

# DuPont™ Vertrel® CMS

Specialty Fluid - Developmental Product

## Defluxing Precision Metal Cleaning Removes Rosin, Oils, Ionic Contaminants

### Introduction

Vertrel® CMS is a patent-pending blend of hydrofluorocarbons Vertrel® XF (2,3-dihydrodecafluoropentane) and HFC-365mfc (1,1,1,3,3-pentafluorobutane) with trans-1,2-dichloroethylene and methanol. It has “zero” ozone depletion potential, and low global warming potential, making it an ideal replacement for HCFC 141b and perfluorocarbons (PFCs) in many applications. All components of Vertrel® CMS are accepted under the USA EPA’s Significant New Alternatives Policy (SNAP).

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® CMS are shown in **Table 1** and **2**.

### Applications

Vertrel® CMS is intended for applications to remove rosin-based fluxes from electronic assemblies. It can also be used in applications for precision cleaning of metal or solvent-safe plastic substrates. It is suitable for use in boiling systems such as vapor degreaser systems, due to its excellent compositional stability. Since it has enhanced solvency, compatibility with plastic and elastomeric materials should be checked prior to use.

Vapor degreasing should be used for optimum cleaning effectiveness and economy. Modern vapor containment technology is recommended for both batch and in-line equipment. These systems have higher freeboard and a secondary set of low-temperature (–29 °C [–20°F]) condenser coils to reduce vapor loss.

**Table 1**  
Physical Properties

Property <sup>a</sup>	Vertrel® CMS
Molecular Weight	125
Boiling Point, °C (°F)	36 (97)
Liquid Density, g/cc (lb/gal)	1.33 (11.1)
Vapor Pressure, mm Hg (psia)	497 (9.6)
Surface Tension, dyn/cm	19.2
Freezing Point, °C (°F)	–27 (–17)
Heat of Vaporization at Boiling Point, cal/g (Btu/lb)	54 (96)
Heat Capacity, cal/g°C (Btu/lb°F)	0.3 (0.3)
Viscosity, cPs	0.58
Flash Point, °C (°F)	
Closed Cup <sup>b</sup>	None
Open Cup <sup>c</sup>	28 (82)
Vapor Flammability in Air, vol%	
Lower Limit	6.25
Upper Limit	14

<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)	1.39 (11.6)	166 (3.2)
10 (50)	1.36 (11.4)	264 (5.1)
20 (68)	1.34 (11.2)	405 (7.8)
25 (77)	1.33 (11.1)	497 (9.6)
30 (86)	1.32 (11.0)	601 (11.6)
40 (104)	1.30 (10.8)	866 (16.7)
50 (122)	1.27 (10.6)	1,216 (23.5)
60 (140)	1.25 (10.4)	1,668 (32.3)



## Plastic and Elastomer Compatibility

Most plastics commonly used for components mounted on printed wiring board assemblies can be safely cleaned in Vertrel® CMS. 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	
Incompatible <sup>a</sup>	
Polystyrene	ABS
Cellulosic	Acrylic
Polyphenylene Oxide, PPO	Polycarbonate

<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	EPM, EPDM, Nordel® Polysulfide
Natural Rubber, Isoprene	Neoprene
Urethane	Viton® B Silicone
Incompatible <sup>a</sup>	
Chlorosulfonated PE	

<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® CMS was found compatible with aluminum, copper, and iron, with and without rosin flux present, after exposure for two weeks at 36°C (97°F) in sealed tubes.

Large amounts of water may extract alcohol and affect cleaning performance. Therefore, to reduce alcohol loss, use desiccant dryers rather than water separators in the condensate return line.

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

## Safety/Exposure Limits

Users of Vertrel® CMS must read and understand the DuPont Material Safety Data Sheet (MSDS). Data from toxicity studies have demonstrated that the components of Vertrel® CMS have low toxicity and are safe when handled in accordance with DuPont recommendations and when exposures are maintained below recommended exposure limits. Vertrel® CMS 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® CMS.

## Safety/Flammability

Vertrel® CMS exhibits no closed cup flash point per the Pensky-Martens Closed Cup Tester (ASTM D93) and is not classified as a flammable liquid by NFPA or DOT. The product does exhibit vapor flammability limits in air, and has the potential to ignite in an open vessel or in case of a spill, if an ignition source is present. However, laboratory tests with virgin solvent in an open vessel show the solvent did not sustain combustion, and quickly self-extinguishes. 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
Trans-1,2-dichloroethylene	TLV <sup>c</sup> 200	8-hr TWA
Methanol	AEL 200 TLV 200 STEL <sup>d</sup> 250	8- and 12-hr TWA 8-hr TWA
Stabilizer	AEL 10 TLV 20	8- and 12-hr TWA 8-hr TWA
Vertrel® CMS	AEL <sup>a, b</sup> 200	Calculated <sup>e</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> 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.

<sup>d</sup> STEL is short-term exposure limit established by ACGIH.

<sup>e</sup> Calculated in accordance with ACGIH formula for TLVs for mixtures.

## Recovery

Vertrel® CMS 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® CMS to ensure proper classification for waste disposal.

## Storage/Handling

Vertrel® CMS is thermally stable and does not oxidize or degrade during storage. Store in a clean, dry area. Protect from freezing temperatures. If solvent is stored below -10°C (14°F), mix prior to use. 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® CMS.

Although Vertrel® CMS 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® CMS concentration is below the AEL.

## Environmental Legislation

Vertrel® CMS 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® CMS are listed in the TSCA inventory. One component, HFC-43-10mcc, is subject to the Significant New Use Rule (SNUR) and should be used only in the indicated applications.

The methanol component of Vertrel® CMS is considered a hazardous air pollutant (HAP), and therefore is subject to NESHAP regulation. Methanol is included in the SARA Title III Section 313 list of toxic chemicals, and is subject to SARA Title III (EPCRA) reporting requirements.

**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
Trans-1,2-dichloroethylene	0	—	Not Exempt
Methanol	0	—	Not Exempt
Stabilizer	0	—	Not Exempt

<sup>a</sup> ODP – ozone depletion potential  
<sup>b</sup> GWP – global warming potential  
<sup>c</sup> VOC – volatile organic compound

## Packaging and Availability

Vertrel® CMS is available commercially in 55-gal (208-L) drums with a net weight of 500 lb (226 kg) and in 5-gal (19-L) pails with a net weight of 45 lb (20 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 7**  
**Vertrel® CMS Specifications**

Vertrel® XF, wt%	37.4 ± 1.0
HFC 365mfc, wt%	18.0 ± 1.0
Trans-1,2-dichloroethylene, wt%	41.0 ± 1.0
Methanol, wt%	3.5 ± 0.3
Stabilizer, wt%	0.10 ± 0.05
Nonvolatile Residue, ppm wt	100 max.
Moisture, ppm wt	200 max.
Appearance	Clear, colorless

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