Lens Inspection and Cleaning by an AR Coater

Many people who have taken tours of our factory are surprised by how many times lenses are inspected and cleaned during the anti-reflection (AR) coating process. Even with all the inspections, actual lenses are touched very little.

The first inspection step occurs just after each box is opened. Job envelopes are checked to make sure the customer name is on the envelope, the number of lenses enclosed matches what the customer marked and any sample lenses included are properly noted. All jobs are immediately entered into the computer system where they are date/time stamped.

The next stop for plastic lenses with AR coating is the racking table. Both lenses are removed from the job envelope and laid concave side down on the envelope. The lenses are traced (or the existing trace is verified). Distinguishing marks and colors are noted on the envelope. These include lens thickness, color, rimless grooving and multi-focal styles. While rare, mix-ups do occur. Including the Rx on the job envelope dramatically improves the chances that your lenses will not be delayed due to a mix-up.

At this stage only gross defects are detected. If anything unusual is detected, it is sent directly to customer service for closer examination and a call to the customer if necessary. Dirty lenses hide defects which may not be discovered until after the lens is cleaned, thus delaying remedial action. Proper cleaning and packaging your lenses before shipping minimizes the chances of damage in transit and ensures fast turnaround.

Progressive lenses are given a hand wash in solvent to remove markings. Even though you may not see the markings, ink residuals are very difficult to get off. After a few months, the AR coating will wear away where the progressives were marked, leaving a ghost impression. Mechanical action is the only effective way to remove all the ink. Cleaning the progressive marks off with alcohol and marking the envelope so it gets cleaned again at Opticote is a simple action you can take to minimize the occurrence of ghosting on progressive lenses.

All lenses are “racked” into stainless steel fixtures, each with a unique serial number. From this point forward humans do not touch the lenses again until they undergo final inspection and are bagged for return shipment. From racking, the lenses go into a robotic cleaning system. The robot carries the racked lenses through a series of ultrasonic wash, rinse and dry cycles; all without human intervention.

One purpose of cleaning is to remove oils, grease and waxes from the lenses. Oil fills scratches making it impossible to see them. This seems like it would be a benefit, but even a hint of oil on the lens will completely destroy AR adhesion and contaminate all other jobs processed in the same cycle.

Once the lenses are ultrasonically cleaned, they are brought into the pre-coating inspection area. Here lenses are given a thorough inspection. The inspection room is completely dark except for the inspection lights at each booth. All booths are painted in flat black (sides, top and bottom). The black background and dark room produce an
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excellent environment for seeing scratches and other defects. Each lens is examined under a lamp with two cool white 15-watt fluorescent lamps and a diffuser as specified by ISO 9211 for optical coatings. Each lens, held only by its racking fixture, is examined at all angles to detect defects. All findings are noted in cartoon form on the job envelope.

After passing pre-coating inspection, the lenses are baked to remove excess moisture. After the optimal bake time for each lens material, the lenses (still in the original racking fixtures) are loaded into the coating system fixtures where they receive a final visual inspection before coating. The most crucial step of all, the in-situ clean, is performed. Under high vacuum, lenses are bombarded by millions of ions. The type and number of ions (i.e., argon, oxygen, xenon, and energy level) determine what materials can be cleaned. Doing the cleaning in a vacuum is crucial because contaminants are pumped away. In fact, even under high vacuum, clean lenses will be recontaminated in about fifteen minutes, so it is essential to begin coating immediately after finishing the in-situ clean.

Opticote’s coating process includes an in-chamber applied topcoat to provide the best performance and minimize touching the lenses. Finally the lenses are mated up to the appropriate envelopes and inspected once again to ensure Opticote has not added flaws to the lenses. After passing final inspection, each lens is inserted into a soft poly bag, which is placed back in the job envelope for invoicing and shipping.

As you can see, lens inspection and coating is much more than a little soap, water and a quick glance.