Vertrel™ MCA

Specialty Fluid

Precision Cleaning

Technical Information

Introduction

Vertrel™ MCA is a proprietary azeotrope of Vertrel™ XF hydrofluorocarbon (2,3-dihydrodeca-fluoropentane) with trans-1,2-dichloroethylene. It is ideally suited for use in vapor degreasing equipment. Its enhanced solvency power, compared to Vertrel™ XF alone, makes it particularly effective for precision and specialty cleaning with difficult soils.

Vertrel™ MCA has zero ozone depletion potential and low global warming potential. It can replace CFC-113, methyl-chloroform (1,1,1-TCA), hydrochlorofluorocarbons (HCFCs), and perfluorocarbons (PFCs) in many applications. Vertrel™ MCA 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.

Physical properties of Vertrel™ MCA are shown in **Tables 1** and **2**.

Table 1. Physical Properties

Property[a]	Vertrel™ MCA	CFC-113
Molecular Weight	157	187
Boiling Point, °C (°F)	39 (102)	47.6 (117.6)
Liquid Density, kg/L	1.41	1.56
Vapor Pressure, atm	0.610	TBD
Surface Tension, N/m	0.0152	TBD
Freezing Point, °C (°F)	<-50 (<-58)	–35 (-31)
Solubility of Water, wt%	0.065	0.011
Heat of Vaporization at Boiling Point, kJ/kg	181.2	TBD
Heat Capacity, kJ/kg • °C	1.13	TBD
Viscosity, cP	0.49	0.68
Flash Point Closed Cup[b] Open Cup[c]	 None None	 None None
Vapor Flammability in Air, vol% Lower Limit Upper Limit	 None None	 None None

[a]At 25°C (77°F), except where indicated.

[b]Pensky-Martens Closed Cup Tester (ASTM D93)

[c]Tag Open Cup Tester (ASTM D1310)

Table 2. Density and Vapor Pressure Change with Temperature

Temperature, °C (°F)	Density, kg/L	Vapor Pressure, atm
0 (32)	1.47	0.213
10 (50)	1.44	0.339
20 (68)	1.42	0.493
25 (77)	1.41	0.587
30 (86)	1.39	0.726
40 (104)	1.37	1.046
50 (122)	1.35	1.462
60 (140)	1.33	1.985

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Cleaning Process

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.

Vertrel™ MCA has a broad range of cleaning capabilities. **Table 3** lists some typical soils readily removed from parts in a short vapor degreasing cycle.

Table 3. Soils Cleaned with Vertrel™ MCA

Cutting Oils	Stamping Oils
Gear Oils	Vacuum Oils
Heavy Greases	Waxes
Hydraulic Oils	Mineral Oils

Oxygen Cleaning

Oxygen cleaning requires solvents that have good degreasing properties and a high cleaning effectiveness factor (i.e., Kb value >20). These solvents must also be easy to remove from cleaned parts (i.e., boiling point >25°C [77°F] and <65°C [149°F]), non-corrosive, compatible with commonly used metallic and non-metallic materials, compatible with oxygen (i.e., low particle count), have low NVR, and nonflammable (i.e., no flash point and no flammability limits). Vertrel™ MCA meets these oxygen cleaning requirements as shown in **Table 4**. Vertrel™ MCA is listed by the Compressed Gas Association in the directory of cleaning agents for oxygen service and also meets liquid oxygen mechanical impact testing in accordance with ASTM method.

Table 4. Oxygen Cleaning Requirements and Vertrel™ MCA

Parameter	Oxygen Cleaning Requirements	Vertrel™ MCA
Kb Value	>20	25
Boiling Point	>25°C (77°F) and <65°C (149°F)	39°C (102°F)
Flammability	None	None
Flammability Limits	None	None
Oxygen Compatibility	Low particle count and non-volatile residue	See Specifications Table 8
Material Compatibility	Commonly uses metals and non-metallic materials	See Metals and Other section

Plastic and Elastomer Compatibility

Vertrel™ MCA is compatible with most polymeric materials commonly encountered in degreasing of precision parts. 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.

Tables 5 and **6** 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 Chemours upon request.

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.

Table 5. Plastic Compatibility Immersion: 15 Minutes at Room Temperature

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

*Material composition varies depending upon compounding agents, plasticizers, processing, etc. Specific materials should be tested for compatibility with solvent.

Table 6. Elastomer Compatibility Immersion: 1 Week at 39°C (102°F)

Compatible	
Polysulfide (Thiokol FA)	EPDM (Nordel®)
Chlorosulfonated PE	Butyl Rubber*
Neoprene*	
Require Additional Testing	
Buna-N	Polychloroprene
Urethane	Silicone
Buna-S*	Natural Rubber
Fluoroelastomers	

*Swelling, but with low extractables

Metals and Other Compatibility

Vertrel™ MCA was found compatible with aluminum, copper, and iron, with and without oil present, after exposure for 2 weeks at 120°C (248°F) in sealed tubes.

Contact with highly basic process materials, pH 10 or above, is not recommended.

Exposure Limits

Data from acute toxicity studies has demonstrated that Vertrel™ MCA has low toxicity. It is a slight skin and eye irritant and has low inhalation toxicity. **Table 7** shows the applicable exposure limits for the component materials of Vertrel™ MCA.

AEL and TLV limits are time weighted average (TWA) concentrations for a normal 8- or 12-hr workday and a 40-hr workweek to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. Please refer to the Safety Data Sheet (SDS) for additional details.

Table 7. Exposure Limits

Component	Limit, ppm		Type
Vertrel™ XF	AEL[a]	200 400	8- and 12-hr TWA Ceiling[b]
Trans-1,2-dichloroethylene	TLV[c]	200	8-hr TWA
Vertrel" MCA	AEL[a,b]	200	Calculated

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

[b]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.

[c]Threshold Limit Value (TLV) is an airborne 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.

[d]Calculated in accordance with ACGIH formula for TLVs for mixtures

Safety/Flammability

Vertrel™ MCA exhibits no closed cup or open cup flash point and is not classified as a flammable liquid by NFPA or DOT. In addition, the product has no vapor flammability limits in air.

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 ensure compliance with NFPA standards and local fire codes.

Recovery

Due to the azeotropic nature of Vertrel™ MCA, the product 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™ MCA to ensure proper classification for waste disposal.

Storage/Handling

Vertrel™ MCA 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™ MCA.

Drum pumps are recommended to dispense Vertrel™ MCA from its container. Refer to the SDS for specific handling precautions and instructions.

Environmental Legislation

Vertrel™ specialty fluids have zero ozone depletion potential and low global warming potential (**Table 8**). They are used as alternatives to CFC-113, methylchloroform, HCFCs, and PFCs in many critical cleaning, drying, carrier fluid, and other high-value specialty uses where reliability is paramount.

Vertrel™ MCA is accepted by the EPA under the SNAP program as a substitute for ozone-depleting substances.

The components of Vertrel™ MCA 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. See SDS Regulatory Section.

Vertrel™ MCA is not a hazardous air pollutant (HAP) and, therefore, not subject to NESHAP regulation. Vertrel™ MCA 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.

Table 8. Environmental Properties

Property	Vertrel™ MCA
Ozone Depletion Potential (ODP)	0
Global Warming* Potential (GWP/100 yr ITH)	806
Volatile Organic Compounds (VOC, g/L)	536

*IPCC Second Assessment Report (1995)

Packaging and Availability

Vertrel™ MCA is available commercially in 55-gal (208-L) drums with a net weight of 550 lb (249 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. Customers are encouraged to secure samples for compatibility and performance testing.

Specifications

Composition and specifications are shown in **Table 9**. All components are listed in the TSCA Inventory.

Table 9. Vertrel™ MCA Specifications

Property	Vertrel™ MCA
Vertrel™ XF, wt%	62.0 ± 1.0
Trans-1,2-dichloroethylene, wt%	38.0 ± 1.0
Total Purity, wt%	99.8 min.
Nonvolatile Residue, ppm wt	10 max.*
Moisture, ppm wt	100 max.
Acidity (as HCl), ppm wt	1.0 max.
Chloride, ppm wt	1.0 max.
Particle Count, mg/L	2.0 max.
Appearance	Clear, colorless

*50 ppm max. in 5-gal/19-L pails

For more information on Vertrel™, please visit opteon.com or call (800) 235-7882.

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