

DuPont™ Vertrel® MCA Plus

Specialty Fluid

Precision Cleaning of Metals Removes Heavy Oil, Grease, Wax, Vacuum Oil Removes Difficult Soils

Introduction

Vertrel® MCA Plus is a proprietary blend of Vertrel® XF hydrofluorocarbon (2,3-dihydrodecafluoropentane) with trans-1,2-dichloroethylene and cyclopentane. It is ideally suited for use in vapor degreasing equipment for precision cleaning and specialty applications. Its enhanced solvency power makes it particularly effective with difficult soils.

Vertrel® MCA Plus 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 Plus 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 Plus are shown in **Table 1**.

Table 1
Physical Properties

Property ^a	Unit	Vertrel® MCA Plus	HCFC- 141b	1,1,1 TCA	Freon® TF	
Molecular Weight	—	136	117	133	187	
Boiling Point	°C	38	32	74	48	
	°F	100	90	165	118	
Liquid Density	g/cc	1.33	1.24	1.31	1.56	
	lb/gal	11.1	10.3	11.0	13.1	
Vapor Pressure	mm Hg	461	594	140	226	
	psia	8.9	11.5	2.7	4.4	
Surface Tension	dyne/cm	16.1	19.3	25.9	17.3	
Freezing Point	°C	<-50	-103	<-50	-35	
	°F	<-58	-154	<-58	-31	
Heat of Vaporization at boiling point	cal/g	51	53	57	35	
	Btu/lb	92	94	102	63	
Heat Capacity	cal/g °C	0.28	0.25	0.26	0.22	
	Btu/lb °F	0.28	0.25	0.26	0.22	
Viscosity	cPs	0.49	0.43	0.45	0.67	
Flash Point	°C	None ^b	None	None	None	
	°C	None ^c	None	—	None	
Vapor Flammability In Air						
	Lower Limit	vol%	6	7.6	7.0	None
	Upper Limit	vol%	11	17.7	15.0	None

^a At 25°C (77°F) except where indicated.

^b Pinsky-Martens Closed Cup Tester (ASTM D 93)

^c Tag Open Cup Tester (ASTM D 1310)



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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 Plus has a broad range of cleaning capabilities. **Table 2** lists some typical soils readily removed from parts in a short vapor degreasing cycle.

Table 2
Soils Cleaned with Vertrel® MCA Plus

Cutting Oils	Stamping Oils
Drawing Oils	Synthetic Oils (POE, POG, etc.)
Gear Oils	Vacuum Oils
Heavy Greases	Waxes
Hydraulic Oils	Mineral Oils

Plastic and Elastomer Compatibility

Vertrel® MCA Plus is compatible with most polymeric materials commonly encountered in degreasing of precision parts. EPDM, butyl rubber, Buna-S, and neoprene are recommended for elastomeric parts.

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.

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 3
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	Polypropylene
Polyarylsulfone, PAS	Chlorinated PVC
Polyphenylene Sulfide, PPS	Ionomer
Polysulfone, PSO	
Incompatible ^a	
Polystyrene	ABS
Polyphenylene Oxide, PPO	Acrylic
	Cellulosic

^a Material composition varies depending upon compounding agents, plasticizers, processing, etc. Specific materials should

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 ^a	
None Tested	

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

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Metals and Other Compatibility

Vertrel® MCA Plus was found compatible with aluminum, copper, zinc, carbon steel, and stainless steel.

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 Plus has low toxicity. It is a slight skin and eye irritant and has low inhalation toxicity. **Table 5** shows the applicable exposure limits for the component materials of Vertrel® MCA Plus.

Table 5
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
Cyclopentane	AEL 600 TLV 600	8- and 12-hr TWA 8-hr TWA
Vertrel® MCA Plus	AEL ^{a, b} 214	Calculated ^d

^a 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.

^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 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.

^d Calculated in accordance with ACGIH formula for TLVs for mixtures.

Safety/Flammability

Vertrel® MCA Plus 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. 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.

Recovery

Vertrel® MCA Plus is readily recoverable. During some recovery operations, however, especially with flammable soils, or where the composition of the Vertrel® MCA Plus in the liquid or vapor state may change (e.g., during distillation), it is possible for the mixture to exhibit either a flash point or wider UEL and LEL.

Because the product is not a true azeotrope, the concentration of Vertrel® XF may decrease in the boiling liquid during recovery operations. This may change the flammable characteristics of the remaining mixture, especially during the last 25 percent of the recovery operation or with heavy soil loading. Unless recovery equipment is rated for flammables, it is recommended that no more than 75 percent of the liquid be recovered (i.e., stop the recovery process when 75 percent of the liquid has been boiled over and recovered). This should ensure an adequate concentration of Vertrel® XF to suppress the flammability characteristics of the remaining liquid. However, the customer should check carefully for flammability in their particular application.

Recovery operations should be monitored closely to ensure operating levels are maintained. Users should test the spent Vertrel® MCA Plus to ensure proper classification for waste disposal.

Storage/Handling

Vertrel® MCA Plus 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 Plus.

Although Vertrel® MCA Plus 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. Refer to the Material Safety Data Sheet for specific handling precautions and instructions.

Environmental Legislation

Vertrel® specialty fluids have “zero” ozone depletion potential and low global warming potential (**Table 6**). They are used as alternatives to CFC-113, methylchloroform, hydrochlorofluorocarbons (HCFCs), and perfluorocarbons (PFCs) in many critical cleaning, drying, carrier fluid, and other high-value specialty uses where reliability is paramount.

Vertrel® MCA Plus 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.

The components of Vertrel® MCA Plus are listed in most country chemical inventories, such as TSCA in the U.S., ELINICS in Europe, Chemical Substances Control Law (MITI/MHW) in Japan, DSL (notified) in Canada, NICNAS in Australia, and TCCL in Korea.

Vertrel® MCA Plus is not a hazardous air pollutant (HAP), and therefore not subject to NESHAP regulation. Vertrel® MCA Plus 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 6
Environmental Properties

Property	Vertrel® MCA Plus
Ozone-Depletion Potential (ODP)	0
Global Warming Potential (GWP/100 yr ITH)	650
Volatile Organic Compounds (VOC, g/L)	665

Packaging and Availability

Vertrel® MCA Plus is available commercially in 55-gal (208-L) drums with a net weight of 500 lb (227 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. Customers are encouraged to secure samples now for compatibility and performance testing.

Specifications

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

Table 7
Vertrel® MCA Plus Specifications

Vertrel® XF, wt%	50.0 ± 1.0
Trans-1,2-dichloroethylene, wt%	45.0 ± 1.0
Cyclopentane, wt%	5.0 ± 0.3
Nonvolatile Residue, ppm wt	10 max.*
Moisture, ppm wt	200 max.
Appearance	Clear, colorless

*50 ppm max. in 5-gal pails.

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