



Product Information: HIGH PERFORMANCE ANTI-FOG COATING (HTAF-308)

02/11

PRODUCT DESCRIPTION

HTAF 308 is an opaque, aqueous solution that will cure when exposed to thermal processing system. HTAF-308 is a primerless, permanent anti-fog coating intended for polycarbonate, polyester, acrylic, and glass surfaces.

KEY PERFORMANCE PROPERTIES

Water-based
Permanent Anti-Fog
Thermal curing type
Adheres to many substrates

TYPICAL APPLICATIONS

HTAF-308 is designed for surface Anti-Fog coating of plastic and glass materials. It provides an exceptionally long-lived non-fogging surface.

Typical Liquid Properties

Properties:	HTAF-308
Main Component:	Proprietary waterborne polyurethane
Appearance:	Opaque Liquid
Viscosity@25°C(cP):	30 — 40
Density@25°C:	1.025
Solids Level (%):	25.8 ~ 27.8
Ph:	9 ~ 10

* For safety details, please refer to the MSDS provided.

Application Method

Coating Methods:	Dip coating, flow-coating, spin-coating, spray
Useable Solvents:	Dipping – PM/Water [80/20 pre-mixed] Flowcoat/Spray – IPA/Water [50/50 pre-mixed]
Working Temperature Condition:	18°C ~ 22°C
Dipping Bath Temperature:	20°C ~ 22°C
Working Relative Humidity Condition:	Below 70%
Useable Filter/Filter Pore Size:	Polyolefin, PTFE / 0.45µ ~ 0.5µ

Substrate Preparation

Cleaning Process	Conditions
Destaticize:	De-staticized air Static-reducing air source or electrostatic air stream)
Cleaning:	Isobutanol / LD Naphtha* (90:10) *heptane or LD Naphtha
Molded Articles:	Submersion bath. 25°C 2 ~ 5 min. Large, flat panels: Manually wiped with solvent, if necessary to remove residue.
Drying:	Infra-Red oven or Ambient 25 - 60°C 5 ~ 10 min.
Destaticize	De-staticized air



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Cure Conditions

Thermal Curing Process

		Conditions
1st Drying	Solvent Flash Time	25°C 10 min.
2nd Curing	Thermal Curing on Lexan Polycarbonate	122°C 30 min.
	Thermal Curing on Plexiglas Acrylic	92°C 45 min
	Thermal Curing on Glass	135°C 10 min

DIPPING RATE

Ø 73mm/30 sec. Film Thickness : ~ 4.0m

FLOW RATE

500 ml/minute/cm (orifice diameter) Film Thickness : ~ 3.0 — 8.0m

Cure Film Properties

Property	Method	Values
Transparency:	550nm, 3mm thick	91.5%
Adhesion:	ASTM D3359-87	100/100
Pencil Hardness:	ASTM D 3363	1H
Water Resistance:	ASTM D70	PASS
Chemical Resistance:	Ammoniated Cleaners	PASS
	Isopropanol	PASS

HTAF-308 AF Application Information

1. DESCRIPTION

HTAF-308 is a waterborne, polyurethane coating that provides a permanent, non-fogging surface upon polycarbonate, acrylic, and glass. It is a primerless, thermal cure coating composition. HTAF-308 coating solution is stored at 5 — 25° C; minimum shelf life is 10 months. Do not freeze or expose to freezing temperatures during transport. Clean the fully cured HTAF-308 coating film with water and a soft, lint-free cloth.

2. EQUIPMENT PREPARATION - TANK CLEANING

Distilled or deionized water is the recommended cleaning solvent for the tank before and after using HTAF-308. Extra care should be taken to wash out all coating residue from the tank prior to adding HTAF-308. **Do not use HTAF coatings in a coating system previously used for siliconecontaining coatings.** Dried coating is removed with a solution of 10% sodium hydroxide in water and/or physical abrasion.

2. EQUIPMENT PREPARATION - TUBING

Stainless steel tubing and fittings are recommended for use with HTAF-308. If plastic tubing is necessary, it should consist of polyethylene, polypropylene, or teflon. **Use of brass/copper, mild/galvanized steel, or PVC-type tubing or materials with this coating will result in reduced functional characteristics.**



3. SOLUTION PROPERTIES

The following solution properties are typical values for HTAF-308, as supplied:

% Solids:	25.8 – 27.8 %
Viscosity @ 23°C:	30.0 – 40.0 cps
Specific Gravity:	1.025 grams/ml
% n-methyl pyrrolidone:	0.0 — 5.5 %
% Water:	66.7 — 74.2 %

The solids content of HTAF-308 needs to be controlled in the operating range of 20.0 – 28.0 %, by weight. For dipping applications, a blend of 75 – 80 parts PM (methoxypropanol) and 20 - 25 parts water (PM & Water are pre-mixed before addition to the coating) may be added to reduce solids/viscosity, to reduce foaming, and to help de-aerate the coating liquid. PM will also reduce 'skinning'.

For flow-coating & spray applications, a blend of equal parts isopropanol and water (pre-mixed before addition to the coating) may be added to reduce solids/viscosity, to reduce foaming, and to help de-aerate the coating liquid.

Maximum Dilution: 3 parts coating to 1 part diluent.

4. RECOMMENDED OPERATING RANGES

It is the responsibility of the coating user to determine the best process conditions for their equipment. Water additions are used to maintain the non-volatile, solids content in the recommended operating range.

The following operating ranges are recommended for consistent processing of this product:

% Solid:	20.0 – 28.0%
Viscosity measured at 25°C:	20 – 40 cps
% Water:	72.0 – 80.0 %
% PM:	0 – 20 %
% IPA:	0 – 15 %
Addition Solvent:	See above
% Relative Humidity:	40 – 75%
Air Temperature 20 – 25°C:	(68 - 77°F)
Air Flow:	HEPA Filtered Laminar air flow
Air Dry Time Before Cure:	5 – 15 minutes
Extraction Speed:	1.0 – 2.5 mm/second (2.4 – 6 inches/minute)
Cure Conditions:	135°C (275°F) (0 – 20 minutes) 122°C (252°F) (30 – 45 minutes) 92°C (197°F) (60 – 180 minutes)

Type of Defect	Possible Cause	Remedies
Anti-Fog (weak or Absent)	<ul style="list-style-type: none"> Excessive Cure Coating air-dried before it was cured 	<ul style="list-style-type: none"> Reduce cure temperature or duration Expose coating to thermal processing system while still wet. Do not dry.
Solution Smells of rotten eggs	<ul style="list-style-type: none"> Microbiological Contamination 	<ul style="list-style-type: none"> Discard coating & clean system. Use fresh coating and eliminate sources of microbial contamination
Hazy and/or opacity	<ul style="list-style-type: none"> Improper application method Improper cure Coating froze subsequent to use, or contamination is present 	<ul style="list-style-type: none"> Use flow-coating, dipping, or spraying Cure at recommended temperatures Discard coating and clean system. Use fresh coating
Soft/reduced hardness	<ul style="list-style-type: none"> Under-cured Solids content too low 	<ul style="list-style-type: none"> Raise cure temperature and/or duration Use coating with higher solids content
Poor Adhesion	<ul style="list-style-type: none"> Improperly cleaned/prepared substrate Incompatible substrate 	<ul style="list-style-type: none"> Clean/prepare appropriately Use alternative coating or a primer
Flow Lines	<ul style="list-style-type: none"> Fluid flow too strong Low humidity (<35%) Air dry time too short Solids content too high 	<ul style="list-style-type: none"> Reduce or baffle incoming fluid Increase Humidity Allow more time for coating to level Dilute coating
Bubbles and Foam in liquid	<ul style="list-style-type: none"> Solids content too high 	<ul style="list-style-type: none"> (a) Dipping: Dilute 3 parts coating with 1 part PM mixture [75%PM: 25% Water] (b) Spraying: Dilute 3 parts coating with 1 IPA mixture [50% IPA: 25% Water]

Type of Defect	Possible Cause	Remedies
Solution forms a skin on top	<ul style="list-style-type: none"> • Fluid flow too weak • Container is not air tight • Solids content is too high 	<ul style="list-style-type: none"> • Increase flow rate • Use sealed containers for storage/holding • Increase humidity • Dilute coating using PM/Water
Build-up on lower edge (flow-coating)	<ul style="list-style-type: none"> • Solids content too high • Air dry time too short • Low humidity (<35%) • Excess (<i>drip</i>) is not properly removed 	<ul style="list-style-type: none"> • Dilute coating • Allow more time for coating to dry • Increase humidity • Remove coating build-up at lower edge
Dots, specks, particles	<ul style="list-style-type: none"> • Insufficient filtration • Airborne contaminants 	<ul style="list-style-type: none"> • Improve filtration system (<5 microns) • Improve HVAC/HEPA environment
Viscosity is very high	<ul style="list-style-type: none"> • Solids content too high • Coating has reached end of pot life 	<ul style="list-style-type: none"> • Lower solids content • If solids correct, replace with fresh coating



Material Safety Data Sheet

HTAF-308 Anti-Fog

MSDS No. EX0070703

Date of Revision: July 2003 -EB

Section 1 - Chemical Product and Company Identification		H
Product/Chemical Name: HTAF-308 Aqueous Anti-Fog Chemical Formula: mixture CAS Number: na Other Designations: waterborne coating solution General Use: anti-fog coating for plastic (polycarbonate, acrylic) and glass Manufacturer: Exxon Corporation , 5939 Holly Road, Corpus Christi, Texas 78414, (361)991-8391, FAX(361)991-9057, (Sam—5pm CST)		P P E G
★★★★★ Emergency Overview ★★★★★		

Section 2 - Composition / Information on Ingredients							
Ingredient Name	CAS Number		%				
1-methyl-2-pyrrolidinone	872-50-4		10				
N,N-diethylethanamine	121-44-8		1				
Isopropanol	67-63-0		6				
			0				
Ingredient	OSHA PEL		ACGIH TLV		NIOSH REL		NIOSH IDLH
	TWA	STEL	TWA	STEL	TWA	STEL	
1-methyl-2-pyrrolidinone	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm	100 ppm
N,N-diethylethanamine	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm	10 ppm
Isopropanol	50 ppm	50 ppm	400 ppm	400 ppm	50 ppm	50 ppm	50 ppm

Section 3 - Physical and Chemical Properties	
Physical State: liquid	Water Solubility: 100 %
Appearance and Odor: opaque liquid w/amine odor	Boiling Point: 100° C
Vapor Pressure: 22 mm Hg at 70 °F (22 °C)	Freezing: 5° C
Vapor Density (Air=1): heavier than air	Viscosity: 35 CPS
Specific Gravity (H ₂ O=1, at 4 °C): 1.025	% Volatile: 74
pH: alkaline	Evaporation Rate: (nBA=1) >1

Section 4 - Fire-Fighting Measures
Flash Point: > 90 °C
Flash Point Method: Pensky-Martens CC
LEL: 1.2 % w/v
Flammability Classification: OSHA combustible liquid Class III

MSDS No. EX0070703

HTAF-308 Anti-Fog

Extinguishing Media: Carbon dioxide, water fog, dry chemical

Unusual Fire or Explosion Hazards: Coating solution will not support combustion. Non-volatile components will burn.

Hazardous Combustion Products: Carbon dioxide, carbon monoxide, nitrogen oxides

Fire-Fighting Instructions: Water may be used to cool sealed vessels to prevent pressure buildup. Do not release runoff.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 5 - Stability and Reactivity

Stability: HTAF-308 Aqueous Anti-Fog is stable at room temperature in closed containers under normal storage and handling conditions. Elimination of microbiological sources of contamination will extend usable pot life; do not freeze.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: strong oxidizing agents, solvents except n-methyl pyrrolidone & water

Hazardous Decomposition Products: Thermal oxidative decomposition of HTAF-308 Aqueous Anti-Fog can produce carbon dioxide, carbon monoxide, and nitrogen oxides.

Section 6 - Health Hazard Information

Potential Health Effects

Primary Entry Routes: dermal, inhalation, eye contact

Acute Effects:

Inhalation: Nose, throat & lung irritation.

Skin: May cause irritation.

Eye: Severe irritation.

Ingestion: Harmful if swallowed.

Carcinogenicity: IARC, NTP, and OSHA do not list HTAF-308 Aqueous Anti-Fog or its components, as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: none known

Chronic Effects: Human dermal exposure has demonstrated redness, cracking, and blistering of skin through repeated and prolonged contact with n-methyl pyrrolidone (NMP). NMP is reported to be a teratogen and is fetotoxic by dermal exposure.

Emergency and First Aid Procedures

Inhalation: Remove to fresh air.

Eye Contact: Flush immediately with copious quantities of running water for at least 15 minutes. Acquire medical attention immediately.

Skin Contact: Wash affected area with soap and water.

Ingestion: Acquire medical attention immediately.

Section 7 - Spill, Leak, and Disposal Procedures

Spill/Leak Procedures: Ventilate area. Remove sources of vapor ignition & remove residue with inert absorbent.

Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Cleanup: Use water for removal of wet residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Remove excess material w/absorbent material, rinse w/water. Dried material may require physical abrasion to remove.

Section 8 - Exposure Controls / Personal Protection

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*



MSDS No. EX0070703

HTAF-308 Anti-Fog

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Dried coating material is relatively inert.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Special Precautions and Comments

Handling Precautions: DO NOT GET IN EYES. DO NOT INGEST. AVOID BREATHING VAPORS. Avoid prolonged or repeated dermal contact.

Storage Requirements: Store @ room temperature in a sealed plastic or non-magnetic stainless steel. Once opened, store in refrigerated environment: 5° →15° C.

DOT Transportation Data (49 CFR 172.101):

Generic name: coating solution

DOT Proper Shipping name:

DOT Hazard Class: III B unregulated

UN/NA Number:

Disclaimer: All information contained in this document is based on data obtained from the manufacturers and other technical sources, and is believed to be accurate. Because the conditions of use are beyond the control of Exome Corporation it is the users responsibility to verify this data under their own operating procedures.