

HFC TO HFO RESOURCE

What Are HFCs and HFOs?

HFCs (hydrofluorocarbons) are powerful insulation gasses developed as replacements for ozone-depleting substances in the refrigeration and air conditioning, aerosol, fire suppression, foam blowing, and other sectors. Unfortunately, many HFCs have a long lifetime in the atmosphere (hundreds of years), which, coupled with their insulation performance, can lead to increased heating of the planet; in other words, global warming.¹ Therefore, high GWP (global warming potential) HFCs are being phased out of use to enhance the environment.²

HFOs (hydrofluoroolefins), on the other hand, have the same powerful insulation performance as HFCs with zero ozone depletion potential. However, by design, they have a much shorter lifetime in the atmosphere (days not years), so they have a low GWP (by not trapping heat in the atmosphere), thereby offering an alternative to HFCs.³ HFOs can provide comparable to performance characteristics with reduced environmental impact.⁴



What Do They Do in Spray Foam?

When used as an ingredient in closed cell polyurethane foam, HFCs and HFOs are typically referred to as “blowing agents.” In closed cell products, the blowing agent causes the expansion of the cells during the chemical reaction and remains behind as a powerful insulation gas. Alternatively, open cell products use water that creates CO₂ gas with Isocyanates to achieve the expansion of the cellular structure. CO₂ gas leaves the foam and is replaced with air, which is not nearly as effective at insulating as HFOs and is why the R-values are half as good as closed cell foams.⁵

Why the Industry Is Moving to HFOs?

HFC use in all segments is estimated to contribute 18% of increased global warming, so federal and state governments are restricting their uses as a means of helping to slow environmental impacts.⁶ HFCs are currently restricted in 11 U.S. states as well as all Canadian provinces.⁷ To reduce the global warming potential impact, the US EPA has restricted the use of HFCs in the manufacturing of polyurethane foam beginning Jan. 1, 2025.⁸ This means all spray polyurethane foam formulas that include HFC blowing agents will cease production at year end 2024. HFOs are acceptable for these states and the US EPA; therefore, all closed cell formulations will have to convert to them by Jan. 1, 2025.⁸

For more information, go to www.owenscorning.com/naturalpolymers

¹ Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland, 104 pp.

² IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.J. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. In Press.

³ Hodnebrog, Ø., Aamaas, B., Fuglestad, J. S., Marston, G., Myhre, G., Nielsen, C. J., et al. (2020). Updated global warming potentials and radiative efficiencies of halocarbons and other weak atmospheric absorbers. *Reviews of Geophysics*, 58, e2019RG000691. <https://doi.org/10.1029/2019RG000691>

⁴ Todd M. Krieger, Christopher Johnas, Shaibal Roy, Helen Walter Terrinoni, “Low GWP Spray Foam Expansion Agents: Why Performance also Matters – A Comparative Life Cycle Assessment of Foam Expansion Agents”, CPI conference, September

⁵ Roy, Shaibal and Wysong, Ernest. “Low GWP Blowing Agents: Reduce Footprint through better performance of Opteon™ 1100.” CPI conference, October 2018, Atlanta, GA 2012, Atlanta, GA.

⁶ Inventory of US Greenhouse Gas Emissions and Sinks, US EPA 430-R-22-03 (2022)

⁷ www.nrdc.org/sites/default/files/media-uploads/fact_sheet_on_state_hfc_action_0.pdf

⁸ [technology-transitions-final-rule-2023-pre-publication.pdf](https://www.epa.gov/technology-transitions-final-rule-2023-pre-publication.pdf) (epa.gov)

Natural Polymers and HFO Formulations

Ben Brown (founder and lead chemist at Natural Polymers) started working with HFO formulations in 2015 and began the first commercial production of Natural-Therm® 2.0 HFO Summer and Winter products in 2017. Today, Natural-Therm® 2.0 HFO Summer and Winter are Natural Polymers' flagship closed cell products, designed to provide a reliable and user-friendly application experience.

Natural-Therm® 2.0 HFC	Natural-Therm® 2.0 HFO
<ul style="list-style-type: none">• 3" Max pass.• 4,500–5,000 BDFT theoretical yield.• HFCs react instantly, requiring less heat for the reaction to take place.• Winter grade: 20°F minimum substrate temp.• Minimal creep occurs.	<ul style="list-style-type: none">• 4" Max pass.• 5,000–5,500 BDFT theoretical yield.• More heat drives catalyst reaction.• Winter grade: 20°F minimum substrate temp.• Some creep occurs as a result of the catalyst (catalyst provides shelf life stable to 6 months without performance loss).

Understanding Creep

The term "creep" describes the lateral growth of foam across a substrate that occurs AFTER the initial reaction has completed. Creep may be observed as slight growth laterally, where the foam stops short of the framing members, and may be visible for several seconds after the reaction is completed. Creep may result in a reduced bond to the substrate in the area where the symptom has occurred. This will not be a factor if applying a complete pass within a four-sided cavity because framing members will restrict lateral expansion.

Because of the unique catalysts required for the HFO formulations, these products are more inclined toward creep than HFC formulations. It is one difference that may appear in application behavior as these HFO products provide similar performance and shelf life to HFC counterparts.

Max Pass



Heat Drives the Reaction



Drum Conditioning

- Both excessive temps and drum agitation can create frothing in the drum.
- Caution: Remove caps slowly and carefully as contents may be slightly pressurized resulting in frothing or spraying of material (always wear appropriate PPE).
- Excessive temperatures may cause drum swelling from pressurization (especially top and bottom lids). This may impact drum stacking, however product quality is unchanged if drums remained sealed until use (see precautions for opening caps).
- NEVER circulate chemical to warm up cold drums. Drums should be warmed with blanket or plate heaters with a thermostat set to no higher than 75°F.

Applicator Tips

- Prepare your drums at 65–80°F just as with NT HFC.
- Dial in the product with the same process as the NT HFC. Begin with your temps lower than you expect. Check for ½- to 1-second cream time. If the foam is runny and has a longer cream time, it is too cool. Raise temps 2–3 degrees at a time until optimal conditions are met. Note: You may need to raise your target temps 4–6°F above where HFC settings would be under similar conditions.
- Be aware of the 4" max pass guidance for NT HFO.
- Use ½" flash pass to achieve better bond to substrate in low temps.
- Reference temperature guide chart on product data sheet.
- Be aware of the age of the B-component relative to its shelf life. As the product approaches 6 months, additional temperature may be needed to maintain the optimum reactivity.
- HFO formulas will stay tacky longer than HFC. You may notice this with the overspray and when you are drilling out material from the mixing chamber. This is normal.
- Excess material is likely to build up on the air cap and mixing chamber when processing too hot. If you are cleaning out your mixing chamber excessively, adjust temps to accommodate.
- Apply as close to a 90° angle to the substrate as possible and avoid spraying into rising foam, which can inject air behind the lift and delaminate it from the substrate or cause pocketing.
- At lower substrate temperatures, additional heat may be needed to dial in and speed up the front end of the reaction.

