

# DuPont™ Vertrel® CF

Specialty Fluid

## Carrier Fluid and Rinsing Applications

### Introduction

Vertrel® CF is a patent-pending blend of hydrofluorocarbons Vertrel® XF (2,3-dihydrodecafluoropentane) and HFC-365mfc (1,1,1,3,3-pentafluorobutane). It has “zero” ozone depletion potential, and low global warming potential, making it an ideal replacement for perfluorocarbons (PFCs) in many applications.

This product bulletin summarizes product property, application and use, safety, health, environmental, and regulatory information. Users should also consult the Material Safety Data Sheet (MSDS) for additional information.

Physical properties of Vertrel® CF are shown in **Tables 1 and 2**.

### Applications

Vertrel® CF is intended for use as a carrier solvent for fluorocarbon lubricants, such as DuPont’s Krytox fluorolubricants. It provides a non-flammable, fast drying medium that quickly deposits uniform, thin layer of lubricant. In addition, Vertrel® CF can be used as a rinsing agent or a flushing solvent for micro particulate removal. It is suitable for use in boiling systems such as vapor degreaser systems, due to its excellent compositional stability. Since it has very mild solvency, it should be used in applications where material compatibility is an important factor.

A blend of two hydrofluorocarbons, Vertrel® CF has zero ozone depletion potential, low global warming potential, and is not photochemically reactive. All components of Vertrel® CF are accepted under the USA EPA’s Significant New Alternatives Policy (SNAP).

**Table 1**  
Physical Properties

Property <sup>a</sup>	Vertrel® CF
Molecular Weight	197
Boiling Point, °C (°F)	45 (113)
Liquid Density, g/cc (lb/gal)	1.44 (12.0)
Vapor Pressure, mm Hg (psia)	347 (6.7)
Surface Tension, dyn/cm	15.9
Freezing Point, °C (°F)	-21 (-6)
Heat of Vaporization at Boiling Point, cal/g (Btu/lb)	36 (65)
Heat Capacity, cal/g°C (Btu/lb°F)	0.3 (0.3)
Viscosity, cPs	0.63
Flash Point, °C (°F)	
Closed Cup <sup>b</sup>	None
Open Cup <sup>c</sup>	None
Vapor Flammability in Air, vol%	
Lower Limit	7
Upper Limit	8

<sup>a</sup> At 25°C (77°F), except where indicated.

<sup>b</sup> Pensky Martens Closed Cup Tester (ASTM D 93)

<sup>c</sup> Tag Open Cup Tester (ASTM D 1310-86)

**Table 2**  
Density and Vapor Pressure Change with Temperature

Temperature, °C (°F)	Density, g/cc (lb/gal)	Vapor Pressure, mmHg (psia)
0 (32)	1.5 (12.5)	108 (2.1)
10 (50)	1.47 (12.3)	177 (3.4)
20 (68)	1.45 (12.1)	258 (5.0)
25 (77)	1.44 (12.0)	347 (6.7)
30 (86)	1.42 (11.9)	427 (8.3)
40 (104)	1.4 (11.6)	629 (12.2)
50 (122)	1.37 (11.4)	901 (17.4)
60 (140)	1.34 (11.2)	1,257 (24.3)



## Plastic and Elastomer Compatibility

Most plastics can be safely cleaned in Vertrel® CF. Acrylic, ABS, and polycarbonate parts, particularly if under stress, may show slight cracking or crazing damage and should be tested. EPDM, butyl rubber, Buna-S, and neoprene are recommended for elastomeric parts.

Elastomer swelling and shrinking will, in most cases, revert to within a few percent of original size after air drying. Swell, shrinkage, and extractables are strongly affected by the compounding agents, plasticizers, and curing used in the manufacture of plastics and elastomers. Therefore, prior in-use testing is particularly important

**Tables 3 and 4** summarize test results on short-term exposures of unstressed plastics and elastomers simulating a typical cleaning cycle. Long-term compatibility data simulating exposure of vapor degreaser construction materials is available from DuPont upon request.

**Table 3**  
**Plastic Compatibility**  
**Immersion: 15 Minutes at Room Temperature**

Compatible	
Polyethylene	Acetal
Polypropylene	Epoxy
Polyester, PET, PBT	Liquid Crystal Polymer
Polyimide, PI, PEI, PAI	Phenolic
Polyetherketone, PEK	PTFE, ETFE
Polyaryletherketone, PEEK	Polyvinylchloride
Polyarylsulfone, PAS	Ionomer
Polyphenylene Sulfide, PPS	Chlorinated PVC
Polysulfone, PSO	Polyphenylene Oxide, PPO
Polystyrene	ABS
Cellulosic	
Incompatible <sup>a</sup>	
Acrylic	

<sup>a</sup> Material composition varies depending upon compounding agents, plasticizers, processing, etc. Specific materials should be tested for compatibility with solvent.

**Table 4**  
**Elastomer Compatibility**  
**Immersion: 15 Minutes at Room Temperature**

Compatible	
Buna N, NBR, Nitrile	Buna S, SBR, GRS
Butyl Rubber, IIR	Chlorosulfonated PE
EPM, EPDM, Nordel®	Polysulfide
Natural Rubber, Isoprene	Neoprene
Urethane	Viton® B
	Silicone
Incompatible <sup>a</sup>	
None Tested	

<sup>a</sup> Material composition varies depending upon compounding agents, plasticizers, processing, etc. Specific materials should be tested for compatibility with solvent.

## Metals and Other Compatibility

Vertrel® CF was found compatible with aluminum, copper, and iron.

Vertrel® CF is not compatible with strong bases; therefore, contact with highly basic process materials is not recommended.

## Safety/Exposure Limits

Users of Vertrel® CF must read and understand the DuPont Material Safety Data Sheet (MSDS). Data from toxicity studies have demonstrated that the components of Vertrel® CF have low toxicity and are safe when handled in accordance with DuPont recommendations and when exposures are maintained below recommended exposure limits. Vertrel® CF is a skin and eye irritant and has low acute inhalation toxicity. As with many safely used halocarbon materials, intentional misuse or deliberate inhalation may result in suffocation by oxygen displacement, central nervous system effects or cardiac sensitization effects. Gross over-exposure may be fatal.

**Table 5** shows the applicable exposure limits for the component materials of Vertrel® CF.

## Safety/Flammability

Vertrel® CF exhibits no closed cup or open cup flash point and is not classified as a flammable liquid by NFPA or DOT. However, the product does exhibit vapor flammability limits in air. Users should clear equipment of all vapors and liquids before performing any maintenance operations that could result in an ignition source.

Flash point data and limits of flammability in air provide the user with additional information that should be used as elements of a fire risk assessment and to determine guidelines for the safe handling of volatile chemicals. Users should assure compliance with NFPA standards and local fire codes.

**Table 5**  
**Exposure Limits**

Component	Limit, ppm	Type
Vertrel® XF	AEL <sup>a</sup> 200 400	8- and 12-hr TWA Ceiling <sup>b</sup>
HFC-365mfc	AEL <sup>a</sup> 200	8-hr TWA
Vertrel® CF	AEL <sup>a, b</sup> 200	Calculated <sup>c</sup>

<sup>a</sup> AEL (Acceptable Exposure Limit) is an airborne inhalation exposure limit established by DuPont that specifies time-weighted average concentrations to which nearly all workers may be repeatedly exposed without adverse effects.

<sup>b</sup> A ceiling limit is the concentration that should not be exceeded during any part of the working day. The ceiling limit for individual components applies to the blend product as well.

<sup>c</sup> Calculated in accordance with ACGIH formula for TLVs for mixtures. (TLV [Threshold Limit Value] is an air-borne inhalation exposure limit established by the American Conference of Government and Industrial Hygienists (ACGIH) that specifies time-weighted average concentrations to which nearly all workers may be repeatedly exposed without adverse effects.)

## Recovery

Vertrel® CF is easily recoverable by off-line or in-line distillation equipment such as a vapor degreaser or still. The presence of soil however, may alter the characteristics of the material during the recovery operation. Recovery should be closely monitored to ensure operating levels are maintained. Users should test the spent Vertrel® CF to ensure proper classification for waste disposal.

## Storage/Handling

Vertrel® CF is thermally stable and does not oxidize or degrade during storage. Store in a clean, dry area. Protect from freezing temperatures. Do not allow stored product to exceed 52°C (125°F) to prevent leakage or potential rupture of container from pressure and expansion.

Consideration should be given to retrofit of existing, or purchase of new, vapor degreasing equipment to provide vapor containment technology that enables safe and economical use of Vertrel® CF.

Although Vertrel® CF is not classified as a flammable liquid by DOT/NFPA, it does have flammable limits in air. A drum pump is recommended to dispense the product from its container. If an electric drum pump is used, avoid operation near open equipment or when solvent vapors are present. In these cases, consideration should be given to the use of a flammable-rated drum pump. If a large release of vapors occurs, such as from a large leak or spill, the vapors may concentrate near the floor or in subfloor areas and displace the oxygen available for breathing, causing suffocation. Evacuate everyone until the area has been well ventilated. Do not re-enter the affected areas without self-contained breathing apparatus unless the Vertrel® CF concentration is below the AEL.

## Environmental Legislation

Vertrel® CF is accepted by the U.S. Environmental Protection Agency (EPA) under the Significant New Alternatives Policy (SNAP) program, as a substitute for ozone-depleting substances (**Table 6**). The components of Vertrel® CF are listed in the TSCA inventory. One component, HFC-43-10mee, is subject to the Significant New Use Rule (SNUR) and should be used only in the indicated applications.

Vertrel® CF is exempt from classification as a volatile organic compound (VOC) by the EPA. The product is also VOC compliant under the California South Coast Air Quality Management District (SCAQMD) regulations, which require VOC content less than 50 g/L of solvent.

Vertrel® CF is not a hazardous air pollutant (HAP), and therefore not subject to NESHAP regulation. Vertrel® CF is not included in the SARA Title III Section 313 list of toxic chemicals, and is not subject to SARA Title III (EPCRA) reporting requirements.

## Packaging and Availability

Vertrel® CF is available commercially in 55-gal (208-L) drums with a net weight of 540 lb (245 kg) and in 5-gal (19-L) pails with a net weight of 50 lb (23 kg). One-gallon and smaller samples in glass containers are available on request.

## Specifications

Composition and specifications are shown in **Table 7**. All components are listed in the TSCA Inventory.

**Table 6**  
Environmental Properties

Property	ODP <sup>a</sup>	GWP (100 yr ITH) <sup>b</sup>	Photochemical VOC <sup>c</sup>
Vertrel® XF	0	1300	Exempt
HFC-365mfc	0	890	Exempt

<sup>a</sup> ODP – ozone depletion potential

<sup>b</sup> GWP – global warming potential

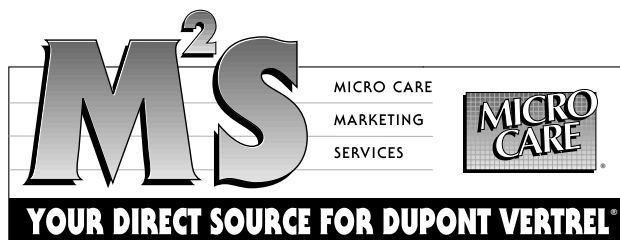
<sup>c</sup> VOC – volatile organic compound

**Table 7**  
Vertrel® CF Specifications

Vertrel® XF, wt%	60.0 ± 1.0
HFC-365mfc, wt%	40.0 ± 1.0
Nonvolatile Residue, ppm wt	100 max.
Moisture, ppm wt	200 max.
Appearance	Clear, colorless

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