

# DuPont™ Vertrel® X-P10

Specialty Fluid

## Removes Water, Particulate, and Ionic Soils

### Introduction

Vertrel® X-P10 is a special solvent blend based on Vertrel® XF hydrofluorocarbon (2,3-dihydrodecafluoropentane) and isopropanol. It is intended for use in the removal of water from nonporous surfaces, as well as cleaning particulate and ionic soils from component parts. It offers improved solvency for polar soils, compared to Vertrel® XF, while maintaining excellent compatibility with most plastic, ceramic, and metal components. Typical applications include absorption drying, precision and specialty cleaning and rinsing for removal of particulate, light soils and fingerprints from plastic, glass, and metal parts.

Vertrel® X-P10 has “zero” ozone-depleting 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. Vertrel® X-P10 is accepted by the U.S. Environmental Protection Agency under the Significant New Alternatives Policy (SNAP) program, as a substitute for ozone-depleting substances.

Although Vertrel® X-P10 is neither an azeotrope nor a constant boiling blend, compositional changes in a vapor degreaser stabilize within the safe operating range. Its unique properties (**Table 1**) include a high density, low viscosity, and low surface tension for effective removal of moisture, particulate, and soil.

### 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.

**Table 1**  
Physical Properties

Property <sup>a</sup>	Vertrel® X-P10
Molecular Weight	191
Boiling Point, °C (°F)	54 (129)
Liquid Density, g/cc (lb/gal)	1.42 (11.8)
Vapor Pressure, mm Hg (psia)	238 (4.6)
Surface Tension, dyn/cm	14.1
Freezing Point, °C (°F)	<–80 (<–112)
Heat of Vaporization (at boiling point), cal/g (Btu/lb)	TBD
Heat Capacity, cal/g°C (Btu/lb°F)	0.27 (0.27)
Viscosity, cPs	0.75
Flash Point Closed Cup <sup>b</sup>	None
Vapor Flammability in Air, vol%	
Lower Limit	5
Upper Limit	11

<sup>a</sup> At 25°C (77°F), except where indicated.

<sup>b</sup> Tag Closed Cup Tester (ASTM D 56)

### Drying Applications

Vertrel® X-P10 is an ideal choice for absorption drying where nested parts or complex geometries make water removal difficult or energy intensive. The low viscosity and surface tension of Vertrel® XF result in superior wetting of parts, while isopropanol removes trace levels of moisture, with the added advantage of a final cleaning step. Absorption drying with Vertrel® X-P10 eliminates spotting and the deposition of ionics associated with aqueous cleaning, reduces energy consumption, and minimizes equipment footprint.



*The miracles of science™*

## Cleaning Applications

Vertrel® X-P10 is ideally suited for cleaning fine particulate matter (submicron range) from metal and nonmetal parts. Contaminants such as dust particles, skin flakes, fibers, and other process contaminants tend to bond with the surface of the part by some physical force such as electrostatic forces or a mechanical entrapment due to the surface geometry. Removal of these contaminants requires a solvent that can reduce the laminar boundary layer thickness to allow particles to be washed away by the liquid solvent flow-through.

A thin boundary layer and higher liquid flow-through momentum can be accomplished with a solvent such as Vertrel® X-P10 which has a high density, low viscosity, and low surface tension so that fine particles can be debonded efficiently. Typical applications include pre-sputter cleaning of disk media, head stack assemblies, and lenses for optical devices. The versatility of Vertrel® X-P10 allows it to be used in other industries with other precision cleaning applications.

## Plastic and Elastomer Compatibility

Most plastics and elastomers can be safely cleaned in Vertrel® X-P10. **Tables 2 and 3** 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 2**  
**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 <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.

**Table 3**  
**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
Viton® B	Urethane
Silicone	
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.

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

In preliminary testing, Vertrel® X-P10 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 toxicity studies has demonstrated that Vertrel® X-P10 has low toxicity. It is a slight skin and eye irritant and has low inhalation toxicity. **Table 4** shows the applicable exposure limits for the component materials of Vertrel® X-P10.

## Safety/Flammability

Vertrel® X-P10 exhibits no closed cup flash point per the Tag Closed Cup Tester (ASTM D 56) 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 4**  
**Exposure Limits**

Component	Limit, ppm	Type
Vertrel® XF	AEL <sup>a</sup> 200 400	8- and 12-hr TWA Ceiling <sup>b</sup>
Isopropanol	AEL 400 TLV <sup>c</sup> 400 STEL <sup>d</sup> 500	8- and 12-hr TWA 8-hr TWA
Vertrel® X-P10	AEL <sup>a,b</sup> 238	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® X-P10 is a blend of Vertrel® XF and isopropanol. These components form an azeotrope at 3.25 weight percent isopropanol. When subject to off-line or in-line distillation such as a vapor degreaser or still, the distillate product from a recovery of Vertrel® X-P10 will no longer meet the product specification for Vertrel® X-P10. The distillate will be rich in Vertrel® XF and lean in isopropanol, while the bottoms will be enriched in isopropanol, which may become flammable. The presence of soil may further alter the characteristics of the material during the recovery operation.

Recovery should be conducted in properly designed and rated equipment, and closely monitored to ensure operating levels are maintained. Users should test the spent Vertrel® X-P10 to ensure proper classification for waste disposal.

## Storage/Handling

Vertrel® X-P10 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® X-P10.

Although Vertrel® X-P10 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 5). 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® X-P10 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® X-P10 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® X-P10 is not a hazardous air pollutant (HAP), and therefore not subject to NESHAP regulation. Spent Vertrel® X-P10 is not a RCRA characteristic or listed waste. However, addition of contaminants could change that status. Vertrel® X-P10 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 5**  
**Environmental Properties**

Property	Vertrel® X-P10
Ozone-Depletion Potential (ODP)	0
Global Warming Potential (GWP/100 yr ITH)	1170
Volatile Organic Compounds (VOC, g/L)	142

## Packaging and Availability

Vertrel® X-P10 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 6**. All components are listed in the TSCA Inventory.

**Table 6**  
**Vertrel® X-P10 Specifications**

Vertrel® XF, wt%	90.0 ± 0.5
Isopropanol, wt%	10.0 ± 0.5
Nonvolatile Residue, ppm wt	100 max.
Moisture, ppm wt	500 max.
Appearance	Clear, colorless

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