DuPont™ Vertrel® X-B3

Specialty Fluid

Cutting and Drilling Lubricant Carrier Fluid and Coolant

Introduction

Vertrel® X-B3 is a proprietary blend of Vertrel® XF and 2-butoxyethanol (butyl cellosolve). It has been developed for the aircraft and aerospace industry for drilling and machining a variety of high-strength alloys. Vertrel® X-B3 functions to deliver lubricant to the machining operation and at the time provide cooling to the cutting tool and the workpiece. The drilling and cutting process can then be optimized for cutting speed, tool life, and surface finish. Vertrel® X-B3 is designed to replace Freon® TB-1.

The major component of Vertrel® X-B3 is Vertrel® XF (2,3-dihydrodecafluoropentane), a nonozone-depleting, non-flammable hydrofluorocarbon. Vertrel® X-B3 physical properties are shown in **Table 1**.

Table 1
Physical Properties

Property	Vertrel® X-B3	Freon® TB-1
Molecular Weight	244	186
Boiling Point, °C (°F)	61 (142)	48 (118)
Liquid Density at 25°C (77°F)		
lb/gal	12.8	13.1
g/ml	1.54	1.57
Volatility, %	100	100
Flash Point		
Closed Cup[a]	None	None
Open Cup[b]	None	None
Vapor Flammability in Air, vol%	None	None

[a] Pensky-Martens Closed Cup Tester (ASTM D 93)

[b] Tag Open Cup Tester (ASTM D 1310)

High Cooling Efficiency

The rapid volatility of Vertrel® X-B3 helps assure effective cooling along with delivery of lubricant to the cutting point. The improved cooling efficiency of the fluid minimizes thermal expansion. This effect not only improves the ability of the cutting and high-speed drilling operations to achieve extremely close tolerances, but also improves the surface finish and quality of the finished workpiece. The cooling further reduces costs by eliminating the use of aluminum cladding and promoting longer life of the cutting tool.

Lubrication Efficiency

Vertrel® X-B3 contains a small amount of butyl cellosolve that sometimes is used by itself as a lubricant. Because of the viscosity and unique solubility properties of Vertrel® XF, a uniform supply of lubricant is delivered to the workpiece.

Complete Volatility

The components of Vertrel® X-B3 are volatile and, therefore, leave no cutting fluid residues to clean after drilling. This is particularly valuable when machined surfaces must be painted or are part of a structure to which sealants and protective coatings must adhere.

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Metalworking Process

Vertrel® X-B3 is intended to be used in automated metal working equipment such as cutting or drilling where controlled dispensing of the fluid is accompanied with proper ventilation design for the workspace and the equipment operator. Special precautions may be necessary whenever this cutting fluid is used in a confined space so that personnel are not exposed to high concentrations of the vapors. Special ventilating equipment or an independent air supply should be considered in order to appropriately manage the exposure level.

Exposure Limits

Toxicity data is available on Vertrel® X-B3 components. Even with the low concentration of butyl cellosolve in Vertrel® X-B3, personnel should avoid contact with the skin.

Vertrel® XF evaporates more quickly than butyl cellosolve. During evaporation, the remaining liquid phase will become richer in butyl cellosolve. Sprays or mists of Vertrel® X-B3 should be directed away from operators and personnel. **Table 2** shows applicable exposure limits for the component materials of Vertrel® X-B3.

Table 2
Exposure Limits

Component	Limit	ppm	Type
Vertrel® XF	AEL[a]	200 400	8- and 12-hr TWA Ceiling[b]
Butyl Cellosolve	TLV[c] AEL	20 5	8-hr TWA 8-hr TWA
Vertrel® X-B3	AEL[a, b]	59	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 in mixtures.

Safety/Flammability

Vertrel® X-B3 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

Vertrel® X-B3 is not normally recovered. Users should test spent solvent to ensure proper classification for waste disposal.

Storage/Handling

Vertrel® X-B3 is thermally stable to 300°C (572°F) 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.

Drum pumps are recommended to dispense Vertrel® X-B3 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 3)**. 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-B3 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 product is VOC compliant under California South Coast Air Quality Management District (SCAQMD) regulations, which require VOC content less than 50 g/L of solvent.

The components of Vertrel® X-B3 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.

The butyl cellosolve component of Vertrel® X-B3 is considered a hazardous air pollutant (HAP), and therefore is subject to NESHAP regulation. Spent Vertrel® X-B3 is not a RCRA characteristic or listed waste. However, addition of contaminants could change that status. Butyl cellosolve is included in the SARA Title III Section 313 list of toxic chemicals, and is subject to SARA Title III (EPCRA) reporting requirements.

Table 3
Environmental Properties

Property	Vertrel® X-B3
Ozone-Depletion Potential (ODP)	0
Global Warming Potential (GWP/100 yr ITH)	1261
Volatile Organic Compounds (VOC, g/L)	46

Packaging and Availability

Vertrel® X-B3 is commercially available in 55-gal (208-L) drums with a net weight of 660 lb (299 kg), and in 5-gal (19-L) pails with a net weight of 60 lb (27 kg). One-gallon and smaller samples in glass containers are available on request. Customers are encouraged to secure samples now for testing.

Specifications

Composition and specifications are shown in **Table 4**. All components are listed in the TSCA Inventory.

Table 4
Vertrel® X-B3 Specifications

Vertrel® XF, wt%	97.0 ± 0.3
Butyl Cellosolve, wt%	3.0 ± 0.3
Nonvolatile Residue, ppm wt	30 max.
Moisture, ppm wt	200 max.
Appearance	Clear, Colorless

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