

## ***Cleaning Instructions for Optical Surfaces***

***You will need the following:***

- **Astro-Physics Optical Cleaning System:**
  - **Baader Optical Wonder™** Cleaning Fluid
  - **Purosol™** Enzyme Optical Fluid
  - Lint-Free Professional Optical Cleaning Wipes
- Plain, white, unscented, Kleenex or other brand facial tissues
- Air bulb camera duster
- Camel hair brush (from camera store)
- Optional items:
  - 10x – 20x Loupe
  - Alcohol
  - Acetone
  - Dry Canned Aerosol Air Duster (without additives)



***Oh! Those Dirty Optics! ...***

It is always disheartening to see a fine, expensive optic coated with dust and other debris and there is always a desire to have everything super clean and new looking. In some cases this will enhance the view, in others it does not matter at all, and excessive cleaning can ruin an expensive optic. A simple rule is that optics toward the aperture end of the scope (i.e. objective lenses, primary mirrors and corrector plates) need the least cleaning, and dust/debris will have the least effect on the image. Optics toward the focal point will need the most cleaning to provide the best contrast and image definition. This would include eyepieces, diagonals, secondary mirrors, Barlows, telecompressors and filters.

***First, determine whether you really need to clean an optical surface:***

Before touching any large optical surface, first determine whether the surface really needs cleaning. Use a bright light source such as a flashlight held at a glancing angle to the surface. If you see dust and debris in stark relief accumulated on the entire surface, it is perhaps time to clean. If the surface is only stained by dried dew spots (these are small round silvery spots seen by reflection), then it is wise to delay your thoughts of a thorough spring cleaning. These spots do **not** affect the performance of a telescope objective in any way; they just look bad by reflection.

***Cleaning refractor objective lens surfaces and corrector plates:***

Any thin layer of dust that accumulates over time can normally be blown off with a puff of air from an air bulb (available in camera stores). This is usually enough to eliminate 99% of any small image degradation that results from dust on the front surface. In fact, dust or other loose debris will not affect the resolution, definition or contrast of your optic to any significant extent. It will simply reduce the light transmission a tiny amount.

The main problem with dust and atmospheric contaminants occurs when the lens surface is allowed to dew over, and the dew subsequently dries. This will cement the dust particles hard onto the glass surface and will make cleaning very difficult. Therefore it is imperative that a dew preventive system (dewcaps and heated dew removers) be used at all times when using your telescope on nights when dew is a possibility. If your telescope is in an observatory, simply letting a fan blow air past the front of the telescope aperture can also be an effective method to prevent dew. **Never blow hot air on a lens surface to remove dew** - you can use warm air for dew removal, and a good test whether it is too warm is to blow it on your forearm. If it is comfortable, then it is ok for the lens.

If you have determined that your objective lens needs more thorough cleaning, follow these steps below:

1. Blow off any loose dust/debris with an air bulb. I would not recommend compressed aerosol cans unless you really know what you are doing. If you must use canned compressed air, heed the following **IMPORTANT** advice: **DO NOT** use canned air with additives (canned air for electronics often has anti-static chemical additives). **DO NOT** shake the can prior to or during spraying. **ALWAYS** test spray away from the optics first to purge any liquid from the sprayer apparatus. When spraying, hold the can upright, as plumb as possible, at least 6" from the optics, and use bursts of 1 to 3 seconds rather than long streams. Improper use of canned air can spray frigid (-190°F) liquid onto the optics causing irreversible damage. This cold shock can actually cause a micro-crack to form on the lens surface. If the front element is made of ED or fluorite, this micro-crack will eventually spread across the surface and can result in a lens that simply breaks in half. (Astro-Physics Refractors do not use ED or fluorite glass in the front element.) Canned compressed air is handy, but dangerous if used improperly. That is why we recommend using an old fashioned air bulb.

2) After all loose material has been removed with the air bulb, follow this procedure by brushing any stubborn spots with a camel hair brush (available in camera stores). Work a small area at a time until the entire surface has been brushed clean. You can also combine brushing and air bulb action to get the surface clean.

3) When you are done with this, all that should remain are the stubborn atmospheric contaminants and dried dew spots. Spray a bit of the **Baader Optical Wonder™ Cleaning Fluid** on a plain white Kleenex (or other plain, white, un-perfumed nothing added ...) facial tissue and wipe once gently over a small section of the aperture. Discard the tissue - do not use it twice! Repeat this procedure, working over small sections of the lens surface until the entire surface has been cleaned at least once. Optical Wonder™ will clean spores and fungi off the surface and keep the surface antiseptic clean to prevent these nasties from gaining a foothold.

If your lens surface has tree sap or pollen deposited on it, it may not come off with Optical Wonder™ because this fluid is very gentle acting. We then recommend using the **Purosol™** cleaning fluid. This is a solvent-free cleaner which releases foreign particles by breaking their molecular bonds. The cleaning method is the same with plain white facial tissues in a circular motion over small areas of the lens until the entire lens has been cleaned. This fluid will likely leave heavy streaks and should be followed by one wipe with the Baader Optical Wonder™ to remove most of the marks.

4) When you are done with above steps, you will probably see swirling cleaning marks which look terrible, but which actually do zero harm to the image itself. These marks cause discoloration because they add a tiny thickness to the 1/4 wave anti-reflection coatings. You can eliminate these by one of two methods. The easiest is to breathe onto the surface and use the Lint-Free Professional Optical Cleaning Wipes in a final gentle rubbing action to get the surface clean. You can also wet the Lint-Free Wipe with clean acetone and wipe once around the aperture. Do not wet the wipe thoroughly, just barely damp to see the acetone evaporate almost instantly as you finish wiping. Do not get acetone onto the inner surface of any black painted retaining ring, since this will dissolve some of the black paint and deposit it onto the lens surface.

5) When you have finished these steps you may still have a surface covered with shiny silvery spots. These are caused by atmospheric contaminants that have been deposited on top of the lens coatings and changed the anti-reflection properties of the underlying coating. They are **not** areas where the coating is gone, and they have not damaged the coatings beyond salvation. If you look through the lens, you will see no effect whatsoever. The only way you see them is by reflection from the front, and as we all know, that is not the way an optic is ever used. These spots are extremely difficult to remove and may require professional service if you absolutely must have them removed.

The way it is done here is by using the powerful enzymes found in saliva. These will remove almost any contaminant, no matter how hard they have been cemented onto the coated glass surface. The saliva is placed on a clean finger tip and each spot is carefully rubbed until it disappears. The saliva must **not** be allowed to dry, and after each application must be quickly wiped away with a facial tissue wetted with either alcohol or the Baader fluid. Do not rub all over the lens; rather work only on each individual spot. If the spot will not come off with gentle rubbing, **do not force the issue**. It may be that

the dew contaminant has worked its way under the coating through a pinhole in the coating. Continued rubbing will eventually lift the coating off and change the local wavefront error in that area that has come off. This will definitely affect your image quality, whereas the original silvery spot will do nothing to the emerging wavefront.

### ***Cleaning Eyepiece, Binocular and small optic surfaces:***

The above instructions also pertain for the most part to eyepieces, filters, diagonals, binocular prisms and other optics that are close to the focal point. These optical surfaces must be clean for the best contrast and definition of subtle planetary detail. Eyepieces normally should not be cleaned internally. It is difficult to get them apart, and many times the tiny lens elements can chip if you try to remove them from the barrel. This type of cleaning should be left to the manufacturer. The eye lens is the part that gets the most crud buildup, and even one observing session can degrade the performance for subtle planetary detail.

It is interesting that whenever a new eyepiece appears on the market, that the reviewer will favor it greatly over an older design from another manufacturer. The reason for that is that a new eyepiece is almost always way cleaner than a used one, and the reviewers do not realize this simple fact. Cleaning an eyepiece eye lens will probably be all that is required to bring it to new condition.

The field lens usually gets little or no deposits of any kind, unless the ocular was stored upside down on a dusty shelf with no lens cap. After blowing loose material off the eye lens surface with the air bulb, spray some Baader Optical Wonder™ on a small piece of Lint-Free Wipe and gently wipe around the entire lens surface. If the surface is very small as is the case of short focus oculars, you may want to wrap the wipe around a cotton swab. A final wipe is done after applying a thin fog of breath to the glass. This will remove any discoloration and cleaning marks.

I do not recommend using cotton or facial tissue for these small optics because the fibers have a way of lodging into the edges of the barrel and are nearly impossible to remove once they are stuck between the glass and the metal rim. You will see their annoying shadows projected onto the lunar surface. Lint-Free Wipe lint-free cloth will leave the surface clean and free of any foreign matter. The surface should be checked with a 10x to 20x loupe (available from camera stores) to see if it is fully clean. An air bulb can remove any stray particles of lint. This is very necessary for the best possible planetary contrast and definition because even a few particles scattered about can degrade the image.

The above methods can be used for all other small optics. After the eye lens of an ocular, the star diagonal is the second most important surface that must be completely clean for highest planetary definition and contrast. Our dielectric-coated **MaxBright™** star diagonal (PMDMAX) has a tough ion implanted non-metallic coating layer that is quite easy to clean repeatedly without causing streaks to appear. Use gentle pressure and small pieces of Lint-Free Wipe wetted with the Baader fluid to wipe in a circular motion around the surface, then lift the wipe off the edge. Final wiping is done with either acetone or breathing on the surface and wiping it clean.

Beware, that not all dielectric-coated surfaces are super durable. There are cheaper processes to deposit the multiple layers that result in dielectric coatings, and they are not necessarily as durable as they should be. Be careful when wiping these, and use the same technique that is needed for aluminum coated mirrors. Star diagonals with conventional aluminized surface are the most delicate and need care when cleaning. Even if it is coated with a protective overcoat or multi-layer enhanced coating, this type of surface is very easy to ruin with improper cleaning technique. One successful method is to place a facial tissue on the surface (which has been carefully blown with an air bulb), wetting the tissue with alcohol or Baader fluid, and dragging the wet tissue with zero pressure across the surface and off the edge. This can be followed with acetone and a Lint-Free Wipe to eliminate lint from the facial tissue. No further rubbing should be attempted, and any stubborn spot or debris that does not come off must be left in place. After the mirror is re-assembled into the diagonal body, a final blowing with the air bulb will remove any remaining lint.

You can also use these products and techniques with your eyeglasses, cameras, microscopes and any other fine optical instruments!