

**3M** Science.  
Applied to Life.™

3M Personal Safety Division

**3M™ Scotchgard™  
Anti-Fog  
Technology.**

## 3M™ Scotchgard™ Anti-Fog Technology Overview.

### Products included



SecureFit™ 600



Solus™ 1000



Goggle Gear™ 500

### Product Description

3M™ Scotchgard™ Anti-Fog provides advanced anti-fog, anti-scratch properties designed to enhance eyewear performance. The 3M™ Scotchgard™ Anti-Fog coating helps keep lenses clear in rugged, dusty, steamy and wet environments providing at least 12 times longer lasting fog resistance than traditional anti-fog, anti-scratch coatings. Designed for the toughest environments, 3M™ Scotchgard™ Anti-Fog also features an anti-static property which helps keep dust, dirt and particles from sticking to the lens.

Lasting at least 25 washings with water, 3M™ Scotchgard™ Anti-Fog retains its anti-fog effectiveness which may allow workers to wear the lens longer – resulting in potentially lower costs.

3M™ Scotchgard™ Anti-fog coating is applied to both sides of 3M™ SecureFit™ 600 and 3M™, providing premium anti-scratch protection and anti-fog properties for the interior and exterior surfaces.

### Key features

- › Helps keeps lenses clear, longer
- › Less down time needed to wipe lenses
- › Lasts at least 12 times longer than traditional anti-fog coatings when tested to the EN166 Standard, Clause 7.3.2, Resistance to fogging
- › Anti-static property helps keep dust from sticking to the lens
- › Lasts at least 25 washings with water

- › Anti-scratch properties meeting the K mark requirements of European standard EN166 Clause 7.3.1
- › Meets the anti-fog requirements of the European N mark testing (EN166 Clause 7.3.2)

## 3M™ Scotchgard™ Anti-Fog

### Resistance to surface damage by fine particles.

There are a number of test methods available that are designed to assess a lens' ability to resist surface damage.

In Europe, the EN 166 test method includes an optional requirement for 'resistance to surface damage by fine particles'.

In this test, the diffusion of light through the lens is measured before and after the lens is subjected to conditioning involving falling sand.

Products which comply with this requirement carry a K mark on their lens.

3M™ Anti-Scratch coating provides superior protection to lens surfaces and therefore complies with the K mark requirements of the European test standard EN 166.

#### Test method:

- › Conditioned and tested in accordance with EN 166:2001 Clause 7.3.1 Resistance to damage by fine particles.
- › Testing conducted by Inspec Plc. As per the requirements of the standard, 4 samples were used in the testing

### Surface damage by abrasion

1% - 3M™ RAS

11% - Generic Anti-Scratch

24-31% - Generic Anti-fog, 3M™ Scotchgard AF, DX

55% - Uncoated Lens

In order to assess the abrasion resistance of lens coatings, 3M has performed extensive comparative tests using industry-recognised methods. In these tests, abrasion was simulated using specified equipment. The amount of surface damage was represented as a change in light diffusion through the lens; the smaller the change, the better the performance.

The abrasion resistance provided by 3M™ RAS outperforms any of our other hard coats being at least 5 times more scratch resistant.

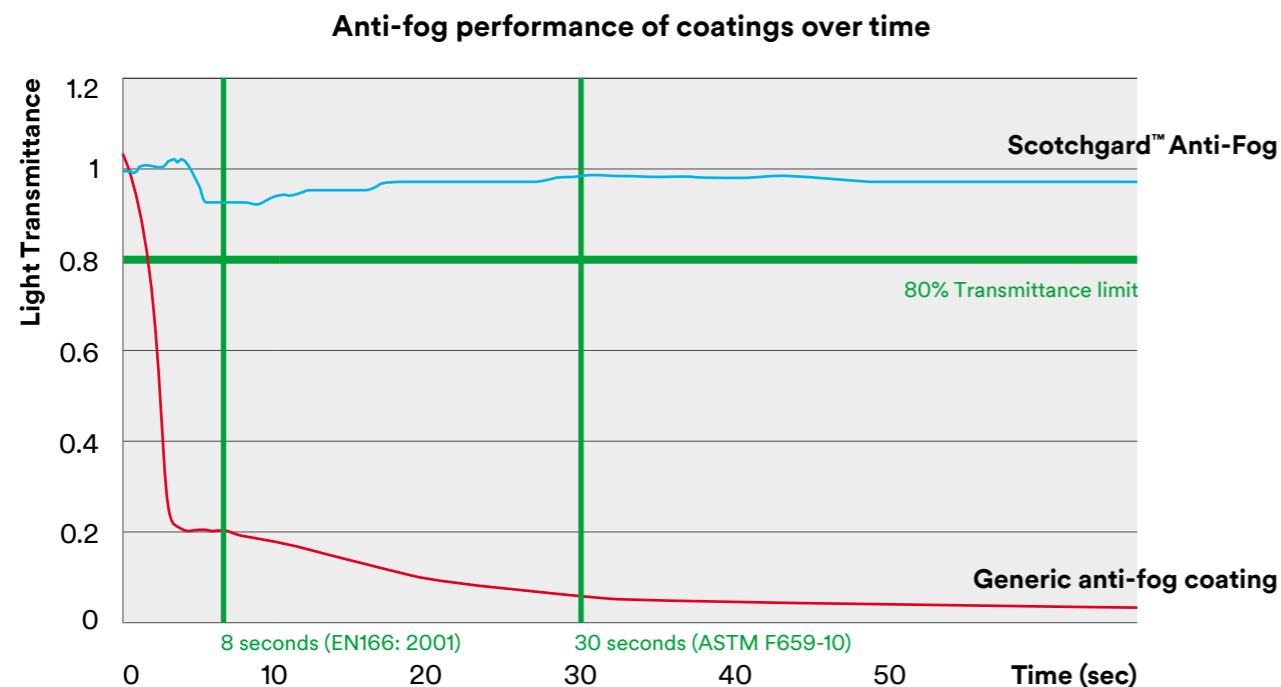
#### Test method:

- › Test based on US Military Combat Eye Protection System GL-PD 10-12 Section 4.3.3.4.3.1 Abrasion Resistance.
- › Sample eyewear is placed on the Taber Linear Abrader and rubbed with wear-eraser for 20 cycle with 750 g additional weight on the abrader arm. Haze of the abraded track is then measured using BYK-Gardner haze-gard plus with a reduced 1/4" opening.
- › The percent haze gain is the difference between the haze readings taken before and after the abrasion. Lower haze change indicates improved abrasion resistance.
- › Tested was conducted in 2012 by 3M. Results for 3M™ Scotchgard™ Anti-fog lenses were averaged from a batch of 141 models. With the exception of the 3M™ Scotchgard™ Anti-fog lenses, five samples were tested from each set and the haze change value was then averaged.

## 3M™ Scotchgard™ Anti-Fog Resistance to fogging.

Fogging on a lens is assessed from the point-of-view of the wearer i.e. does fogging interfere with vision. This property is assessed quantitatively through measurement of the change in light transmittance through the lens. Both EN166 and ASTM F659 use 80% of the original transmittance as a minimum acceptable level. To achieve the EN166 N mark, the change in transmittance must remain above 80% for a minimum of 8 seconds. In the ASTM standard, a minimum of 30 seconds must be achieved.

3M™ Scotchgard™ Anti-Fog coating surpasses the requirements of both EN166 and ASTM, outperforming the majority of generic anti-fog coatings available on the market. Compliance with the N mark requirements of EN166 has been verified by external testing.



### Test method:

- › Comparative testing performed in accordance with EN168:2001 Clause 16 Test for resistance to fogging of oculars.
- › Sample eyewear is soaked in distilled water at 72°F +/- 5°F for 1.5 hours, dabbed dry with a household paper towel, and allowed to sit at 72°F +/- 5°F at 50% +/- 10% relative humidity for 12 hours. Lenses are then tested on the fog resistance test equipment as described in EN168:2001 Personal Eye Protection Test Methods, Section 16. Time until fogging is defined as the time until the transmittance of the test sample is reduced to 80% of its original transmittance when exposed to the humid air above a water bath at 50°F.
- › Comparative testing conducted in 2012 by 3M. Graph shows representative data taken from results for 141 models of 3M™ Scotchgard™ Anti-Fog coated lenses and 3 models with a generic anti-fog coating.
- › Testing to the N mark requirements of EN166 was completed in 2012 by Colts Laboratories and verified by Inspec Plc as part of EC Type Examination. As per the requirements of EN166:2001, 4 samples were used in the testing.

## 3M™ Scotchgard™ Anti-Fog Static charge dissipation.

Static charge can be the result of natural events such as body movements that cause objects to rub against each other. A build-up of static charge on a lens can cause problems because dust and other small particles may be attracted to the lens surface, reducing visibility.

3M™ Scotchgard™ Anti-Fog promotes fast dissipation of static charge, helping to prevent dust from sticking to the lens.

Coating	Static Charge (Volts)			
	Immediately after Neutralization	Immediately after 20 Rubs with Micro Fiber Cloth	After 5 minutes	After 15 minutes
3M™ Scotchgard™ Anti-Fog Coating	0	+500	0	0
Uncoated lens	0	+5000	+5000	+5000

### Test method:

- › A static neutralizer was used to remove existing charge from eyewear samples (confirmed by an initial measurement).
- › A charge was induced on the lens by rubbing them 20 times with a microfiber cloth.
- › Subsequent charges were then measured as the intervals of 0.5 minutes, 5 minutes and 15 minutes while the lens sits in air at 72°F +/- 5°F and 50% +/- 10% RH.
- › Testing conducted in 2012 by 3M using samples of 3M Maxim lens, one uncoated and one coated with 3M™ Scotchgard™ Anti-Fog.

## Resistance to disinfection with Isopropyl Alcohol (IPA)

Isopropyl Alcohol (IPA) can be used as a mild disinfectant and general cleaning solution. Lens cleaning solutions, such as those sold by 3M, often contain varying amounts of IPA. To ensure that this chemical did not adversely affect the anti-fog properties of 3M™ Scotchgard™, samples were wiped with tissues saturated in a solution of IPA in water (70%), rinsed, dried and then assessed for fogging.

Cleaning and disinfecting with IPA does not affect the anti-fog performance of lenses coated with 3M™ Scotchgard™ Anti-Fog. After conditioning, lenses still provide fog resistance for over 60 seconds.

### Test method:

- › Sample eyewear was wiped with a household paper towel saturated with a 70% solution of IPA in water.
- › The eyewear was allowed to dry at room temperature and 50% +/- 10% RH for 1 hour.
- › The samples were then tested for up to 60 seconds on the EN168 Fog Tester and their „time until fogging“ was determined (time until the transmittance of the test sample is reduced to 80% of its original transmittance when exposed to the humid air above a water bath at 50°F).
- › Testing conducted in 2012 by 3M using a single sample coated with 3M™ Scotchgard™ Anti-fog
- › Note: For cleaning and disinfection, please follow product user instructions, manufacturer recommendations and site specific procedures

## Resistance to washing using water.

Cleaning of spectacles and goggles is a necessary part of using them but the unfortunate truth is that even washing with water can degrade some lens coatings.

During development of the 3M™ Scotchgard™ Anti-Fog coating, simple wash tests were used to assess the durability of various coatings.

The table to the left shows the time taken for lenses to fog after being subjected to a number of washing cycles.

3M™ Scotchgard™ Anti-Fog can withstand at least 25 washes with water without a reduction in the performance of its anti-fog properties.

Coating	Time Until Fogging (seconds)				
	0 Wash Cycles	1 Wash Cycles	5 Wash Cycles	10 Wash Cycles	25 Wash Cycles
3M™ Scotchgard™ Anti-Fog Coating	> 60	> 60	> 60	> 60	> 60
Generic Coating	< 10	< 10	< 10	< 10	< 10

### Test method:

- › The lenses on sample eyewear were washed repeatedly by placing them under running tap water at 72°F +/- 5°F for 5 seconds, and then dried off with a household paper towel after each wash cycle.
- › After the wash cycles were complete, the samples were allowed to dry further for 1 hour at 72°F +/- 5°F and 50% +/- 10% RH.
- › The samples were then tested for up to 60 seconds on the EN168 Fog Tester and their “time until fogging” was determined (time until the transmittance of the test sample is reduced to 80% of its original transmittance when exposed to the humid air above a water bath at 50°F).
- › Testing conducted in 2012 by 3M. Five samples of each lens type were tested and two tests were performed on each lens (left ocular and right ocular region).
- › Note: For cleaning and disinfection, please follow product user instructions, manufacturer recommendations and site specific procedures.

## Resistance to disinfection with bleach.

Eyewear is often used in environments where it is exposed to substances that could potentially pose a biological hazard. Many proprietary disinfectants are used in medical and industrial workplaces, often featuring Sodium Hypochlorite as a base ingredient. Unfortunately, this chemical can have a detrimental effect on both lenses and lens coatings.

To assess the resistance of Scotchgard, lens samples were conditioned in a Sodium Hypochlorite solution (0.6%), rinsed, dried and then assessed for fogging.

3M™ Scotchgard™ Anti-Fog has excellent resistance to degradation caused by disinfection with bleach. After conditioning, lenses still provide fog resistance for over 60 seconds.

### Test method:

- › Sample eyewear was immersed for 10 seconds in solution of 10% household bleach (6% diluted down to 0.6% Sodium Hypochlorite) in tap water at 72°F +/- 5°F.
- › The lenses on the eyewear were rinsed off in tap water at 72°F +/- 5°F for 5 seconds, dried with a household paper towel, and allowed to further dry for 1 hour at 72 +/- 5°F and 50 +/- 10% RH.
- › The samples were then tested for up to 60 seconds on the EN168 Fog Tester and their “time until fogging” was determined (time until the transmittance of the test sample is reduced to 80% of its original transmittance when exposed to the humid air above a water bath at 50°F).
- › Testing conducted in 2012 by 3M. Two samples were used in this testing.
- › Note: For cleaning and disinfection, please follow product user instructions, manufacturer recommendations and site specific procedures.