

# DuPont™ Vertrel® SMT

## SPECIALTY FLUID

### Technical Information

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

### Introduction

DuPont™ Vertrel® SMT is a proprietary azeotrope of DuPont™ Vertrel® XF hydrofluorocarbon (2,3 dihydrodecafluoropentane) with trans-1,2-dichloroethylene and methanol. It is ideally suited for use in vapor degreasing equipment with solvency power for cleaning ionic soils and flux residues from electronic assemblies. It can also be used for precision and general industrial cleaning where this enhanced solvency is required.

DuPont™ Vertrel® SMT has “zero” ozone-depletion potential, and low global warming potential. It can replace CFC-113, 1,1,1-trichloroethane (1,1,1-TCA), hydrochlorofluorocarbons (HCFCs), and perfluorocarbons (PFCs) in many applications. DuPont™ Vertrel® SMT is accepted by the U.S. Environmental Protection Agency under the Significant New Alternatives Policy (SNAP) program, as a substitute for ozone-depleting substances.

Physical properties of DuPont™ Vertrel® SMT are shown in **Tables 1** and **2**.

### 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.

In a test with RMA and RA flux soldered assemblies, DuPont™ Vertrel® SMT gave lower ionics and residual rosin levels when compared to the CFC-113/methanol azeotrope under identical cleaning cycles of 2 minutes boil sump and 1 minute rinse sump. DuPont™ Vertrel® SMT is also effective in removing heavy industrial soils (e.g., mineral oil, vacuum oil, wax, heavy grease) from parts in a short vapor degreasing cycle.

**Table 1**  
**Physical Properties**

Property <sup>a</sup>	DuPont™ Vertrel® SMT	HCFC-141b with MeOH
Molecular Weight	128	106
Boiling Point, °C (°F)	37 (99)	29 (85)
Liquid Density, kg/l	1.37	1.22
Vapor Pressure, atm	0.639	TBD
Surface Tension, N/m	0.0155	TBD
Freezing Point, °C (°F)	<–50 (<–58)	<–103 (<–154)
Solubility of Water, wt%	0.34	—
Heat of Vaporization at Boiling Point, kJ/kg	207.1	TBD
Heat Capacity, kJ/kg·°C	1.13	TBD
Viscosity, cPs	0.47	0.45
Flashpoint		
Closed Cup	None <sup>b</sup>	None <sup>c</sup>
Open Cup	None <sup>d</sup>	None <sup>d</sup>
Vapor Flammability in Air, vol%		
Lower Limit	7	6
Upper Limit	15	20

<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 Closed Cup Tester (ASTM D 56)

<sup>d</sup> Tag Open Cup Tester (ASTM D 1310)



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

Temperature, °C (°F)	Density, kg/l	Vapor Pressure, atm
0 (32)	1.42	0.217
10 (50)	1.40	0.338
20 (68)	1.38	0.510
25 (77)	1.37	0.619
30 (86)	1.36	0.748
40 (104)	1.33	1.071
50 (122)	1.31	1.501
60 (140)	1.29	2.061

## Plastic and Elastomer Compatibility

Most plastics commonly used for components mounted on printed wiring board assemblies can be safely cleaned in DuPont™ Vertrel® SMT. Acrylic, ABS, and poly-carbonate 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	

<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: 1 Week at 39°C

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	
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

DuPont™ Vertrel® SMT was found compatible with aluminum, copper, and iron, with and without rosin flux present, after exposure for two weeks at 120°C (248°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.

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

## Exposure Limits

Data from acute toxicity studies has demonstrated that DuPont™ Vertrel® SMT has low toxicity. DuPont™ Vertrel® SMT is a slight skin and eye irritant and has low acute inhalation toxicity. **Table 5** shows the applicable exposure limits for the component materials of DuPont™ Vertrel® SMT.

## Safety/Flammability

DuPont™ Vertrel® SMT 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
DuPont™ Vertrel® XF	AEL <sup>a</sup> 200 400	8- and 12-hr TWA Ceiling <sup>b</sup>
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
DuPont™ Vertrel® SMT	AEL <sup>a, b</sup> 192	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

DuPont™ Vertrel® SMT is readily recoverable. During some recovery operations, however, especially with flammable soils, or where the composition of the DuPont™ Vertrel® SMT 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.

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 DuPont™ Vertrel® XF to suppress the flammability characteristics of the boiling 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 DuPont™ Vertrel® SMT to ensure proper classification for waste disposal.

## Storage/Handling

DuPont™ Vertrel® SMT 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 DuPont™ Vertrel® SMT.

Although DuPont™ Vertrel® SMT 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

DuPont™ 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.

DuPont™ Vertrel® SMT 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 DuPont™ Vertrel® SMT 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 MSDS Regulatory Section.

The methanol component of DuPont™ Vertrel® SMT 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	DuPont™ Vertrel® SMT
Ozone-Depletion Potential (ODP)	0
Global Warming Potential (GWP/100 yr ITH)*	688
Volatile Organic Compounds (VOC, g/L)	645

\* IPCC Second Assessment Report (1995)

## Packaging and Availability

DuPont™ Vertrel® SMT 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 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**  
**DuPont™ Vertrel® SMT Specifications**

DuPont™ Vertrel® XF, wt%	52.9 ± 1.0
Trans-1,2-dichloroethylene, wt%	43.0 ± 1.0
Methanol, wt%	4.0 ± 0.3
Stabilizer, wt%	0.10 ± 0.05
Nonvolatile Residue, ppm wt	10 max.*
Moisture, ppm wt	200 max.
Appearance	Clear, colorless

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

**If you are interested in purchasing or finding out more about DuPont™ Vertrel® please use the list below to contact the DuPont office closest to you.**

### North America

DuPont Fluorochemicals  
Customer Service Center  
Chestnut Run Plaza 702  
Wilmington, DE 19880-0702  
Ph: 800-969-4758 (U.S. only)  
Ph: 1-302-774-1160 (Outside U.S.)

### Europe, Middle East, Africa

DuPont de Nemours Intl., S.A.  
2, Chemin du Pavillon  
CH-1218 Le Grand-Saconnex/GE  
Switzerland  
Ph: 41 22 717 5296  
Fax: 41 22 717 6169

### Asia Pacific

DuPont-Mitsui Fluorochemicals Co. Ltd.  
Chiyoda Honsha Building  
1-5-18 Sarugaku-cho  
Chiyoda-Ku Tokyo 101  
Japan  
Ph: 03 5281 5850 (Japan only)  
Ph: 1-302-774-1160 (All others)

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**CAUTION:** Do not use in medical applications involving permanent implantation in the human body or contact with internal body fluids or tissues. For other medical applications, see "DuPont Medical Caution Statement," H-50102.

