EcoTech Aurora 3000: Measurement Cell and Optical Chamber Cleaning Procedure

Measurement Cell Cleaning

As the nephelometer cell gets dirty, the wall signal will slowly increase with each calibration. A 5% change in wall signal is considered a good indication of when to clean the cell. It is a good to record the wall signal when it is first put into the field (or after cell cleaning) and then monitor the wall signal with each calibration. When the wall signal increases 5% above the initial value, it may be time to give the cell a clean. If this is part of the six-monthly maintenance, the cell does not need to be removed. If it is part of the 12-month maintenance, then follow the procedure in section 6.3.9 where the optical chamber is removed.

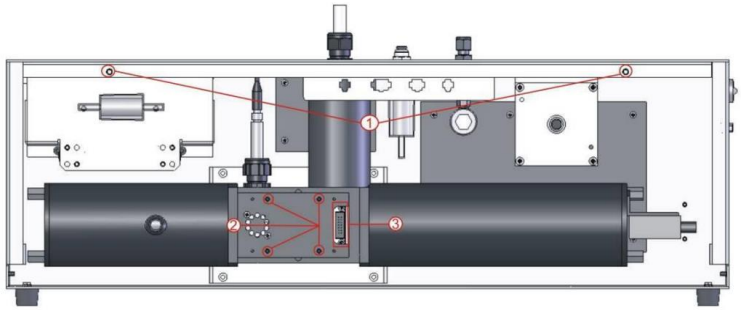
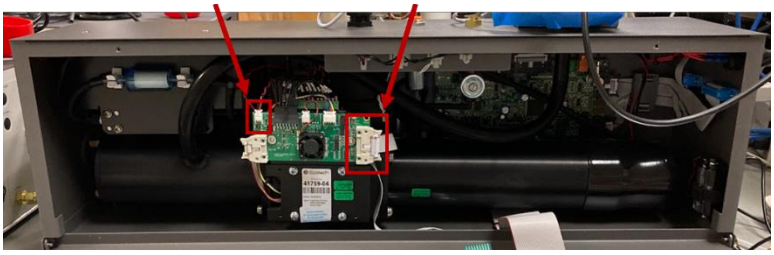


Figure 39 – Aurora internal components

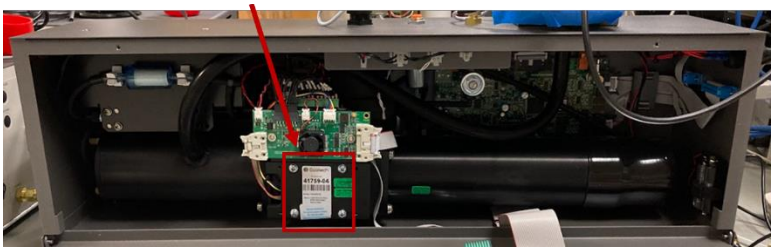
1. Turn off the nephelometer.

2. Undo the two screws located on the front panel of the nephelometer (1) and lower the Aurora front panel.

3. Unplug the light source ribbon cable (3) connected to the right side of the light source as well as the 2-pin red and black cable connected to the top of the light source.



4. Unscrew the 4 screws (2) holding the light source in place.



5. Carefully slide the light source straight out by lightly resting the light source on the bottom

surface of the cell opening. This will prevent the backscatter shutter from catching

Ensure that the o-ring within the light source is not lost or misplaced.

6. Use warm water on a lint free tissue or cloth to wipe the insides of the cell paying special attention to the bottom right section and the walls.

Do not leave finger prints or any residue within the cell.

7. Leave the cell open until all internal surfaces are dry of water

8. Carefully replace the light source, cables, and front panel of the nephelometer.

9. Always perform a leak check and full calibration after removing the light source.

Optical Chamber Cleaning

In order to clean all parts of the optical chamber, the optical chamber should be completely removed from the nephelometer. This procedure should also include the step for cleaning the Measurement cell as in section 6.3.2. Refer to Figure 42 (and additional pictures) for component locations.

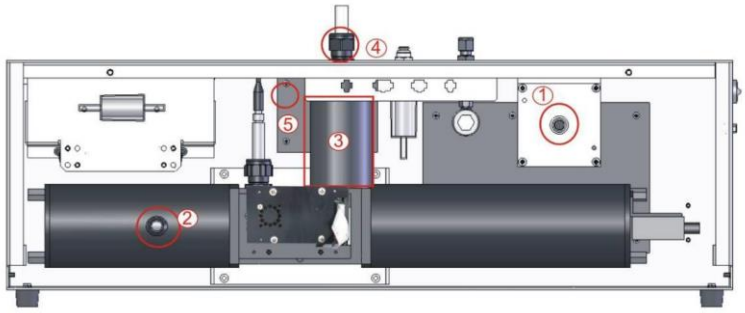
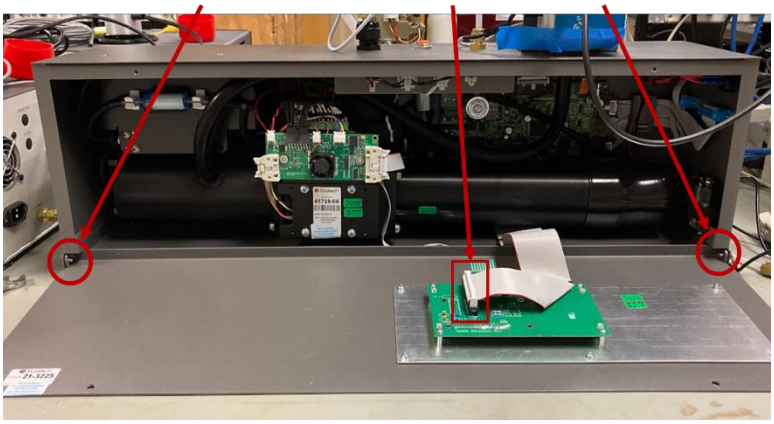


Figure 42 – Internal pneumatic tubing

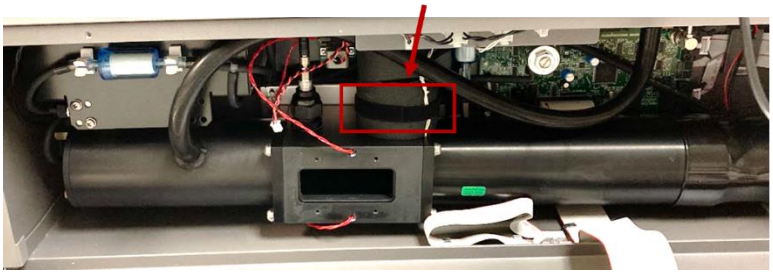
Optical Chamber Removal

1. Follow the steps 1 to 5 from section 6.3.2 (Measurement Cell Cleaning) to remove the light source.

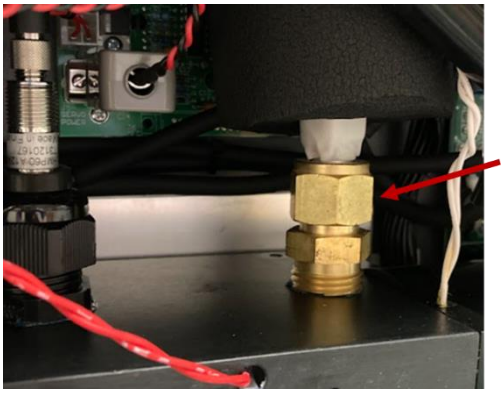
Additionally, it is extremely helpful to simply remove the front cover of the instrument before taking out the optical chamber. Simply unplug the ribbon cable connected to the front screen, there are two metal clips that also attach it to the door and these are easily bent to free the cable, tuck it out of the way, and pull forward on the door while it is laying flat. This should remove the door from its two hinges.



2. Remove the lower part of the inlet heater insulation by undoing the black velcro strap (3).



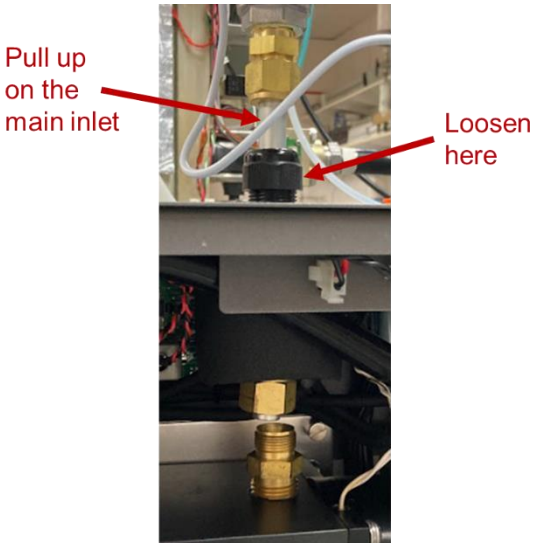
3. Using the adjustable wrench disconnect the sample inlet heater from the cell by turning the brass ~~feral~~ nut anti-clockwise. Use a second wrench to hold the bottom fitting.



4. Loosen the black cable gland (4) at the top of the inlet and pull it up so that it is clear of the measurement cell.

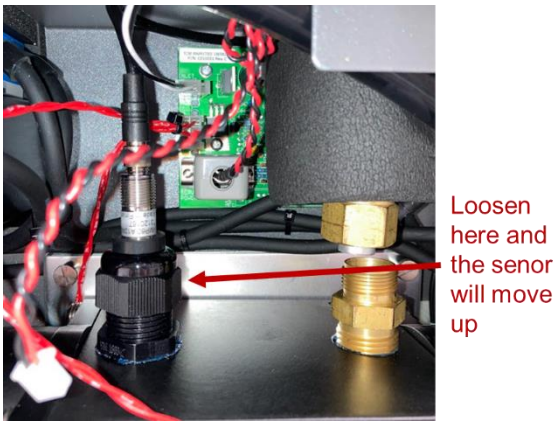
The upper insulation will limit how far you can pull the inlet up so be gentle. Additionally, the heat tape can make unscrewing this a little difficult. Once it's clear of the cell tighten the black cable gland to hold the inlet in place while you continue.

Note: When you go to put this back together after the cleaning you may notice that your inlet doesn't sit quite straight. It can help to leave the chambers connection to the backing plate a little loose and the inlet loose (untwist the black cable gland on top) to get things to line up. DO NOT force things too much as threading these connections would be very problematic.

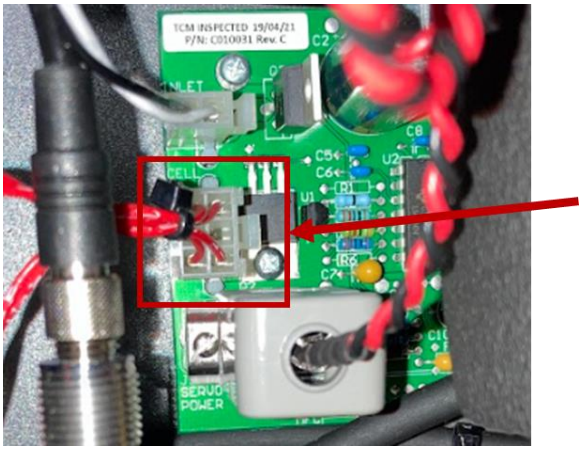


5. Disconnect the sample temperature sensor by turning the outer metal sleeve anti-clockwise and pull up.

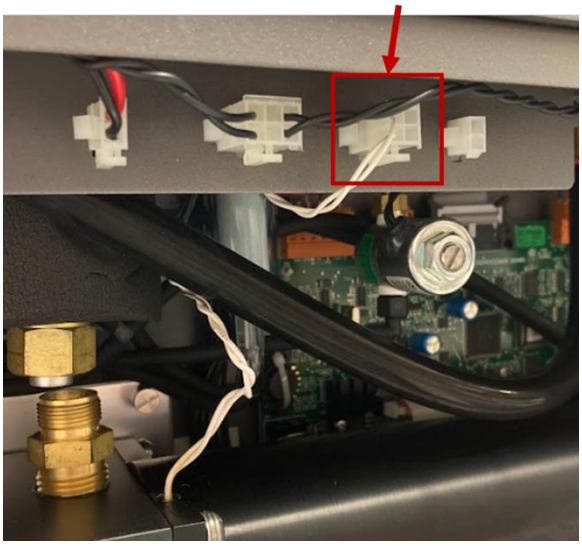
Note: Things are tight and the RH sensor will not come out of the cell fully when you do this – so you will have to remove it as you take the cell out of the instrument. Be aware of this moving forward.



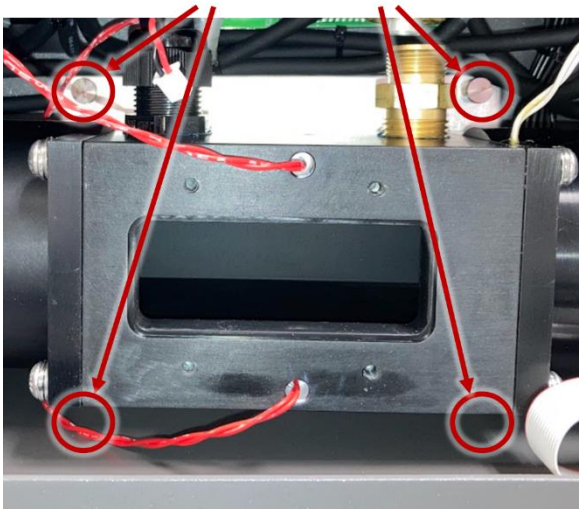
6. Disconnect the ~~two~~ heater cable~~s~~ (5) on the power control board.



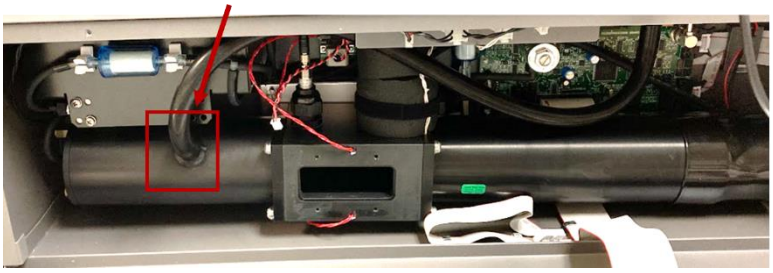
7. Disconnect the (white) reference shutter cable from the top panel connector.



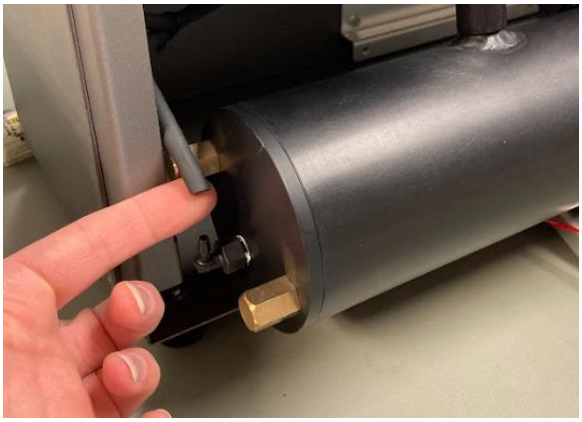
8. Using a long flat screwdriver, unscrew the 4 captive screws at the base of the measurement cell mounting plate. Before doing this, it may be helpful to put a piece of foam under the cell because the optical chamber will drop out once it no longer has the screws holding it to the mounting plate.



9. Remove the large black tube off the optical chamber exhaust port (2).

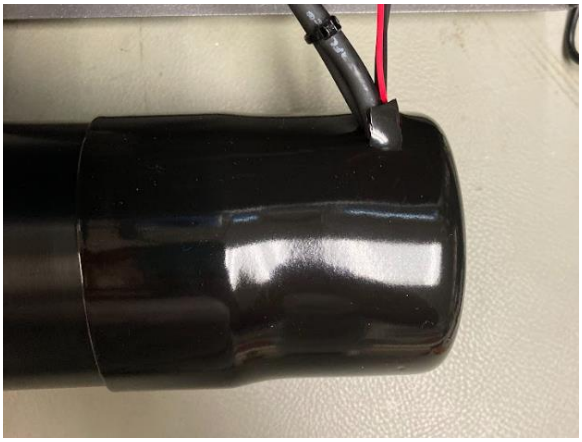


10. Disconnect the small black tube on the left-hand end of the chamber (this is where the light trap is). It can be helpful here to start to pull the chamber out as this port is hard to access with the chamber still inside the instrument. Just note that that tubing is quite tight and you won't be able to fully remove the chamber still attached, just enough for access.

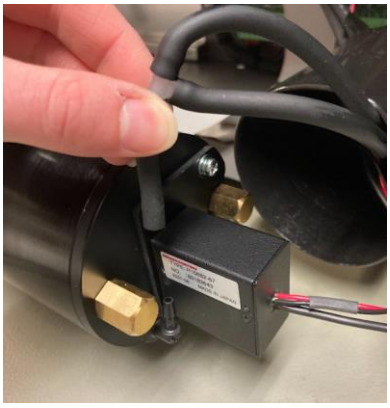


11. With almost everything disconnected, carefully pull the optical chamber out and rest it on the front door – or the table if the door has been taken off - with some bubble wrap under it to protect it.

12. Carefully pull back the large black rubber cap on the right-hand end (where the PMT is) of the chamber. There are 2 cables and 1 small black tube penetrating this cap. Be careful not to pull on these cables, push them into the cap a bit before you remove it so that pulling up on the cap does not put strain on the wires.



13. Remove the black tubing from the port.



14. In the manual this step states: "Disconnect the coaxial cable by rotating it anti-clockwise and pull." However, there appear to be different flavors of PMT. If the PMT does have these cables follow Fig. 43 in the manual:

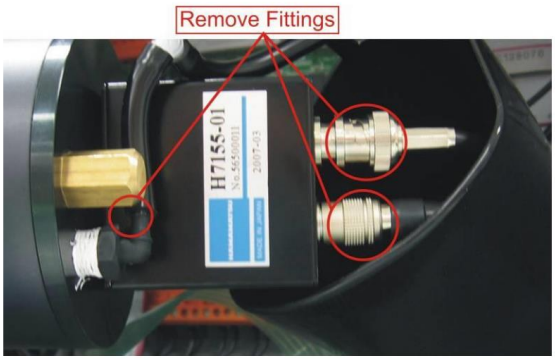


Figure 43 – Removal of cell fittings

If not then there doesn't seem to be a clean way to disconnect the PMT so just be aware of the connection moving forward.

15. Remove the other smaller cable by pulling back the outer metal ring, then pull.

Again, depending on the PMT flavor this may or may not be there.

16. Now the optical chamber should be completely [or at least mostly] free to move.

Cleaning Optical Chamber and Reference Shutter

1. Remove the 2 brass nuts at the PMT end of the chamber and **do not lose the 2 small O-rings**.

2. Remove the right side chamber end plate and PMT assembly by pulling it out. A ~~small~~ large amount of wriggling will be required because of the o-ring seal. Here it's helpful to use a very fine flathead screwdriver to gently help with the removal of this plate.

Cover the PMT to ensure that the PMT's exposure to light is minimized. Use an electronics anti-static bag or a small box, to keep things safe and out of the way.

3. Remove the chamber cylinder on the right side (PMT side) by carefully twisting and pulling it off. This will also take a lot of wiggling. Try to avoid scratching the cylinder's walls.

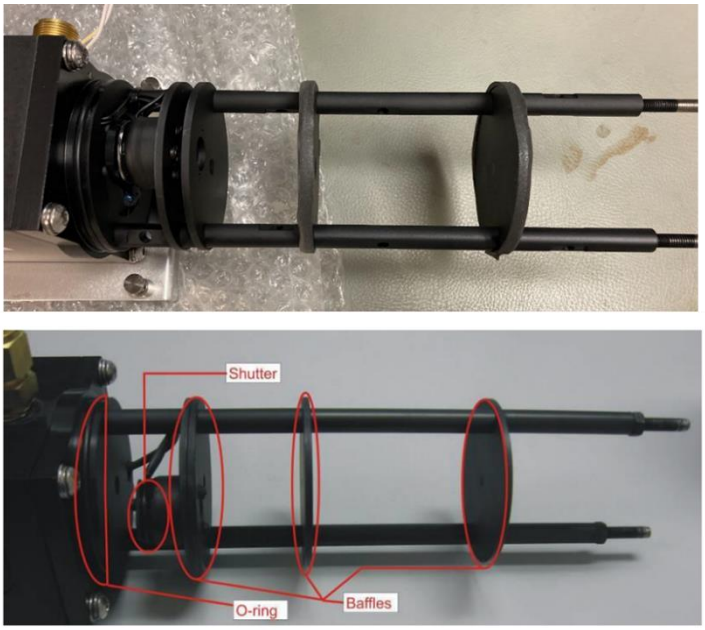


Figure 44 – Optical chamber right cylinder components

4. Clean the top of the reference shutter glass (Figure 45) with a lint free tissue or cotton bud and warm clean water, then leave to dry. Also clean the opposite side of the reference shutter glass by spraying CO Contact cleaner into the small shutter aperture to flush out any debris.

Its important to note that you will need to carefully hold this still while cleaning it as it will move if pushed.

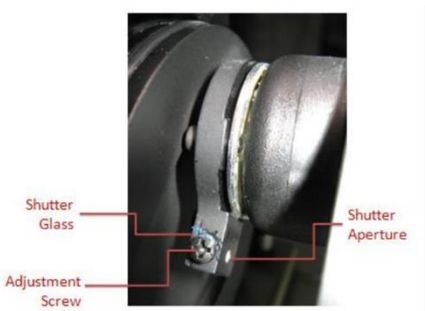
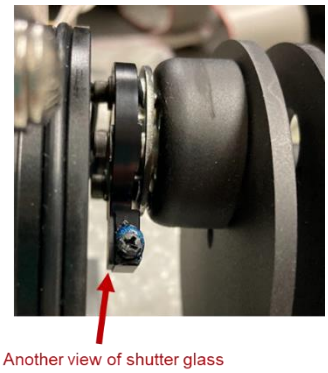


Figure 45 – Reference Shutter



5. Check that the reference shutter adjustment screw in the side of the shutter plate is not loose.

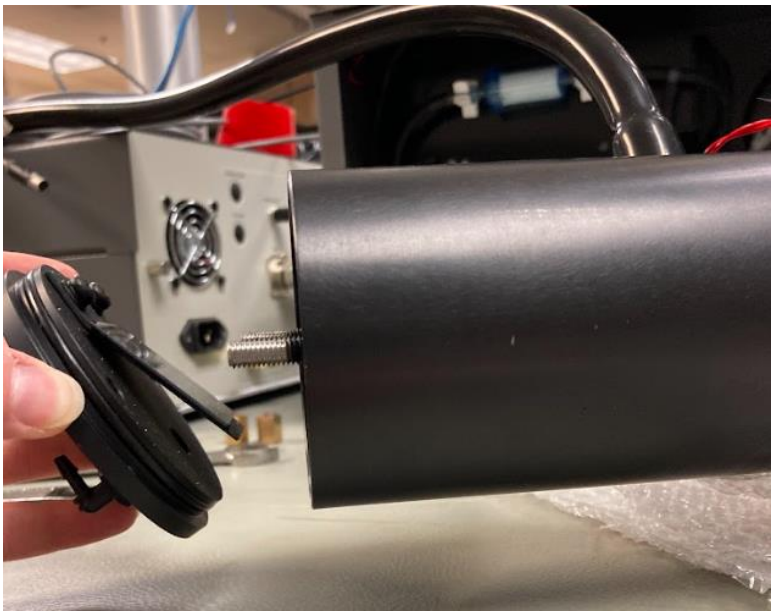
6. If the baffles are dirty, clean them in a similar manner or by using compressed air. Check the o-rings for cracks or dirt and clean if necessary. Avoid using O-ring grease.

Cleaning Light Trap Mirror

1. Remove the 2 brass nuts at the left-hand end of the chamber and again **do not lose the 2 small O-rings.**

2. Remove the chamber end plate from the left end of the optical chamber cylinder (light trap) by pulling it away from center. A ~~small~~ large amount of wriggling will be required because of the o-ring seal. Again, its helpful to use a very fine flathead screwdriver to gently help with the removal of this plate.

As you pull out the plate note that there is a directionality to its orientation:



3. Be very careful not to touch the mirror surface.

4. Slide the outer cylinder off making sure not to scratch the inside surface.

5. Inspect the light trap mirror surface using a very bright torch (e.g. LED type), and viewing it from various angles. Look for signs of white streaks or dust in the center of the glass.

6. If the glass surface does need cleaning, use a precision electronic cleaning solvent which leaves no residue, low toxicity and has a CO2 propellant (CRC CO Contact Cleaner).

DO NOT USE ISOPROPANOL!

If your light trap looks like this it may need cleaning:

7. Spray the electronic cleaning solvent on the surface of the glass, then quickly using a lint free tissue, remove the solvent in one continuous sweep covering the full width of the glass. Then re-inspect with a torch [flashlight] for residue.

8. Surface dust can be cleaned by lightly blowing or using a horse hair camera lens cleaner.

9. If the baffles are dirty, clean them with a lint free tissue or cotton bud and warm clean water or by using compressed air, then leave to dry.

10. Check the O-rings for cracks or dirt and clean if necessary. Avoid using O-Ring grease.

Optical Chamber Replacement

1. With all parts of the chamber cleaned and dry, it is now time to replace the chamber back to its original position.

2. Slide the two cylinders back on the push the light trap end plate and PMT end plates on.

3. Tighten the 4 brass nuts and O-rings on each end to seal the optical chamber.

4. Now replace the optical chamber into the nephelometer and replace all connectors and pneumatic connections in reverse order to steps 1 to 16.

5. With everything connected, perform a leak check, then a full calibration before normal operations can begin.