



Ophthalmic Description of Services

Plastics, Glass, and Coatings

Abrasion	
Bayer (Alundum 10)	Any Coating
Sample lenses are placed onto a tray. A sand-like media of Alundum 10 is placed over the lenses. The tray is mounted on a slide, which allows the tray to quickly oscillate back and forth for 600 cycles. The test replicates normal abrasion to the front of the sample lens. This test is similar to the ASTM D1044 - 82 test standard. A control lens is always included in the tray for comparison purposes. Reference: ASTM F735-94, ASTM D1003, ISO CD Abrasion Draft 15258. Three plano lenses with a 5.00D to a 7.00D base curve for each lens type must be supplied in any lens edge configuration. Flatter curves can be tested but are outside ISO/CD 15258. A control lens is always included for comparison purposes and is configured as a plano 6 base. For flatter curves, a plano 4 base is used.	
Bayer (Kryptonite B)	Any Coating
Sample lenses are placed onto a tray. A sand-like media of Kryptonite B is placed over the lenses. The tray is mounted on a slide, which allows the tray to quickly oscillate back and forth for 600 cycles. The test replicates normal abrasion to the front of the sample lens. This test is similar to the ASTM D1044 - 82 test standard. A control lens is always included in the tray for comparison purposes. Reference: ASTM F735-94, ASTM D1003, ISO CD Abrasion Draft 15258. Three plano lenses with a 5.00D to a 7.00D base curve for each lens type must be supplied in any lens edge configuration. Flatter curves can be tested but are outside ISO/CD 15258. A control lens is always included for comparison purposes and is configured as a plano 6 base. For flatter curves, a plano 4 base is used.	
Eraser	Any Coating
In this abrasion test the sample lenses are mounted in an abrader using a standard eraser. The eraser device is set at a 2.25 pound (10 Newton) load and cycled back and forth a distance of about 20mm to 30mm for 20 strokes depending on the level of abrasion desired. This test is similar to MIL-E-12397A. The test replicates normal abrasion to the front/back of the lens. Reference: ISO/CD Abrasion Draft 15258. Three lenses with a 5.00D to a 7.00D base curve for each lens type must be supplied in any lens edge configuration. This is a subjective evaluation and any power can be used, although plano is preferred.	
Hydrophobic Durability	Any Coating
An initial contact angle reading and tape pull are measured. The samples are then rubbed with the STE and microfiber cloth for 5000 cycles. The tape pull will be performed again and results documented. This rub and tape pull protocol will be repeated for 3 additional cycles (total of 20,000 rubs) and then a post-test contact angle will be taken. Test samples can be of any power but should all be the same front curve and as close to a 6 base as possible.	
Hydrophobic Durability – Extended	Any Coating
An initial contact angle reading and tape pull are measured. The samples are then rubbed with the STE and microfiber cloth for 5000 cycles. The tape pull will be performed again and results documented. This rub and tape pull protocol will be repeated for 3 additional cycles (total of 20,000 rubs with a contact angle taken at each interval). Test samples can be of any power but should all be the same front curve and as close to a 6 base as possible.	
Steel Wool	Any Coating
Sample lenses are placed on a holder and a weighted arm is lowered onto the lens surface that contains a portion of a steel wool pad. The holder is then cycled back and forth a number of times. The test is an attempt to replicate normal abrasion to the front/back of the sample lens. A 6 base control lens is always included for comparison purposes. Reference: ISO/CD Abrasion Draft 15258. For flatter curves a 4 base plano control lens is used, but is outside ISO requirements. Three plano lenses with a 5.75D to a 6.75D base curve for each lens type must be supplied in any lens edge configuration.	
Taber	Any Coating
A flat 4" plaque is mounted on a rotary table. A CS-10F abrasion wheel is weighted and the plaque is rotated under the wheel. Upon completion of this treatment, the plaque is measured for haze and transmittance.	
Tumble (Concave Side)	Any Coating

In this abrasion test the sample lenses are placed into a barrel approximately 9" (28cm) wide and 18" (44cm) in diameter. Media is placed in the barrel, which will abrade the samples in a manner that relates to about one year of actual wear after the barrel is rotated on its rollers for a period of 180 minutes. All lenses will be edged to 50 mm diameter, including the 6 base control lens which is always included in the barrel for comparison purposes. (For flatter curves, a 4 base plano control is used, but is outside ISO requirements.) Reference: ISO/CD 15258 Abrasion Committee Draft. Plano lenses with a 6.00D to a 6.50D base curve for each lens type must be supplied in any lens edge configuration.

Tumble (Convex Side)

Any Coating

In this abrasion test the sample lenses are placed into a barrel approximately 9" (28cm) wide and 18" (44cm) in diameter. Media is placed in the barrel, which will abrade the samples in a manner that relates to about one year of actual wear after the barrel is rotated on its rollers for a period of 20 minutes. A 6 base control lens is always included in the barrel for comparison purposes. (For flatter curves, a 4 base plano control is used, but is outside ISO requirements.) Reference: ISO/CD 15258 Abrasion Committee Draft. Plano lenses with a 6.00D to a 6.50D base curve for each lens type must be supplied in any lens edge configuration.

Adhesion & Simulation Exposure

AR Craze/Heal

AR Coating

In this test, lenses are subjected to incremental increases in dry heat for 15-minute intervals. Lenses are immediately inspected for crazing as they come out of the oven. The lenses are then left out in ambient conditions for a period and inspected again. The crazing effect seen on some AR coatings will disappear ("heal") during this time and some will not. Any type, power, and base curve of finished lenses can be used for this test. Ten (10) lenses are required.

Boiling Salt Water

Hard Coating

This is a test to assess the robustness of a lens coating. The lens is boiled in a solution of salt and deionized water for 15 minutes. Any effects are graded and recorded by digital photography. Lenses of any power and base curve may be supplied. Any lens edge configuration is acceptable.

Boiling Salt Water (AR)

AR Coating

This is a test to assess the robustness of an AR lens coating. The lens is boiled in a special solution of two different salts and water with intermittent rinses in de-ionized water. The lens is placed in these solutions 6 times and inspected for effects following each cycle. Any effects are graded and recorded by digital photography. Any lens edge configuration or base curve is acceptable.

Boiling Water

Any Coating

This test is used to simulate the tinting of a lens. The lens is boiled in deionized water for 15min, the lenses are then inspected for defects.

Contact Angle

Any Coating

This test is an attempt to accurately measure the "wettability" of the convex surface of a lens. The angle created between the lens surface and a droplet of water illustrates the hydrophobic coatings ability to repel the water.

Crosshatch Adhesion

Hard Coating

In this adhesion test a series of fine cuts are made using a razor-like device across and into the front surface of the test lens. This is done again at a 90-degree angle to the first series of cuts. Tape is placed firmly on the crosshatched area and quickly pulled off the crosshatched surface. This is repeated three times and then evaluated for coating loss.

Crosshatch Adhesion/Boiling Water

Any Coating

In this adhesion test a series of fine cuts are made using a razor-like device across and into the front surface of the test lens. This is done again at a 90-degree angle to the first series of cuts. The test lens is then subjected to boiling water for a period of time. Tape is placed firmly on the crosshatched are and quickly pulled off and removed for inspection of the coating along the edges of the cuts. The test replicates normal effects on adhesion of a coating to the sample lens following the temperature of a tinting operation. Lenses with a varying

power of -2.50D and +2.50D or several base curves of approximately 4.50D, 6.50D or 8.50D for each lens type can be supplied in any lens edge configuration.	
Cycle Humidity Oven	Any Coating
In this adhesion test lens samples are placed in a 95% RH environmental oven for a period of 8 hours, every day for three days at a temperature of 65 degrees C. The test lenses are inspected following each 8 hour cycle. The concave, convex or both sides of the lenses are ranked for crazing and delamination effects. The test is an attempt to replicate normal environmental affects on adhesion of a coating to the sample lens.	
Cycle Humidity Oven/Crosshatch	Any Coating
In this 3-day adhesion test coated lenses are submitted to both a crosshatch test and the cycle humidity test. The crosshatch cuts are completed on both sides of the lenses prior to the start of the humidity portion, thereby attempting to replicate what may occur under actual conditions. In this three day test the oven cycles to 95% RH three times at 65 degree C. The test lenses are inspected following each 8 hour cycle. Tape is placed firmly on the crosshatched area and quickly pulled off and the sample is inspected.	
Dry Heat	Any Coating
In this environmental test samples are submitted to three days at 8 hours of 180-degree F dry heat. This test is an attempt to simulate dashboard conditions.	
Ease of Cleaning	Any Coating
This test is one of a series of tests designed to help determine the cleanability of a lens. Using abrasion caused by subjecting a lens surface to 100 cycles of a linear wiping action, cleanability is measured by applying a piece of tape to the lens surface in a prescribed manner and determining the force required to remove the tape from the lens. There is as yet no base line for comparison for this test so it is suggested that a known lens type be submitted with the test lenses to allow comparative information. Plano lenses should be supplied, having a base curve of from 5.00 to 7.00 diopters.	
Heat/Cold	Any Coating
In the natural environment, changes in temperature are normal. This test is an attempt to replicate that environmental condition. Samples are exposed to hot "dashboard" conditions and then slowly allowed to change to frigid conditions all in a dry environment. Lens are then inspected for crazing and delamination.	
Lifetime Properties	Any Coating
This test is one of a series of tests designed to help determine the long term lifetime of a lens surface. Abrasion is caused by subjecting the lens surface to a series of strokes of a standardized linear wiping action. Measurement is accomplished by use of affixing a tape to the surface after a number of cycles and determining the force required to remove the tape from the surface. There is as yet no base line for comparison for this test so it is suggested that a known lens type be submitted with the test lenses to allow comparative information. Plano lenses should be supplied, having a base curve of from 5.00 to 7.00 diopters.	
Photosensitive Activation Rate	Any Coating
This test is to determine the transmittance change when darkened in a device that creates artificial sunlight in a new instrument designed to measure the lens in an irradiated state as it darkens. This is the only instrument known at this time to be able to complete photochromic testing against ISO 8980-3 and does very well in the activation area of test requirements. Results are plotted and reported graphically together with the measured data.	
Photosensitive Deactivation Rate	Any Coating
This test is to determine the transmittance change when darkened in a device that creates artificial sunlight in a new instrument designed to measure the lens from an irradiated state as it fades. This is the only instrument known at this time to be able to complete photochromic testing against ISO 8980-3 and does very well in the activation area of test requirements. Results are plotted and reported graphically together with the measured data.	
Photosensitive Life	Any Coating
This test is to determine the transmittance change when darkened in a device that creates artificial sunlight in a new instrument designed to measure the lens from an irradiated state as it fades. This is the only instrument known at this time to be able to complete photochromic testing against ISO 8980-3 and does very well in the deactivation area of test requirements. Results are plotted and reported graphically together with the measured data.	

Photosensitive Temperature Dependence	Any Coating
This test is to determine the transmittance change when darkened in a device that creates artificial sunlight in a new instrument designed to measure the lens in an irradiated state as the temperature is changed. This is the only instrument known at this time to be able to complete photochromic testing against ISO 8980-3 and does very well in the activation area of test requirements. Results are plotted and reported graphically together with the measured data.	
QUV	AR Coating
In this environmental test, lens samples are placed in the QUV instrument for a period, alternating from between UV, heat, and then a period of moisture. The lens sample is then inspected for damage including crazing and delamination of coating. The typical profiles for this test are 24, 72 or 120 hours.	
QUV Tint Fade	Any Coating
In this environmental test, lens samples are placed in the QUV instrument for a period, alternating from between UV, heat, and then a period of moisture. The lens sample is then inspected for change in color or fade in color due to UV.	
Real Life Simulation +	Any Coating
This test builds upon Real Life Simulation by adding Contact Angle testing before and after Lifetime Properties.	
Stain Release Test	Any Coating
This test is designed to test the robustness of the hydrophobic or top coating used in AR lenses. The test employs the application of standardized permanent ink onto the top coating and then the mechanized rubbing of a standardized cloth for a predetermined number of cycles. Haze and transmittance measurements are completed at each interval of the test. A graph is then supplied as part of the report that illustrates the number of verses the haze and transmittance information. The test requires plano lenses.	
Thermal Shock	Any Coating
This environmental test attempts to simulate dropping a warm pair of spectacles into the snow. Test lenses are placed in an oven at 180 degrees Fahrenheit for a specific period of time and then into a freezer at 0 degrees Fahrenheit for the same period.	
Work of Adhesion	AR Coating
This test is designed to help determine the cleanability of a lens. A piece of tape is attached to a clean lens and then removed with a force gauge to determine the force necessary to remove the tape. Plano lenses are used for this test.	

Inspection

Cosmetic & Mechanical Inspection	Any Coating
A complete inspection of lenses using common industrial and laboratory techniques within ISO recommendations are used to report findings regarding: sphere power, front surface power, cylinder power, diameter, center thickness, edge thickness, pits, scratches, bubbles, flow lines, stress, unidentified particulate, edge cracks etc. Findings relate to both the coating and the lens underneath the coating This is a COLTS Laboratories Procedure based on ANSI Z80 recommendations and on what is now being used in the industry. A minimum of twenty (20) lenses of each lens type must be supplied in any power, base curve and edge configuration The customer may wish to include two (2) lens types to allow comparison when results are received. The customer should know market acceptance of one (1) of the two (2) lens types. This will allow for a good comparative base.	

Strength

Drilled Hole Lens Strength Test	Any Coating
This test is designed to test the robustness of a lens edge when drilled with a standard hole required for a three-piece mounting. A hole is drilled into a lens and the test requires plano lenses.	
FDA 50 Inches	Any Coating
This will be the regulatory go, no-go test that is used in the eyewear industry. Number of samples required is dependent on lot size. Reference: FDA, ANSI Z80.	
Variable Height Impact	Any Coating

This test is an extension of the FDA test. The equipment used has the capability of releasing a ball at up to 2000 inches equivalent to impact the lens. Using the Bruceton technique, the residual strength is testing over and above what the FDA requires. An additional auditing program is offered.

Lens Tinting & Dying

Tint Consistency	Any Coating
BPI Black dye is used to determine if the lens will absorb dye in a manner that will make the transmittance in the lens inconsistent across the surface of the lens. This is a subjective test to determine what is more commonly referred too as 'blotching'. Additionally, 3 transmission readings are taken across the surface of the lens to create a Max/Min chart quantifying the % transmission consistency across the lens surface. A control lens is always included for comparison purposes if blotching is observed. Plano lenses for each lens type must be supplied in any lens edge configuration.	

Other Lens Treatments

Anti-Fog	Any Coating
This test is designed to replicate moving from cold to warm areas while wearing lenses. The test is done using the ASTM f-659 or EN 166 standards.	

Optical Attributes

Clarity	Any Coating
This optical test will determine the level of clarity in a lens. The lens is placed in a BYK Gardner Hazegard Plus through which the dispersion of light can be measured. Clarity is the measurement of narrow angle light scattering (angles less than 2.5 degrees). Plano lenses for each lens type must be supplied in any lens edge configuration.	
Distortion – Ann Arbor Tester	Any Coating
An Ann Arbor distortion tester is used to evaluate the amount of distortion present in the lens. Photographs of typical levels of distortion are provided. Plano samples are preferred for this test.	
Hard Coating Thickness	Hard Coating
This test will determine the thickness of an abrasion-resistant coating on a lens. All samples are to be plano but “absolute” measurement requires an additional sample of the same sample without the coating. The index of the coating must also be supplied.	
Haze	Any Coating
This optical test will determine the percent of haze in a lens that may cause a decrease in visibility to the wearer. The lens is placed in a BYK Gardner Hazegard Plus through which the dispersion of light caused by haze can be measured. Reference: ASTM D1003. Plano lenses for each lens type must be supplied in any lens edge configuration.	
Luminous Transmittance	Any Coating
A BYK Gardner HazeGard Plus is used to measure average luminous transmittance. Plano lenses for each lens type must be supplied in any edge configuration.	
Polarized Lens Efficiency	Any Coating
This test is used by the polarized film industry. Transmission is measured with 2 lenses where the polarized film axis are running parallel. This value is Tmax. The polarized film axis are then crossed and transmission is measured to obtain Tmin. Pe is then calculated.	
Polarized Lens 0° - 180° Alignment Accuracy	Any Coating
This test aligns the sample lens with the notched polarized film standard to obtain luminous transmittance at 90° to each other. The polarized sample lens notches are compared to the standard to obtain the accuracy in degrees (±3° or less).	
Spectral Analysis (Polarized or Nonpolarized Lenses)	Any Coating
This spectrophotometer test can yield nearly all of the information typically required to meet transmittance requirements in standards such as ISO 8980-3, CEN 94 and the Australian standards as well	

as ANSI 80.3. Information is provided for traffic light recognition minimums (pass/fail) as well as luminous transmittance information for illuminates C (Photopic), C (Scotopic), A, D65, values for Average Blue Light, UVA and UVB. X, Y, Z tristimulus values and the x and y chromaticity coordinates are also given as well as the spectral graph and table of values from 280nm to 790nm. Test samples should be plano and in any lens edge configuration.

Spectral, Luminous and Mean Reflectance	Any Coating
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A spectrophotometer is used to measure the characteristics of a sample with AR coating. The X, Y, Z tristimulus values shall be used to calculate the Y, x and y Chromaticity Coordinates. ISO /WD 8980-18 are the referenced document. Calculation follows that standard specified by the International Commission on Illumination (CIE) established in 1931. Plano samples for each lens type must be supplied in any lens edge configuration however, convex curves are preferred.

Surface Curve Mapping	Any Coating
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The A&R Dual Lens Mapper is used to generate a map of the sample. Accuracy is ± 0.01 diopters. There are no restrictions for this test regarding type of lenses, shape, size or power.

Surface Curve Power	Any Coating
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The A&R Dual Lens Mapper is used to generate a map of the sample. Accuracy is ± 0.01 diopters. There are no restrictions for this test regarding type of lenses, shape, size or power.

Through Power Mapping	Any Coating
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The A&R Dual Lens Mapper is used to generate a map of the sample. Accuracy is ± 0.01 diopters. There are no restrictions for this test regarding type of lenses, shape, size or power.

UV Transmittance	Any Coating
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A spectrophotometer is used to measure the ultraviolet transmittance of a lens. Attenuation of UVA and UVB are completed in accordance with the ANSI 290nm, 315nm and 380nm definition and calculation of areas under the curve for percent attenuation of each. Plano samples of each lens type must be supplied and can be in any lens edge configuration.

Yellowness Index	Any Coating
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A spectrophotometer is used to measure the yellowness of a sample. This is based on CIE 1925 and 1931 calculating the degree where hue leaves white or achromatic color towards yellow. As a positive value, it moves in the yellow direction. Plano samples of each lens type must be supplied in any lens edge configuration.

Cleaners & Cloths

Cleaner & Cloth
AR Cleaning Solution Soak
This test is used to determine if a cleaning solution will cause delamination or crazing of an AR-coated lens. Also included is a pH test to determine acidity or alkalinity. Lenses of any power or base curve can be used for this test.
Cleaning Cloth Abrasion
Dry cleaning cloths typically used to clean AR coated lenses are subjected to a dry 4000 cycle mechanical rubbing to replicate the typical action seen in normal use. This is done on the surface of an AR standard control lens. Haze is measured before and after the test to determine cleaning capability as well as possible abrasion to the lens. It is best to perform several tests to compare results. The customer will supply enough cloth to complete the test requested.
Oily Cleaning
Cleaning cloths used with liquid cleaners, and moist towelettes typically used to clean lenses and AR coated lenses are subjected to a number of cycles of mechanical rubbing to replicate the typical action seen in normal use. Haze is measured before and after the test to determine cleaning capability as well as possible abrasion to the lens. It is best to perform several tests to compare results. The customer will supply enough cloth to complete the test requested.
Oily Cleaning with Oil & Dirt
Moist towelettes or liquid cleaners applied with a cloth that are typically used to clean lenses and AR coated lenses are subjected to a number of cycles of mechanical rubbing to replicate the typical action seen in normal use. Haze is measured before and after the test to determine cleaning capability as well as possible abrasion to the lens. It is best to perform several tests to compare results. The customer will supply enough cloth to complete the test requested.

Frames

Frames
Chemical Resistance Resistance to a variety of household chemicals is tested for a 24 hour period.
Cosmetic Inspection This is an inspection of the frames following ANSI guidelines. The "surface finish of frames shall be free of surface imperfections or roughness and free of residue." Ref ANSI Z80.5-4.8.2 & 4.9.3-1997.
Cycle Humidity QUV This test replicates normal weathering by subjecting samples to 36 hours cycling at 8 hours UVA and 4 hours condensation. Visual inspection is completed at the end of the cycles.
Lateral Bridge Stress This test will check for fatigue and durability of solder joints by moving the temples forward and backward in the same direction, while holding the center of the bridge stationary for a given number of cycles equating to the lifetime of a prescription.
Saltwater Soak Test samples are submerged in a solution of salt water for a period of 100 hours and assessed for damage.

Frames – ISO Tests
ISO – Artificial Perspiration (Frames) A chemical mixture that replicates perspiration provides the basis for a test of frame components to assure that there is no spotting or color change or corrosion, surface degradation or separation at the conclusion of the test as described in ISO 12870.
ISO – Bridge Deformation When tested with the apparatus defined in ISO 12870, the bridge must not deform in excess of that given on the ISO document.
ISO – Endurance The frame shall not permanently deform or fracture when subjected to this durability test in accordance with ISO 12870.
ISO – Lens Retention Characteristics Lens must not dislodge in whole or partially during the "ISO Bridge Deformation" test per ISO 12870.
ISO – Resistance to Ignition Frames must pass flame resistance in accordance with ISO 12870.
ISO – Resistance to Optical Radiation Frames are subjected to UV through arc lamp exposure and must not exceed fade limits in accordance with ISO 12870.