

TIME FOR RENEWAL

Bring sensory innovation to your personal care products using Earth-friendly Solstice® ingredients.

Solstice® Propellant
& Solstice® Enhance



Honeywell

It's time to renew our focus on ways we can help preserve our planet. And while doing that, it's also our mission to bring unique sensory innovation to your personal care products.

At Honeywell, we offer Earth-friendly¹ Solstice® ingredients that allow you to do both. Not only do they help keep your products ahead of changing environmental regulations, they provide breakthrough formulating advantages for face, body, hair, and sun care products. Some of the benefits include:

- **Solstice Propellant** (HFO-1234ze(E)) helps to create creamy, shiny, and easy to spread foam in aerosol-based products
- **Solstice Enhance** (HFO-1233zd(E)), a solvent and carrier fluid, enables superb cooling, fast drying, and unique foaming action

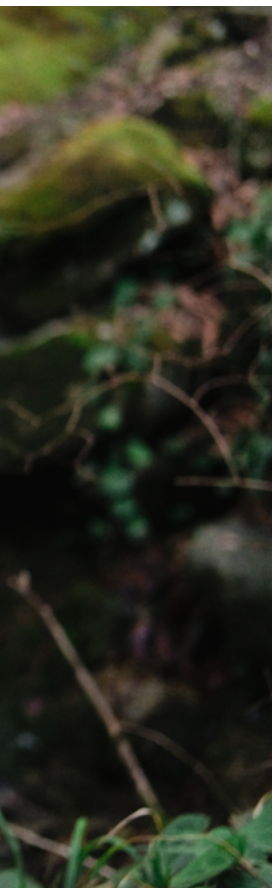
Based on our ultra-low global warming potential (GWP) hydrofluoro-olefin (HFO) technology, they help reduce climate impact without compromising

on performance. Some additional benefits of Solstice Enhance and Solstice Propellant include:

- Nonflammable (ASTM E-681, EU A11) – a proven alternative to flammable ingredients or to help reduce formulation flammability²
- Ultra-low GWP of 1 or less – reduces carbon dioxide equivalent emissions by 99.9% compared to hydrofluorocarbons (HFCs)
- Non-ozone-depleting
- VOC-exempt (per U.S. EPA) Solstice Propellant is also VOC-exempt (per CARB)³
- Negligible contribution to smog formation

At Honeywell, we believe “what’s good for the earth is good for business.” Learn why.





SOLSTICE PROPELLANT PRODUCT INNOVATION PROPELLED

Solstice Propellant is a groundbreaking advancement for aerosol-based personal care products. As a proven alternative to flammable propellants or high GWP HFCs in a wide variety of formulations, it provides exceptional benefits. Some of the reasons it is being used globally in award-winning products include:



BETTER FOR THE ENVIRONMENT

- **Stay ahead of changing requirements:** With the Kigali Amendment to the Montreal Protocol, many countries are eventually phasing out hydrofluorocarbons (HFCs) due to high GWPs. Solstice Propellant offers an ultra-low GWP alternative to HFC-152a and other HFCs
- **Meets VOC targets:** Solstice Propellant meets strict emissions regulations. It is VOC-exempt per the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB).



CONSISTENT, EFFECTIVE SPRAY PERFORMANCE

- **Medium pressure** (49 PSIG at 70°F /21°C): Provides even, consistent spray with minimal overspray. Ideal for hair and facial applications.
- **Higher liquid density** (1.17 g/cc at 70°F/21°C): Enables better solubility in viscous formulations. Works very well in formulations containing inorganics, such as zinc oxide.



EASY AND EFFICIENT CONVERSION

- **Minimal conversion costs:** Honeywell's experienced team helps ensure a smooth, efficient transition
- **Compatible with existing equipment:** Few changes to existing storage and filling equipment are required
- **Focus on safety:** It is the only nonflammable, ultra-low GWP liquefied gas propellant available today. Hydrocarbons may require special flammable materials handling equipment



DELIVERS A QUICK DRYING SPRAY

- **Fast evaporation:** Spray small-sized droplets for quick dry time



MAXIMIZES PACKAGING DESIGN FLEXIBILITY

- Only liquefied propellant that enables packaging in plastic aerosol bottles:
- Nonflammable liquefied gas propellant allows formulation of nonflammable products which can be transported under current regulations⁴
 - Suitable vapor pressure range for developing formulations compliant with U.S. DOT plastic aerosol pressure restrictions
 - Compatible with PET plastic aerosol bottles: No degradation after > 12 months at 104°F (40°C)
 - Very low loss rate: Diffusion rate through PET is 1/29th that of carbon dioxide



EARTH-FRIENDLY FACT

If every can of hairspray sold in the U.S. used Solstice Propellant, it would be equivalent to the amount of carbon dioxide emissions removed annually by approx. 6,500 square miles of trees.⁵



MATERIALS COMPATIBILITY

Solstice Propellant can be blended with other common propellants such as HFC-152a, DME, butane, isobutane and propane, and commonly-used solvents including alcohols, acetone, halogenated and hydrocarbon solvents. It is thermally and hydrolytically stable and exhibits good compatibility with plastics, elastomers, and metals. Additional information can be provided about compatibility with specific materials.

PHYSICAL PROPERTIES OF SOLSTICE PROPELLANT

Chemical Name	trans-1,3,3,3-tetrafluoroprop-1-ene	
INCI Name	Tetrafluoropropene	
Molecular Formula	CHF=CHCF ₃	
Molecular Weight	114	
Boiling Point	-2.2 °F (-19 °C)	
Vapor Pressure at 70 °F (21 °C)	49 psig	3.4 bars
at 130 °F (54 °C)	147 psig	10 bars
Liquid Density at 70 °F (21 °C)	1.17 g/cc	
Vapor Flame Limits (Vol. % in Air) Measure at 70 °F (21 °C)	None	
Solubility of Water in 1234ze at 68 °F (20 °C)	225 ppm	
Solubility of 1234ze in Water at 68 °F (20 °C)	373 ppm	

SOLSTICE® ENHANCE

DELIVERING NEW POSSIBILITIES

Solstice Enhance enables the development of innovative and novel personal care formulations. Consumers will experience unique sensations due to the innovative benefits it could provide for your products such as:



EXCELLENT COOLING AND FOAMING ACTION

- **Absorbs heat from skin:** High heat of vaporization provides a refreshing, cooling skin sensation
- **Excellent foaming action:** Crackling effect enables visual cues to create a strong reason to believe in your formulations



IMPROVES SURFACE WETTING AND SPREADING (VS. HYDROCARBON-BASED FORMULATIONS)

- **Excellent surface wetting for delivery of active ingredients:** Extremely low surface tension enables delivery of actives for enhanced efficacy even on rough, wrinkled, or uneven skin
- **Better spreadability:** Enables even spreading of the product over a larger surface area
- **Penetrates nooks and crannies:** Delivers actives and lifts oils⁶/particulates in rinse-off products
- **Exceptional carrier:** Non-VOC carrier fluid for active ingredients



- SUPERIOR SOLUBILITY (VS. ALCOHOLS AND HYDROFLUOROCARBONS)

- **Solubilizes heavy oil-based ingredients:** Create formulations with a light texture and feel
- **Solubilizes a wide variety of ingredients:** Examples include protic solvents, ethers, sunscreen ingredients, triglycerides, esters, hydrocarbons, silicones, liquid fatty acids, and oxygen carrying solvents like perfluorodecalin. It may also help solubilize actives to improve formulation efficacy.
- **Miscible with liquid surfactants:** Develop revolutionary emulsions. Excellent miscibility with surfactants such as polysorbate 20, laureth 4, and oleth-2.
- **Superior removal of oils on skin:** Readily dissolves natural skin oils and other oily ingredients⁶ in rinse-off applications for a clean, refreshing sensation



FAST DRYING

- **Evaporates quickly:** Leaves behind pure product/active and minimizes waiting
- **Ideally suited for hair applications:** Create dry formulations for hair sprays, dry shampoos, and other styling products



EXCELLENT DISPERSION OF SOLIDS-BASED AEROSOL PRODUCTS

A powerful combo: Solstice Enhance can be combined with Solstice Propellant to provide excellent dispersion of solids-based aerosol products



MATERIALS COMPATIBILITY

Solstice Enhance is highly compatible with a wide variety of commonly used plastics and elastomers. Additional information can be provided about compatibility with specific materials.

PHYSICAL PROPERTIES OF SOLSTICE ENHANCE

Chemical Name	trans-1-chloro-3,3,3-trifluoropropene	
INCI Name	Chlorotrifluoropropene	
Molecular Formula	CF ₃ - CH = CClH	
Molecular Weight	130	
Boiling Point	66 °F (19 °C)	
Latent Heat of Vaporization at Boiling Point	83.4 BTU/lb / 194 kJ/kg	
Freezing Point	-161 °F (-107 °C)	
Vapor Pressure at 77 °F (25 °C)	18.6 psia 126 kPa	4.1 psig = 0.3 bars
Liquid Density at 77 °F (25 °C)	10.5 lb/gal / 1.26 gm/mL	
Surface Tension at 77 °F (25 °C)	12.7 dyne/cm	
Liquid Viscosity at 77 °F (25 °C)	0.446 cP	
Vapor Flame Limits (Vol. % in Air) Measured up to 212°F (100°C)	None	
Solubility of Water in Solvent at 25 °C	460 ppm	
Hansen Solubility Parameters		
- Dispersion	15.5	
- Hydrogen Bonding	2.2	
- Polarity	4.8	
Kb Value	25	
pH Range (stable over studied range)	3.5 - 11.7	

SOLSTICE PROPELLANT AND SOLSTICE ENHANCE - A GROUNDBREAKING COMBINATION

Solstice Propellant and Solstice Enhance can be used in your formulations independently, or together to create groundbreaking products. In addition to providing exceptional formulating flexibility, they also offer benefits related to safety and the environment.

Environmental, Health, and Safety

Solstice Propellant and Solstice Enhance are classified by the U.S. Department of Transportation (DOT) as UN class 2.2 nonflammable liquefied gases.⁴

The results of extensive toxicity testing support the conclusion that Solstice

Propellant and Solstice Enhance exhibit a very low order of toxicity. Accordingly, the American Industrial Hygiene Association (AIHA) has assigned a Workplace Environmental Exposure Limit (WEEL) of 800 PPM (8-hour time-weighted average) for both of these ingredients.

However, Solstice Propellant and Solstice Enhance have not been tested for use in every personal care formulation and it is the customer's responsibility to determine whether they are appropriate for use in its specific formulation and to conduct required testing.

REFERENCES

1. Ultra-low global warming potential of 1 or less
2. Your specific formulation incorporating Solstice Propellant and/or Solstice Enhance would require flash point or other flammability testing to confirm it is nonflammable
3. Solstice Enhance is pending CARB VOC exemption approval
4. U.S. DOT does not allow transport of flammable plastic aerosol products at time of publication
5. Assumes a 10 oz. can with 40% Solstice Propellant vs. HFC-152a. Source using EPA website
6. Per Honeywell internal ingredient solubility test completed Jan. 2017

Learn More

Whether it's for new formulations or aerosol-based products, contact us today.

Visit: <http://hwl.co/PersonalCare>

Call: 1-800-631-8138 (U.S. and

Canada) or your local sales office

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