# DuPont™ Vertrel® XE

## SPECIALTY FLUID

Technical Information

# Removes Particulate and Ionic Soils

## Introduction

DuPont™ Vertrel® XE is a proprietary azeotrope of DuPont™ Vertrel® XF hydrofluorocarbon (2,3-dihydrodecafluoropentane) with ethanol. It is ideally suited for use in vapor degreasing equipment. It offers improved solvency for polar soils, compared to DuPont™ Vertrel® XF, while maintaining excellent compatibility with most plastic, ceramic, and metal components. Typical applications include precision and specialty cleaning and rinsing for removal of particulate, fingerprints, and light soils from metal, plastic, and glass parts.

DuPont™ Vertrel® XE 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® XE is accepted by the U.S. Environmental Protection Agency under the Significant New Alternatives Program (SNAP) program, as a substitute for ozone-depleting substances.

Its unique properties (**Tables 1** and **2**) include a high density, low viscosity, and low surface tension for effective particle and soil removal.

## 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 greatly reduce vapor losses.

## Plastic and Elastomer Compatibility

Most plastics and elastomers can be safely cleaned in DuPont™ Vertrel® XE. **Tables 3** and **4** summarize test results on short-term exposures of unstressed plastics and elastomers simulating a typical cleaning cycle.

Long-term exposure data simulating exposure of vapor degreaser construction materials is available from DuPont upon request.

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

| Property[a] | DuPont™ Vertrel® XE |
|---|---|
| Molecular Weight | 214 |
| Boiling Point, °C (°F) | 52 (126) |
| Liquid Density, kg/l | 1.52 |
| Vapor Pressure, atm | 0.329 |
| Surface Tension, N/m | 0.0141 |
| Freezing Point, °C (°F) | <–80 (<–112) |
| Heat of Vaporization (at boiling point), kJ/kg) | 144.8 |
| Heat Capacity, kJ/kg•°C) | 1.13 |
| Viscosity, cPs | 0.73 |
| Flash Point | |
| Closed Cup[b] | None |
| Open Cup[c] | None |
| Vapor Flammability in Air, vol% | |
| Lower Limit | None |
| Upper Limit | None |

[a] At 25°C (77°F), except where indicated.
[b] Setaflash Closed Cup Tester (ASTM D 3278)
[b] 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) | 1.58 | 0.076 |
| 10 (50) | 1.56 | 0.146 |
| 20 (68) | 1.53 | 0.255 |
| 25 (77) | 1.52 | 0.329 |
| 30 (86) | 1.50 | 0.416 |
| 40 (104) | 1.48 | 0.638 |
| 50 (122) | 1.45 | 0.932 |
| 60 (140) | 1.42 | 1.306 |

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

| Compatible | |
|---|---|
| Polyethylene | ABS |
| Polypropylene | Acetal |
| Polystyrene | Acrylic |
| Polyester, PET, PBT | Epoxy |
| Polyphenylene Oxide, PPO | Ionomer |
| Polyimide, PI, PEI, PAI | Liquid Crystal Polymer |
| Polyetherketone, PEK | Phenolic |
| Polyaryletherketone, PEEK | PVC, CPVC |
| Polysulfone | PTFE, ETFE |
| Polyarylsulfone | Cellulosic |
| Polyphenylene Sulfide, PPS | |
| **Incompatible[a]** | |
| None Tested | |

[a] 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[a]** | |
| None Tested | |

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

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.

## Metals and Other Compatibility

DuPont™ Vertrel® XE was found compatible with zinc, stainless steel, aluminum, copper, and brass after exposure for two weeks at 100°C (212°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® XE has low toxicity. DuPont™ Vertrel® XE 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® XE.

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

| Component | Limit, ppm | | Type |
|---|---|---|---|
| DuPont™ Vertrel® XF | AEL[a] | 200<br>400 | 8- and 12-hr TWA<br>Ceiling[b] |
| Ethanol | AEL<br>TLV[c] | 1,000<br>1,000 | 8- and 12-hr TWA<br>8-hr TWA |
| DuPont™ Vertrel® XE | AEL[a, b] | 235 | 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

DuPont™ Vertrel® XE 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 assure compliance with NFPA standards and local fire codes.

## Recovery

Due to the azeotropic nature of DuPont™ Vertrel® XE, 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 DuPont™ Vertrel® XE to ensure proper classification for waste disposal.

## Storage/Handling

DuPont™ Vertrel® XE 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® XE.

Drum pumps are recommended to dispense DuPont™ Vertrel® XE 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® XE 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® XE 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 the denatured alcohol used in DuPont™ Vertrel® XE is considered a hazardous air pollutant (HAP), and therefore, is subject to NESHAP regulation. Spent DuPont™ Vertrel® XE is not a RCRA characteristic or listed waste. However, addition of contaminants could change that status. 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® XE |
|---|---|
| Ozone-Depletion Potential (ODP) | 0 |
| Global Warming* Potential (GWP/100 yr ITH) | 1248 |
| Volatile Organic Compounds (VOC, g/L) | 61 |

*IPCC Second Assessment Report (1995)

## Packaging and Availability

DuPont™ Vertrel® XE is commercially available in 55-gal (208-L) drums with a net weight of 600 lb (272 kg) and in 5-gal (19-L) pails with a net weight of 55 lb (25 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® XE Specifications**

| | |
|---|---|
| DuPont™ Vertrel® XF, wt% | 96.0 ± 0.5 |
| Ethanol (SDA), wt% | 4.0 ± 0.3 |
| Nonvolatile Residue, ppm wt | 2.0 max. |
| Moisture, ppm wt | 200 max |
| Appearance | Clear, colorless |

**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

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Customer Service Center
Chestnut Run Plaza 702
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