



COLTS | Laboratories™

Precision Testing. Definitive Results.

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 is an attempt to replicate 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. Subjective evaluation is also available with no base Base Curve/Power restrictions for a 15% additional charge. 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 is an attempt to replicate 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. Subjective evaluation is also available with no base Base Curve/Power restrictions for a 15% additional charge. 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 is an attempt to replicate 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 micro fiber 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 micro fiber cloth for 5000 cycles. A tape pull and contact angle will be performed again and results documented. This rub, tape pull and contact ang

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. Subjective evaluation is also available with no base Base Curve/Power restrictions for a 15% additional charge.

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Abrasion

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 on the concave side of the lens. A 50 mm diameter, plano 6 base control

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. Subjective evaluation is also available with no base Base Curve/Power restrictions for a 15% additional charge.

Adhesion & Simulated 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.

AR Environmental Durability (QUV)

AR Coating

In this 5 day 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. Thi

Boiling Salt Water

Hardcoating

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.

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Adhesion & Simulated Exposure

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

Hardcoating

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

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 area and quickly pulled off and removed for inspection of the coating along the edges of the cuts. The test is an attempt to replicate normal affects 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.

Cycle Humidity QUV Accelerated Weathering

Any Coating

In this 24 hour environmental test, lens samples are placed in the QUV instrument for a period, alternating between UV, heat, and then a period of moisture twice during the 24 hour period. The lens sample is then inspected for damage including crazing and delamination of coating.

Cycle Humidity QUV/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 prior to the start of the humidity portion, thereby attempting to replicate what may occur under actual condit

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.

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Adhesion & Simulated Exposure

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.

Frame/Lens Strain

Any Coating

This environmental test attempts to duplicate the effects of a lens mounted in a metal frame, under pressure, in changing climatic conditions. A slightly oversized lens is mounted in a metal frame and subjected to a three-day cycle humidity test. The lenses are inspected after each 8hr cycle for defects.

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 environ

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

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

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

Plastics Glass and Coatings

Adhesion & Simulated Exposure

Real Life Simulation

Any Coating

In this environmental test, replication of normal wear is attempted through a progression of three (3) tests: Lifetime Properties Determination (AR Cleaning); Tumble Test (Abrasion/scratch abuse) and Cycle Humidity Oven/Crosshatch Adhesion. Haze and Luminous Transmittance are measured both initially and following the last in this series of tests. Results are based on a weighted average of craze, delamination, adhesion, haze gain and transmittance loss. This final COLTS' Index is plotted against the COLTS baseline data for this test. Results have proven to be reliable and repeatable. Plano lenses for each lens type must be supplied in any lens configuration.

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.

UV Resistance

Any Coating

The QUV Accelerated Weathering Tester is recognized in ASTM, ISO, ANSI, SAE, DIN, JIS, BS and other standards groups. This test attempts to replicate outdoor weathering conditions on an accelerated basis using lighting that closely simulates the UV in sun

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 and the test may a

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.

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Strength

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 (that strength over and above what the FDA require

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 to 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. Test lenses are subjected to ambient conditions for a period of time and then moved over 50°C water vapor conditions in which there is a controlled environment. The t

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

Hardcoating

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.

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Optical Attributes

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 T_{max}. The polarized film axis are then crossed and transmission is measured to obtain T_{min}. P_e 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 ($\pm 3^\circ$ or less).

Spectral Analysis

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 Analysis-Polarized

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

Spectral, Luminous and Mean Reflectance

Any Coating

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

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

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

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.

Plastics Glass and Coatings

Optical Attributes

UV Transmittance

Any Coating

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

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 and 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.

Cleaner & Cloth Wet for Cleaning Oil & Dirt

Moist towelettes or liquid cleaners applied with a cloth that are typically used to clean non-AR coated lenses and AR coated lenses are subjected to a number of cycles of mechanical rubbing to replicate the typical action seen in normal use. This is done

Cleaner Lubricity

A cleaner must clean but also provide some protection from abrasion that can be caused by the cloth being used to wipe the cleaner from the lens. This is a 2000 rub test using a standard technical grade pure cotton cloth to rub an AR lens. The sample cleaner is sprayed on the lens in a measured quantity after a specific number of cycles throughout the test. Actual scratches are counted periodically during the test and recorded. Based on the number of scratches counted the score may be from "0" to "5" where 5 is pristine and 0 is more than 20 scratches. A quantity of 16 oz. is required for this test. There will also be a charge of our cost for the AR coated lenses used.

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 uncoated standard control lens. Haze is measured before

Dry Cloth for Aggressive Cleaning

Dry cleaning cloths typically used to clean AR coated lenses are subjected to a number of strokes across soft chalk. This is done to determine the amount of chalk by weight is removed from the chalk block, This is not a measurement of "abrasion" and illustrates how aggressive the cleaning will be under dry conditions.

Dry Cloth for Cleaning Oil

Dry cleaning cloths typically used to clean AR coated lenses are subjected to a number of cycles of mechanical rubbing to replicate the typical action seen in normal use. This is done on the surface of an uncoated standard control with a measured amount o

Dry Cloth for Cleaning Oil & Dirt

Dry cleaning cloths typically used to clean AR coated lenses are subjected to a number cycles of mechanical rubbing to replicate the typical action seen in normal use. This is done on the surface of an uncoated standard control lens with a measured amount of oil applied to the surface as well as a precise mix of ingredients that replicate "dirt". 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. Four (4) standard control lenses are used to determine an average in each case. The customer will supply enough cloth to complete the test requested. The customer will also supply four (4) AR coated, plano lenses if performance on AR coated lenses is desired. Price is per cloth cleaner tested.

Oily Cleaning

Cleaning cloths used with liquid cleaners, and moist towelettes typically used to clean non-AR coated lenses and AR coated lenses are subjected to a number of cycles of mechanical rubbing to replicate the typical action seen in normal use. This is done on

Dyes & Tints

Dyes & Tints

Dye & Lens Compatibility

Three manufacturers coated lenses are chosen for this test (5 lenses from each for the standard test). Dye is mixed following dye manufacturer's instructions and lenses are dyed to sunglass shades. The lenses are examined for possible effects to the coating.

Tint Fade

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. Dyes sent to COLTS

UV Dye Resistance to Fade

UV Dye, UV Transmittance and Block - This test is designed to replicate the normal use of a lens when worn outdoors in sunlight by the use of a QUV Accelerated Weathering device. The objective is to determine if the UV absorption properties of the lens are

UV Dye Transmittance

UV Dye, UV Transmittance and Block - This test is designed to measure the amount of reduction in UVA and UVB passing through a lens after the lens has been dyed with UV dye. Dye, sent to COLTS Laboratories will be applied as specified in the dye manufacturer's instructions.

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.

Horizontal Stress

This test will check for fatigue and durability of solder joints by moving the temples outward and inward along the 0/180-degree line of the frame for a given number of cycles equating to the lifetime of a prescription.

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.

Steel Wool Abrasion

"0000" steel wool is used to replicate the wear of a temple coating on a linear surface.

Temple Bending

This test will check for fatigue and durability by moving the temple ends in the same direction, while holding the center of the temple stationary for a given number of cycles equating to the lifetime of a prescription.

Vertical Stress

This test will check for fatigue and durability of solder joints by moving the temples upward and downward in opposite directions, thereby twisting the entire frame for a given number of cycles equating to the lifetime of a prescription.

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.

Frames

Frames - ISO Tests

ISO - Dimensional Stability at Elevated Temperatures

Deviation from original dimensions shall not exceed specified amount in accordance with ISO 12870.

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.