

## OPTICS CLEANING SUPPLIES

The basic rule of cleaning optics is to not have to. Keep fingers, food, smoke, dust, etc. out of the Laser Area. Clean only when necessary, like when the optical noise spectrum of bulls-eyes gets too far out of hand.

New levels of cleanliness are necessary when working with laser optics, and organic solvents, like acetone and methanol are the cleaning agents. As their name implies, they dissolve compounds that have carbon in them, and those are the items most likely to be on the mirrors and lenses, like fingerprints which are bodily secretions which are of course organic, smoke, food particles, wood chips, etc. The dirt goes into solution and is carried away by the solvent. But the rinsing or mopping action must be completed before the solvent evaporates, otherwise the contaminants will be left behind and a second wipe is necessary.

But if the solvent itself has impurities floating around in it, there will always be a residue deposited, causing noise further down in the optical path. The figure of merit for the selection of acetone is the "residue after evaporation", which should be as low as possible, like fractions of parts per millions. This stuff will be available from scientific suppliers only, so be prepared to spend about \$25 per litre or more! Don't use this stuff for cleaning your paintbrushes! The common hardware store grade will do just fine for the lower levels of cleanliness you can get by with outside of the Laser Lab.

Here are the optical cleaners that are stored in the optics cleaner niche in the middle shelf of the big storage area in the **PRINTER ROOM**.

### APPLICATORS

**KODAK LENS CLEANING TISSUE:** The standard of the industry for cleaning optics, as they are soft, lintless, and hold cleaning liquids well and trap dirt in its fibers to be carried off.

**PHOTO-WIPES:** These are soft, lint-free paper towels that are useful for cleaning glass, soft enough even for cleaning plexiglass, for cleaning holographic film, for dragwiping front surface mirrors when no Kodak Lens Cleaning Tissue is available, or just to provide a clean area to lay things on.

Something almost as good but a lot cheaper are **Microwaveable Bounty Paper Towels**. The microwaveable style is unbleached paper and is the softest of all disposable towels.

**Q-TIPS** or equivalent cotton swabs. The ends will leave lint on optics sometimes, and plastic sticks will dissolve in acetone, so

they are not the best things to use on laser optics, but the Holography Department stocks them to clean hard to get mechanical items, like the **Film Gate** in the **PRINTER**.

#### SOLUTIONS

**SPECTROSCOPIC GRADE ACETONE:** Pour a little bit from the bottle into the cap, and use that to pour the acetone onto the surface to be cleaned. Never put anything into the bottle, as our acetone has only .000001% residue after evaporation. (One part per 100 million.)

**GLASS CLEANER:** For cleaning glass, but not plexiglass. Can be used for cleaning the non-emulsion side of a holographic plate, as some ammonia-based solutions can peel the emulsion clean off, like **Laundry Bleach**. Spray the cloth, not the glass is the basic rule for artwork.

**PLEXIGLASS CLEANER:** For cleaning plexiglass, as well as plain glass. Use only the softest of cloths, and wipe the finished artwork only vertically, as horizontal scratches show up worse than vertical under top-lit replay conditions.

**KODAK or EDWAL FILM CLEANER:** For cleaning both side of holographic films and plates, or 16mm footage for the printer. Wet a **Photo-Wipe** with the stuff liberally, and pass the film through it in one direction only to avoid moving the dirt from one spot to another.

**KODAK LENS CLEANER FLUID:** is the best thing to use on microscopes objectives, cylindrical lenses, and of course, photographic objectives like those in the **Stereogram Printer**. **DON'T** use it on front surface mirrors.

**UNIVERSAL PHOTONICS #33 METAL BLOCKING SPRAY** is a useful item for cleaning the large front-surface mirrors. Just spray it on, let it dry, and peel it off, hopefully taking all the crud with it. It's not a bad idea to apply it to mirrors that will not be used for a while as a protective measure.

**LAUNDRY BLEACH:** Not to be used on optics, but on unholograms; plates that didn't come out for one reason or another. Simply soak the dud in a tray of bleach, and watch the emulsion fizz off! The stripped glass can be used as a cover glass for on that turned out, painted on as a target, etc.

It can be used on the holographer who has a case of the dreaded brown pyro fingers. Just remember to use a hand creme after the Clorox soak to prevent drying of the skin.

### THE FINE ART OF DRAG-WIPING

Drag-wiping is the laser age technique of cleaning optics. Reprinted below is the straight poop from the professionals, Coherent Optics Division.

Before proceeding, blow off as much loose crud as possible with compressed air. The pre-soak of Step 2 is optional except in extreme cases.

#### Hard Coatings

For most lasers operating from the UV to near IR, glass or fused silica optics are used and the coating materials are usually hard refractory oxides. The most common of these are:  $\text{SiO}_2$ ,  $\text{TiO}_2$ ,  $\text{ZrO}_2$ ,  $\text{Al}_2\text{O}_3$ . All of these materials must be evaporated at very high temperatures using an electron beam gun. Once applied, they are very durable and usually harder than the substrates themselves. When cleaning hard coatings or Brewster windows we recommend the following technique:

- 1. Remove the mirror from the laser in the manner outlined in the instruction manual.
- 2. Completely remove all excessive amounts of oil, grease, dirt, heat sink compound or other contaminants. This may be done by washing in warm soapy water (use a mild liquid detergent) or acetone (spectrophotometric or electronic grade). Gently flush the part with the solution, being very careful not to abrade the surface. Wipe off excess dirt and solution with tissue (white only).

- 3. After the above preparatory cleaning (which is not always necessary) the mirror is ready for the essential final cleaning. For this step we recommend acetone as the cleansing solvent and the "drop and drag" technique. Always hold the mirror by the edge or place on a clean work surface.

Hold a piece of lens tissue above the mirror and put a few drops of acetone on the paper. (Figure 1.)

- 4. Lower the lens tissue onto the mirror and pull it across the mirror. (Figure 2.) Note that the dry part of the tissue helps remove any acetone residue.
- 5. Repeat the above step until the mirror is clean. Do not reuse the lens tissue. Doing this would drag any loose particles back across the surface and possibly scratch the coating. A clean sheet of lens tissue should be used for each wipe (drag).

Many people recommend ethyl or methyl alcohol in place of acetone in the above procedure. This is fine if the following precaution is observed: Don't let the drops of solvent extend across the lens tissue to your fingers. If this happens oil will be drawn from your fingers and deposited on the mirror surface. In addition, alcohol evaporates more slowly than acetone and may stain the surface. If the coating doesn't look clean repeat steps 3 & 4 and possibly follow with an acetone wipe.

**Use Kodak Lens Cleaning Tissue for drag-wiping optics, as shown in the illustration above, or in the case of the camera lenses, follow the directions below.**

#### How to clean a lens

Careless "cleaning" can spoil the precision of a lens. Too, you can mar the reflection-reducing coating that's given practically all fine modern lenses. KODAK Lens Cleaning Paper is your basic lens-care equipment.

Use it, loosely wadded, to brush dust from a lens.

Use it, sheet-wise, to wipe the surface of a lens gently, with a circular motion.

To remove fingerprints, moisten the paper with a drop of lens cleaner, such as KODAK Lens Cleaner.

Clean front and back surfaces of a lens only. Never disassemble a complex lens; that's a job for specialists.

Take care of your lenses. Unless they are clean, they cannot give you the crisp detail, the undistorted color you have a right to expect in your photographs:

*HOLOGRAMS*



Figure 1



Figure 2