

TECHNICAL INFORMATION SHEET

FOG FREE FILM

Anti fog film may be laminated to any flat substrate to prevent the formation of vision obscuring fog on glass or plastic lenses, windows and mirrors. Anti fog film consists of a scratch resistant, permanent anti-fog coating cured on a thin polyester base. Anti fog film also has an optically clear adhesive and a protective release liner on the reverse side. Both films have a protective masking on the anti-fog treated side.

1. Physical Description:

Available in 2mil (50 microns), 4 mil (100 microns). and 7 mil (175 microns) thickness. Nominal film thickness refers to polyester base, which is actually slightly thinner than the nominal gauge. The adhesive and release liner and masking thickness is additional.

Appearance: Crystal clear and colorless. The removable masking is opaque.

Visible Light Transmission: 90%

Tear Strength (initial): 2 mil- 3.2lbs. (1.4 kg)

3 mil - 8.4 lbs. (3.8 kg)

4 mil - 11.2 lbs. (5.1 kg)

Heat Tolerance: Adhesive: -20°F to 302°F (-29°C to 150°C)

Anti-Fog Film: 40°F to 350°F (-40°C to 175°C)

Note: The heat tolerance of the adhesive may appear less than noted above when applied on certain plastic materials. In actuality this is not a characteristic of the film or the adhesive, but rather the out gassing of the plastic substrate due to the elevated temperature. Such materials should be pre-dried before film lamination.

2. Anti-Fog Coating:

The anti-fog is a patented polymer coating which prevents fogging under all temperature-humidity conditions, even after extended immersion in water or repeated cleanings. The anti fog treatment is extremely hydrophilic which causes water droplets to spread, rather than form beads which appear as fog. Although it absorbs moisture, the coating does not dissolve in water, so it will not smudge when wet. Anti fog film is not adversely affected by commercial glass cleaners, detergents, ammonia, alcohols and gasoline. It will not discolor from exposure to sunlight or heat.

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3. Scratch Resistance:

Rubbing lightly with #0000 Steel wool will leave only a few scratches on the Anti fog surface. Occasionally, fine scratches will appear but will heal when warmed slightly or when moistened. or after simply standing at room temperature for 15 min. to 20 min. Pencil hardness is equivalent to 8H (on acrylic).

The following data were obtained using a Taber abrader with a CS10F wheel and 500g load, according to ASTM 01044:

	<u>100 cycles</u>	<u>500 cycles</u>
Uncoated polyester	20% (approx.) Δ haze	66% (approx.) Δ haze
Anti fog coated polyester	5.6% Δ haze	25.5% Δ haze

Falling sand abrasion was performed according to ASTM 0968 using 3 kg standard Ottawa sand:

Uncoated polyester	30% (approx.) Δ haze
Anti fog coated polyester	1.49% Δ haze

Anti fog is superior to all other formable hard coats in Taber abrasion tests and comparable to most non-formable hard coats on flexible substrates. In the falling sand test, Anti fog outperforms all other hard coats tested. Bayer abrasion test yield ratios ranging from 2.5 to 6 μ coating thickness to over at 15 μ thickness.

4. Anti-Fog Tests:

Test # 1 - The test surface is immersed in distilled or deionized water for 1 hr. and allowed to dry for at least 1 hr. It is then placed face down over a container of warm water (112°F/50°C) so as to completely cover the opening. Anti fog coatings may exhibit a ring of condensation as the coating hydrates, but will remain clear indefinitely thereafter. The test is complete when sufficient moisture has condensed to form large water drops.

Test # 2 - The test surface is immersed in distilled or deionized water for 24 hours, removed and allowed to dry for at least 1 hr. The sample is then cooled in a refrigerator to approximately 40°F (4°C) and withdrawn to a test chamber containing ambient air at 70°F (21°C) and 70 to 80% relative humidity. Material coated with Anti fog will remain free of fog indefinitely.

Untreated plastics or glass will fog within seconds. Inferior anti-fog coatings may fog immediately, or remain clear for a short time until they become saturated. Anti fog passes ASTM and DIN test for resistance to fogging.

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5. Pressure Sensitive Adhesive (PSA):

An optically clear adhesive recommended for use with pressure roll laminating machinery or by professional installers familiar with the handling of adhesive films. Adhesive bonds immediately to glass and plastics; even plastics treated with abrasion resistant silicone or melamine coatings, although at reduced peel strength. Minimum peel strength approx, 2.5lbs. Per lineal inch after adhesive aging over uncoated polycarbonate. Increases slightly after 5 to 10 days. Adhesive bond strength will be reduced after extended immersion in water, but bond will re-strengthen on drying. Non-yellowing.

2 mil PSA film may be applied dry; with laminating equipment or by wet method (see page 4). 4 mil PSA film should be applied dry with laminating equipment for best results.

Adhesive bond strength:

Acrylic/polycarbonate	70 oz/in.	average
	50-90 oz/in.	range
Glass	80 oz/in.	average
	60-100 oz/in.	range
Expected sheer strength	1000 hours	
Tack	270 gr/cm ²	average
	100-450 gr/cm ²	range
Minimum application temperature:	30F (-1C)	

6. Installation With Laminating Machinery:

A clean room environment is recommended when applying Anti fog Film with a pressure laminator. If a clean room is not available, dust may be removed with an ionized air gun connected to a supply of compressed air. A film lamination that is free of contamination may be easier to accomplish in two steps. First, laminate a tacky material to the substrate. Then as a second step peel the tacky material as the sheet enters the nip. This procedure greatly reduces exposure to environmental contamination.

7. Installation by Hand:

Where laminating machinery is not available or not practical, Anti fog film may be installed by hand using a wet application technique. For pressure sensitive adhesives, a dilute detergent solution is required to prevent premature "grab" which will trap pockets of air or water. The preferred detergent is 1.0% Chemwet 29 (Chemcor, Inc., Chester, NY) in distilled water. Filter before used. This detergent allows the film to be positioned and then locked in place with light force so it will not shift when squeegee pressure is applied.

Install on a clean (very important) surface which flat, or curved in on dimension only. With the diluted detergent solution, spray the surface to be treated. Separate release liner from film with cellophane tape attached to the front and back of a single corner. Spray the surface with detergent solution (so squeegee glides) and apply pressure with rubber squeegee to evacuate liquid from beneath the film. Use overlapping strokes to prevent trapping pockets of water or air. If milky blotches appear, too much water remained after squeegee. Water will dry in time and blotches and any distortion will disappear.

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8. Slight Compound Curvature:

If the substrate does have a slight compound curvature, Anti fog film may still be applied with pressure roll laminating machine. Alternatively, a film without adhesive may be used in conjunction with double faced tape or adhesive foam. Or, adhesive can be applied in a specific pattern, i.e. around the perimeter of the shape. ESI will produce such products to specific requirements.

9. Care Instructions:

Treated surfaces may be cleaned with household glass cleaner (such as Windex®) and a sponge, tissue or paper towel. Do not use cleaners which contain abrasives, strong acids, or caustic substances.

Oily residues that may accumulate from cigarette smoke or airborne oils may reduce anti-fog effectiveness if not removed. Remove oily contamination with a grease cutting cleaner, such as Formula 409®, Fantastik®, or Top Job®.

To remove film, slide razor blade beneath one corner and lift slowly. Peeling too fast will cause adhesive to remain on the surface. If traces of adhesive do remain, remove with hydrocarbon solvents (hexane, heptane, mineral spirits) or glycol ethers (Dowanol PM). Rubbing alcohol (50-70% isopropyl alcohol) can also be used. Plastics should be tested first for solvent sensitivity.

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