



High-purity fluids that deliver superior performance

DuPont™ Vertrel®
SPECIALTY FLUIDS



The miracles of science™

DuPont is a dynamic science company with a strong commitment to protecting the environment. Because of that commitment, we are focused on continuing to develop innovative products that meet the demanding specifications of our customers while providing safer cleaning solutions that are more sustainable for the environment.

For more than a decade, DuPont scientists have been developing new, better-performing and sustainable specialty fluids in anticipation of customer needs, changing market trends and regulatory restrictions. By virtue of better performance and environmental properties, DuPont™ Vertrel® specialty fluids have been proven to be ideal replacements for solvents with ozone-depleting and global warming potential. DuPont™ Vertrel® is used as a replacement fluid for products such as CFC-113, 1-1-1 trichloroethane, HCFC-141b, HCFC-123, HCFC-225, PFCs, nPB-based solvents, perchloroethylene, trichloroethylene and hydrofluoroethers.

What are DuPont™ Vertrel® specialty fluids?

DuPont™ Vertrel® specialty fluids are a family of hydrofluorocarbon-based fluids with zero ozone depletion and low global warming potential. The unique properties of DuPont™ Vertrel® specialty fluids include a low boiling point, low heat of evaporation, excellent solvent retention, low surface tension, low viscosity, non-flammability, chemical and thermal stability, low toxicity, and ease of recovery by distillation. DuPont™ Vertrel®, its azeotropes and blends are compatible with a broad range of materials, metals, plastics and elastomers.

DuPont™ Vertrel® specialty fluids are used in a wide array of applications such as:

- Aerosols
- Carrier fluids
- Cleaning solvents
- Brine/Coolant
- Drying fluids
- Dry cleaning
- Heat transfer
- High voltage applications (dielectric)
- Testing or analytical fluid

DuPont™ Vertrel® specialty fluids come with the assurance of consistent performance, quality, safety, technical service and support.

Environmental properties

Because of their zero ozone depletion and low global warming potential, DuPont™ Vertrel® specialty fluids are accepted by key governmental and environmental regulatory agencies in the US and in most countries around the globe.

Please check with the DuPont office closest to you for acceptance of DuPont™ Vertrel® and its blend of components in your specific country.

Safety and handling

DuPont™ Vertrel® specialty fluids are generally safe, but as with any chemical it is important for all users to be well-informed regarding the product properties, safe handling and use.

Flammability/Decomposition

Most DuPont™ Vertrel® specialty fluids do not exhibit a closed-cup flash point and are not classified as flammable liquids by the National Fire Protection Association (NFPA) or the Department of Transportation (DOT). However, there are some blends that have vapor flammability limits in air. Specific flammability information is provided for each blend on the DuPont™ Vertrel® website (vertrel.dupont.com).

Human health

DuPont™ Vertrel® specialty fluids have low inhalation toxicity and pose little risk of adverse health effects when airborne exposure is maintained below established limits. All DuPont™ Vertrel® blends have an exposure limit (AEL) of > 100. For information on the exposure limits for each DuPont™ Vertrel® blend, please visit our website (vertrel.dupont.com).



Because of their versatility and exceptional performance, DuPont™ Vertrel® specialty fluids are commonly used in a multitude of industries ranging from aerospace to medical devices.

DuPont™ Vertrel® specialty fluids provide the high performance, consistent quality and high levels of safety that are synonymous with the DuPont™ brand.



Aerosols

DuPont™ Vertrel® specialty fluids are an ideal choice for replacing HCFC-141b in aerosol formulations due to their excellent environmental properties and ability to meet the diverse requirements of formulators. Specifically, DuPont™ Vertrel® specialty fluids provide outstanding cleaning performance; are non-flammable; feature reduced volatile organic compound (VOC) content and low toxicity; are quick drying; leave no residue; and offer good materials compatibility.



Brine/Coolant

DuPont™ Vertrel® is a very effective brine/coolant to prevent a part or device from overheating. In a brine/coolant application, DuPont™ Vertrel® is enclosed in a heat exchanger system. When DuPont™ Vertrel® comes in contact with parts at high temperatures, it evaporates, cooling the parts. As DuPont™ Vertrel® moves to the cooler side of the heat exchanger system, it condenses back into liquid state. DuPont™ Vertrel® is used to continuously cool down the parts that could become damaged due to excessive heat.



Carrier fluids

DuPont™ Vertrel® specialty fluids are ideal replacements for PFCs in carrier fluid/lubricant deposition applications, especially in the hard disk drive and medical device industries.

In this application, DuPont™ Vertrel® is used to deposit lubricant on a substrate. Because DuPont™ Vertrel® is fast drying, it evaporates, leaving behind an even coating of the lubricant. The thickness of the coating can be controlled by the rate at which the substrate is removed from the solution.



Cleaning solvents

Developed with both performance and the environment in mind, DuPont™ Vertrel® specialty fluids are used for a wide variety of cleaning applications, including light and heavy soil removal; particulate/ionic removal; oxygen systems cleaning; precision cleaning; and defluxing. Due to their low viscosity, low surface tension and high liquid density, DuPont™ Vertrel® specialty fluids enable effective wetting and ensure excellent cleaning performance.

In electronics manufacturing, the trend toward tighter clearances has made defluxing circuit boards more critical and more challenging than ever before. DuPont™ Vertrel® specialty fluids have proven to be the ideal solution due to their low surface tension and ability to quickly and effectively wash away contaminants such as solder paste.

DuPont™ Vertrel® specialty fluids are versatile enough to work in almost any cleaning application and are widely used in critical industries such as defense, aerospace, electronics, optics and medical device manufacturing.



Drying

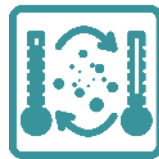
Due to their unique combination of properties, DuPont™ Vertrel® specialty fluids are an excellent drying solution after aqueous cleaning, eliminating the problems that commonly occur with oven drying, hot air knife drying or tumble drying. For example, due to its lower surface tension, DuPont™ Vertrel® eliminates the problem of water getting trapped in a complex part because it can get into small gaps and blind holes and push the water out. The low boiling point of DuPont™ Vertrel® enables it to evaporate quickly, allowing parts to be processed faster and resulting in lower energy costs.

DuPont™ Vertrel® specialty fluids are used extensively for drying in a wide variety of industries, such as jewelry and watchmaking, and automotive tool manufacturing.



Dry cleaning

The main advantage of DuPont™ Vertrel® in a dry cleaning line is its ability to effectively get stains out while leaving behind no residual odor or marks. Since DuPont™ Vertrel® is able to clean clothes without extracting natural oils from the garment, it does not damage clothing like other aggressive dry cleaning agents.



Heat transfer

DuPont™ Vertrel® specialty fluids offer a convenient and affordable solution to meet the complex challenges of heat transfer applications. Their low boiling point (55°C/131°F) and thermal stability guarantee continued effectiveness over several boiling cycles.

DuPont™ Vertrel® specialty fluids are typically used as a heat transfer fluid for semiconductors, semiconductor tools and pharmaceutical manufacturing.



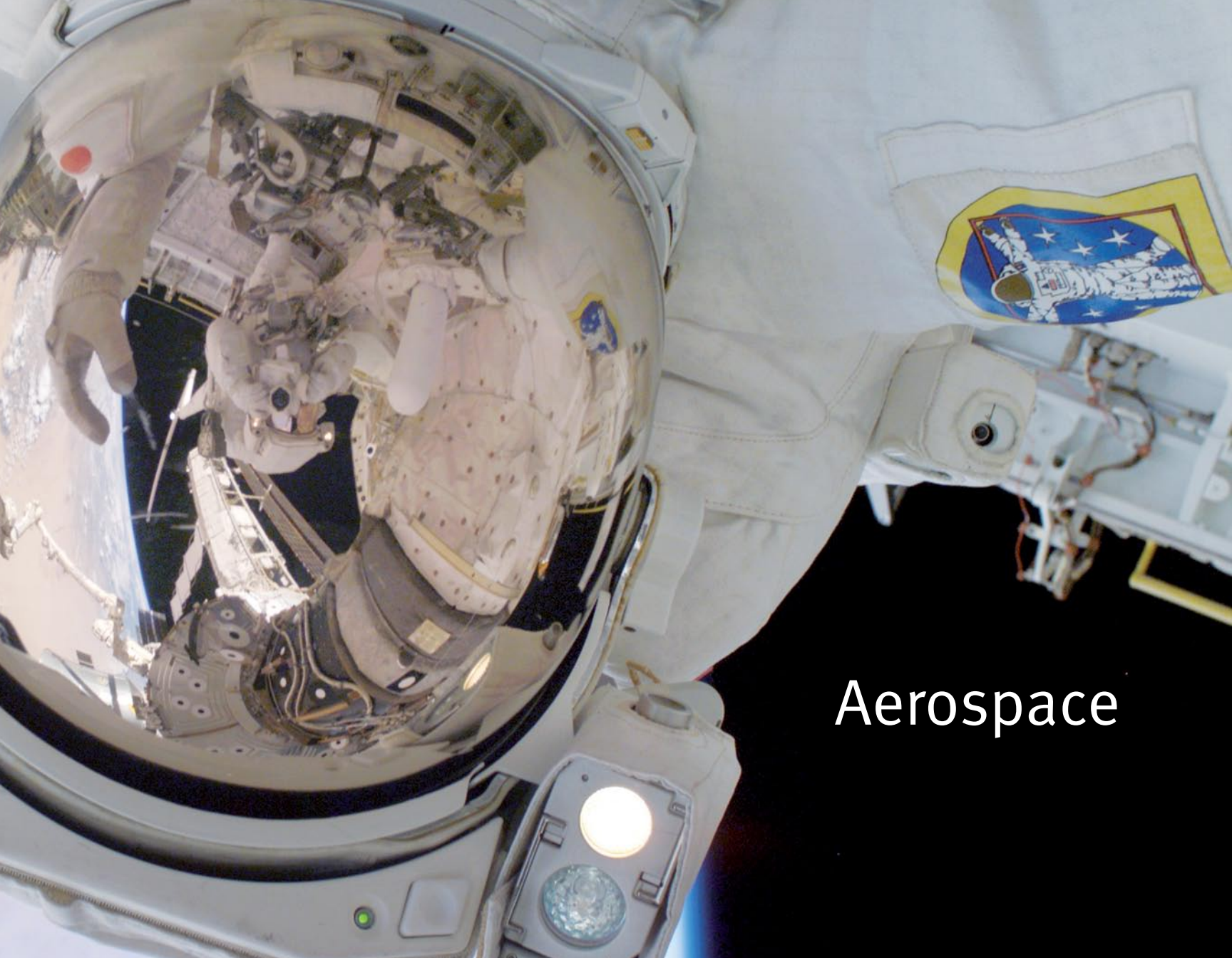
High voltage

DuPont™ Vertrel® is widely used as a dielectric or testing fluid in many high voltage applications. The dielectric properties and breakdown voltage of DuPont™ Vertrel® make it an ideal choice for this application. Typical uses include electrical testing of insulation sleeves, commercial glove testing, and sleeve testing equipment.



Testing

As a testing fluid, DuPont™ Vertrel® is used for a wide range of applications, including fingerprint extraction, wastewater analysis and virus extraction. The properties that make it ideal for these kinds of applications are its materials compatibility, non-flammability, fast evaporation and good solubility of deposition fluids.



Aerospace

In the aerospace industry, DuPont™ Vertrel® specialty fluids are used for a wide variety of applications in manufacturing, during flight and in maintenance.

Cleaning landing gear

Water entrapment in the landing gear is a major concern since on freezing it can fracture parts. DuPont™ Vertrel® is used extensively to clean landing gear, eliminating the problems posed by water, and is the sole solvent specified by NASA to be used on the sealed system of the space shuttle.

Oxygen service

DuPont™ Vertrel® has been used extensively for servicing oxygen systems. The parts that are cleaned using DuPont™ Vertrel® are critical for ensuring a stable oxygen supply in the aircraft.

Defluxing/Cleaning of electronics

The aerospace industry uses critical electronics and circuits whose failure can be catastrophic. To ensure reliable and trouble-free performance, DuPont™ Vertrel® is often the first choice of solvent used to deflux and clean printed circuit boards (PCBs) after soldering.

Microwave systems

DuPont™ Vertrel® has been used as a heat transfer fluid in power semiconductor or IGBT modules used in microwave ovens on airplanes. In such cases, DuPont™ Vertrel® specialty fluids ensure hot meals on a flight.

Drilling of micro-holes

A lot of heat is generated while drilling micro-holes in aircraft wings. DuPont™ Vertrel® is used as a lubricant and heat transfer fluid during this process to prevent overheating and damage. Also, DuPont™ Vertrel® leaves no residue behind.



Electronics

DuPont™ Vertrel® specialty fluids are used extensively in the electronics industry to clean printed circuit boards (PCBs) after soldering.

This is especially challenging because of a shift towards lead-free solders, which require higher temperatures and leave behind more-stubborn residue. Also, the demand for smaller electronics means more parts are packed on a single PCB. Tougher residue in smaller spaces makes today's PCBs more difficult to clean.

DuPont™ Vertrel® has risen to the demands of the electronics world and is the solvent of choice for electronics used in critical operations. Its low surface tension allows DuPont™ Vertrel® to get through the tightest clearances, and its good solubility ensures a suitably cleaned product.

Hard Disk



DuPont™ Vertrel® is the product of choice for cleaning and carrier fluid applications in the hard disk drive industry.

Disk lubing

Every hard disk is coated with a lubricant that needs to be applied evenly and is critical to the performance of the disk. To achieve this, the lubricant is dissolved in DuPont™ Vertrel®. Then, the uncoated disks are immersed in this solution and removed using a controlled process. DuPont™ Vertrel® evaporates rapidly to leave an even layer of lubricant on the disk, protecting against damage and loss of data.

Drive assembly cleaning

The drive assembly is a critical part of the hard disk drive. Any contamination in the assembly can damage the hard disk. To prevent this, these critical parts are cleaned using DuPont™ Vertrel®.



Jewelry and Watchmaking

In the jewelry, watchmaking and lifestyle goods industry, the aesthetics of the product drives the purchase.

Since water-based detergents can leave spots behind, DuPont™ Vertrel® is used as both a cleaning and rinsing agent, ensuring a spot-free product that is cool enough for immediate handling.

DuPont™ Vertrel® is also ideal for cleaning parts before plating and vapor deposition.



Medical Device

The superior performance of DuPont™ Vertrel® specialty fluids enables them to be used for a variety of applications in the medical industry.

Cleaning of parts

The cleaning of medical devices is critical in preventing infection. The quality and performance of DuPont™ Vertrel® specialty fluids makes them the preferred choice of medical device manufacturers for this application.

Carrier fluid

Needles and other devices are coated with a lubricant that enables easy entry into the body, reducing pain. DuPont™ Vertrel® is used to deposit these lubricants evenly in a process similar to that used in the hard disk drive industry. High quality and consistent performance make DuPont™ Vertrel® ideal for this application.

DuPont™ Vertrel® is also used to deposit silicones, as well as clean off the excess that may remain after deposition.



Optics

DuPont™ Vertrel® has superior performance that allows it to be used in wide range of applications in the optics industry, such as optical assemblies, lens manufacturing, fiber optics and flat panel displays.

Cleaning and drying

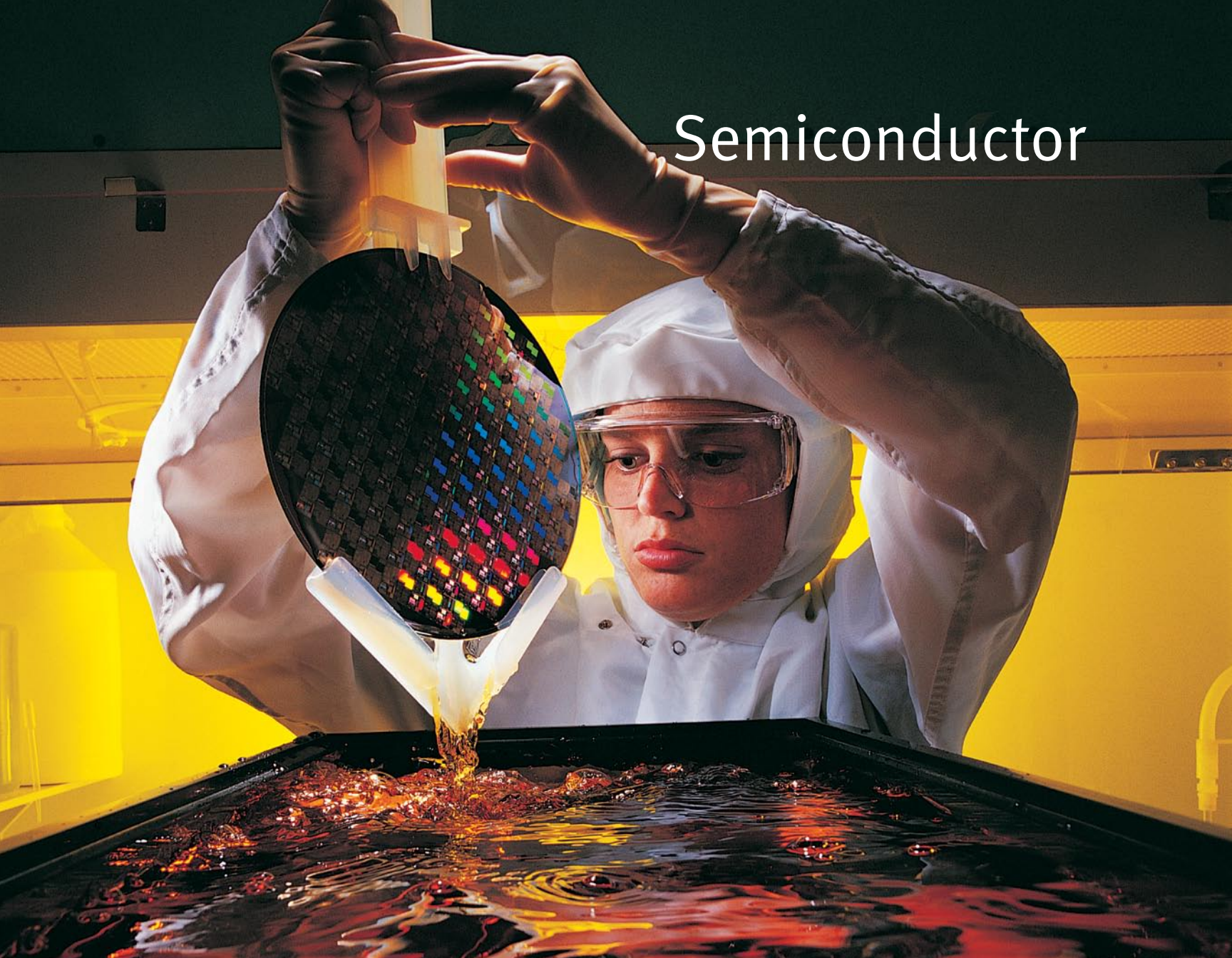
DuPont™ Vertrel® is used to ensure spot-free cleaning of optical parts, assemblies, displays and fiber optics. It is equally effective during manufacturing or as a finishing process.

If water-based detergents are used to clean optical parts, there is often an issue of residue spots. DuPont™ Vertrel® used as a final rinse step ensures a spot-free finish for parts that must meet stringent performance criteria.

Coatings

DuPont™ Vertrel® has developed coatings that enhance the performance of optical parts by reducing reflectivity and increasing the amount of light passing through. These coatings are also used to improve anti-smudging properties.

Semiconductor



Any product used in the semiconductor industry must meet stringent performance criteria, so the exceptional performance of DuPont™ Vertrel® is ideal for a variety of semiconductor applications.

Cleaning

DuPont™ Vertrel® is used to clean the FOUPs which hold silicon wafers in controlled environments. Performance is critical to prevent contamination of silicon chips. Superior and reliable cleaning of FOUPs and flip chips has made DuPont™ Vertrel® the solvent of choice in the semiconductor industry.

Heat transfer

DuPont™ Vertrel® is also used as a heat transfer fluid in power semiconductors or IGBT modules in high-speed trains and high-speed elevator drives. DuPont™ Vertrel® provides consistent and reliable performance in these applications.

DuPont™ Vertrel® also provides superior cleaning and heat-transfer solutions for industries such as MEMS/NEMS.



Transportation

In addition to the aerospace industry, DuPont™ Vertrel® is used in the automotive and the railway industries.

Cleaning

DuPont™ Vertrel® is used extensively in the automotive industry to precision-clean critical parts for fuel injection, ABS brakes, compressors, relays, sensors and switches.

Carrier fluid

DuPont™ Vertrel® is also used for the deposition of anti-squeaking materials in the engine and passenger cabin, as well as materials that improve the performance of the glass and plastic parts comprising the instrument panel.

Heat transfer

DuPont™ Vertrel® is used extensively as a heat transfer fluid in the power modules of high-speed trains, enabling quick cool-down and consistent performance without breaking down.

DuPont™ Vertrel® formulations and their applications

DuPont™ Vertrel® specialty fluids had been formulated as a replacement for Freon®. Since then it has been noticed that DuPont™ Vertrel® fluids are ideal replacements for a range of other fluids. DuPont™ Vertrel® products are available in 5 gallon pails, 55 gallon drums and in 3180 (approx.) gallon bulk ISO containers.

DuPont™ Vertrel® specialty fluid	Current & former solvents	Typical applications	Examples
DuPont™ Vertrel® XF	PFCs PF 5060 PF 5070 HCFC-225 HCFC-141b HFEs	Carrier fluid Rinsing media Grease removal Light soil cleaning Particulate removal Dielectric coolant Aerosol formulations	Various surface treatments Lubricant surface coating Drying systems with Vertrel® X-DA Krytox® grease removal Electrical cabinet maintenance Hard disk drive cleaning HAS/HGA cleaning High-voltage systems Electronics industry Automotive industry
DuPont™ Vertrel® XM DuPont™ Vertrel® XP DuPont™ Vertrel® X-P10 DuPont™ Vertrel® XE DuPont™ Vertrel® XH	HCFC-225 HFEs	Medium soil cleaning Particle removal Dust removal	Dust and light oil removal Electrical cabinet maintenance Fingerprint removal Mineral oils Hydrocarbon oils and greases
DuPont™ Vertrel® MCA DuPont™ Vertrel® MCA Plus DuPont™ Vertrel® C-HD	HCFC-141b HCFC-225 Trichloroethylene Trichloroethane nPB-based solvents HFEs	Cleanliness verification Heavy soil cleaning Metal degreasing	Removal of nonvolatile residue Liquid oxygen system cleaning Vapor degreasing for heavier oils and greases in the automotive, aerospace and medical industries
DuPont™ Vertrel® SMT DuPont™ Vertrel® XMS Plus	nPB-based solvents HCFC-225 HFEs	Defluxing	Defluxing of PCBs and hybrid circuits
DuPont™ Vertrel® X-DA DuPont™ Vertrel® X-DF	HFEs	Displacement drying for metal, glass and plastic parts	Removal of large amounts of water in the optical, medical and micro-mechanics industries
DuPont™ Vertrel® X-Si	HFEs	Metal cleaning Silicone removal Carrier fluid Swelling media	Medical industry

Note that all DuPont™ Vertrel® products are not available in all regions. Please contact the office closest to you to identify the best products available for your specific application.

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