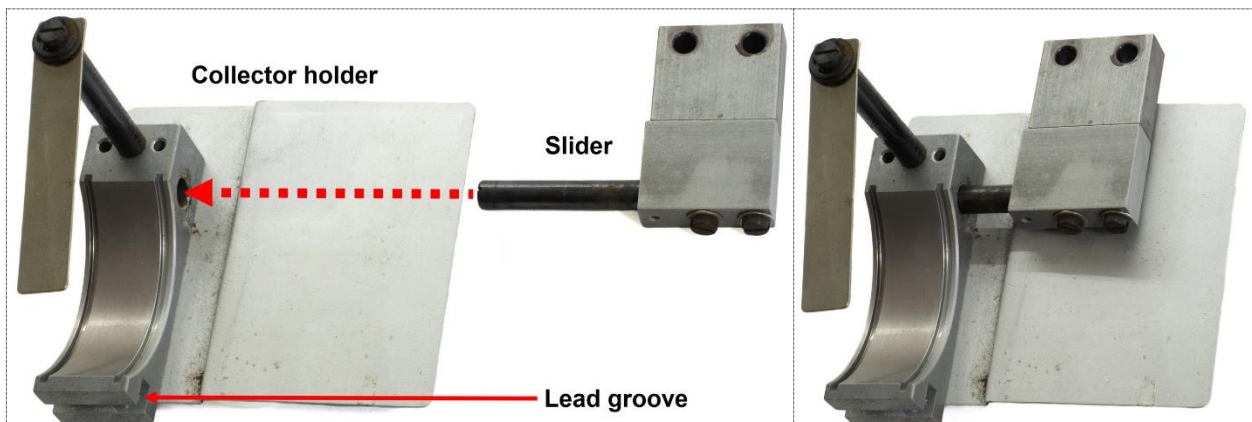


Figure 51: The two parts of the collector holder.

Figure 52: the collector holder.

Still pressing down on the collector holder, attach the slider to the standoff (Figure 38) with the two black M3x16 screws (Figure 37) including the 7.1 x 3.1 x 0.5 mm metal washers. Before tightening the screws try the best you can to align the collector holder+slider to ensure that once the collector is attached, it will be straight vertically positioned in the optical path. Once the screws have been tightened, there is no need anymore to keep the holder pressed down with your fingers.

Turn the collector focus control back and forth to check that the collector holder moves sideways as expected. The collector focus range is 10 mm.

16. Reattach the collector in the lamphouse.

Turn the collector holder's spring (Figure 25) out of the way sideways and place the collector case into the collector holder. Turn the case with the small lens facing the bulb and attach the collector with its retaining ring fitting into the collector holder groove that is closest to the lamp port. Turn back the collector holder's spring over the collector to hold the collector steady in the optical path (Figure 10.)

17. Reattach the halogen bulb holder in the lamphouse.

Attach the halogen bulb in the bulb holder. As mentioned before, never touch the halogen bulb with your fingers, keep the bulb clean, and only handle it wrapped in tissue or a piece of clean cloth. Be gentle with the bulb, bending the pins may crack the brittle quartz envelope.

Before putting back the entire holder into the lamphouse check that the bulb lights up.

From the underside of the lamphouse attach the halogen bulb holder to the baseplate. Turn the holder so the electrical wires go to the left or to the right (according to your needs) while making sure that the indentation for the grub screw (Figure 28) is aligned with the corresponding screw hole in the baseplate (Figure 27.) Attach the M3x8 grub screw and tighten it lightly.

Reattach the door (Figure 3) to the lamphouse.

18. Reattach the mirror to the rear of the lamphouse.

Simple mirror (Figure 2):

Check that the grub screw in the side of the mirror mount on the backside of the lamphouse (blue arrow in Figure 3) is partially unscrewed - its tip must not stick out into the slid and obstruct it. Attach the mirror to the mount on the backside of the lamphouse. Lightly tighten the grub screw.

Advanced mirror (Figure 6):

Turn the mirror carrier plate with the vertical mirror adjustment control on the top (as in Figure 6) and attach the plate to the backside of the lamphouse with the four M4x4 chrome screws.

Appendix 1: Removing rust from steel items

Not only are rusty items ugly to look at, but they also tend to shed rusty dust that may cause problems if it finds its way into sensitive mechanical and optical components. Rust and intact steel transition into each other without any clear boundary which makes it difficult to remove all rust without also causing some loss of healthy steel. Rust is often removed chemically by treatment with carefully selected acids like acetic acid (vinegar), citric acid or phosphoric acid – the trade-off is that the acids also inevitably eat

away some of the intact steel (fortunately at a slower rate.) Here follows a rather simple rust removal procedure that removes most of the rust without also too severely etching the steel. It will not get you a museum grade restoration, but at least it is reasonably simple.

Equipment: Ultrasonic bath, citric acid, baking soda (sodium bicarbonate), 99% isopropyl alcohol.

Procedure: Put the corroded steel items into a plastic or glass container that fits into your ultrasonic bath. Prepare a rather strong aqueous solution of citric acid (make it approx. 10-20%, but the exact concentration is not critical) and pour it into the container with the items so it covers the items. Put the container with the items in the ultrasonic bath and run it for 5-10 minutes. Rinse the treated items with tap water. Put the items into another plastic or glass container, cover them with an approx. 5-10% aqueous solution of baking soda and run the ultrasonic bath for a few minutes. Thoroughly rinse the items with warm tap water. Wipe the items dry with tissue. Soak the items in isopropyl alcohol, wipe them dry again and let them dry completely at room temperature. Rubbing in mineral oil into the item surfaces provides some protection against corrosion, but it is definitely not suitable for all applications.

If required, the time of the ultrasonic treatment in the citric acid can be increased. But don't overdo it – excessive treatment will also dissolve some intact metal.

The sodium bicarbonate treatment is done to neutralize any traces of the acids that otherwise later could promote accelerated corrosion. The alcohol rinse is to ensure that no water remains trapped within the items.

You will find a lot of alternative rust removal procedures if you search the topic on YouTube.

Appendix 2: Electrical plug connections

Lamphouse 100 or 100Z with a halogen bulb requires a variable 12 V power supply capable of providing 100 W. The lamphouse includes a robust 2-prong cord with a particular plug that is a rarity today. The plug fits into the receptacles of a range of rather heavy and bulky power supplies that were provided by Leitz.

Figure 53 illustrates the pin numbering of the plug. One wire is connected to pin no. 3 (i.e., the pin without any number in the middle of the plug in Figure 53); the other wire is connected to pins no. 4 and no. 5, jointly. Pins no. 1 and 2 are inactive. The polarity doesn't matter.

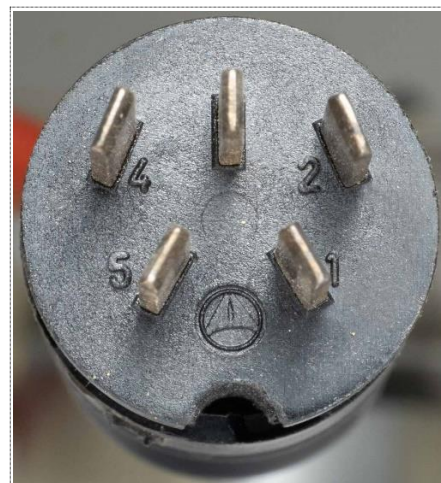


Figure 53: The plug on the lamphouse cord.

Links

User instruction for Leitz lamphouses 100 and 100Z:

<https://www.science-info.net/docs/leitz/Leitz100-100z.pdf>