Micro•Dispersion Lubricants

Clean, Nonmigrating Lubricants Save Money, Boost Quality

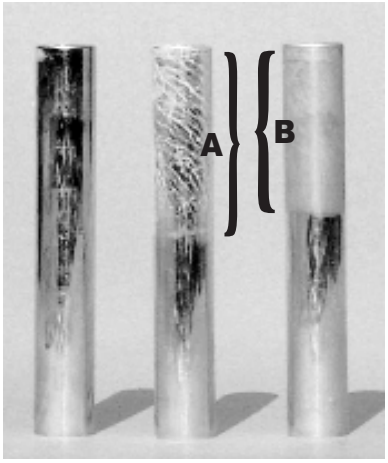
General

For customers requiring nonflammable, non-migrating lubrication, a unique family of sophisticated chemistries based on proprietary "microdispersion" technology is now available from Micro Care. The liquids deposit a thin, smooth and consistent dry film layer of lubricant over treated surfaces, enabling ultra-low "break-away" forces and minimizing the well-documented "stiction" problems common in low-speed, light load applications.

Micro Care microdispersions offer many important money-saving benefits:

- Outstanding lubricity
- Extraordinary microdispersion stability with minimal agitation
- Easy, nonflammable handling, storage and use
- Simple equipment requirements for dipping and spraying
- A non-nutritive environment inimicable to biologic growth
- Non-migrating deposition.

Today Micro Care offers four different microdispersion mixtures. Savvy engineers will select the best Micro Care microdispersion for each application, thereby saving money and improving performance with the reliable assurance of Micro Care quality and innovation.



Micro Care microdispersions deliver superior coverage and lubricity. Here, the surfaces of three eyelets are compared. The shiny surface of the left eyelet is uncoated, the center item (bracket A) demonstrates the irregular results of traditional powdered materials, and on the right (bracket B) the smooth, "fog-like" coating of the VCG dry lubricant can be seen. Both dips were 3% concentrations.

Product Overview

VDX Aerosol

VDX Dry Lubricant is a nonmigrating "pinpoint" lubricant. Unique in the industry, this product combines a plastic-safe, nonflammable, ozone-safe HFC carrier with 1% solids for optimal effectiveness. Select VDX when there are problems with the migration of traditional (wet) lubricants.

KTX Dip

The KTX Dip uses fast-evaporating HCFC-141b as the carrier, with 1.5% solids. Usually found in high-volume applications involving metal components, this is Micro Care's least expensive option. KTX is recommended when cost control is critical and universal materials compatibility is not essential.

KFX Dip (Concentrated)

This product features a fast-evaporating HFC carrier with 9% solids. It is formulated for high speed, high-volume applications where universal materials compatibility is essential. The concentrate can be customized by dilution with additional carrying agent. Select KFX when a unique concentration is required and/or when universal materials compatibility is desirable.

VCG Dip

The VCG Dip uses 2% solids mixed in a fast-drying HFC carrier. The carrying agent is a unique, nonflammable and proprietary mixture. Select VCG when cost and materials compatibility are vital criteria.

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The World's Cleaning Experts

Important Advantages

Unique, Ready-to-Use Concentrations

PTFE microdispersions from Micro Care are packaged in ready-to-use concentrations. This saves money by improving the batch-to-batch consistency while simplifying the application of the lubricant. In addition, the carrying agents used in Micro Care microdispersions are unique. Micro Care can prepare custom concentrations and custom carrying agents to maximize the effectiveness of the lubricant, improve quality and reduce costs.

No PTFE Micropowders

Since PTFE can be manufactured across an enormous range of molecular weights, many users and manufacturers take inexpensive PTFE solids and grind them into fine powders. These PTFE powders have molecular weights hundreds of times greater than the PTFE used in Micro Care's dry lubricants, and very different from the molecular weight of the carrying agents. That means these powders do not easily stay in suspension and, when applied to a surface, form clumps and streaks. Since Micro Care microdispersions only use the lightest fractions of the lubricant, and the molecular weights of the lubricant is very similar to the molecular weight of the carrying agents, the Micro Care products save money by providing a more uniform coating, excellent lubricity and superior cosmetics.

Extraordinary Stability

All PTFE micropowders eventually will settle out from their carrying agents, and all require some degree of mechanical agitation to remain in suspension. Too little agitation results in inconsistent coatings; too much agitation increases solvent losses. In contrast, Micro Care has engineered its microdispersions to remain in a stable, uniform suspension for prolonged periods (see photos, page 4). Better suspension produces better lubrication at lower costs. The improved "hang time" of the microdispersion improves the quality of the coating, reduces carrying agent emissions and simplifies production processes with minimal agitation.

Easy Removal and Rework

Air-dried coatings of PTFE are easily removed with vigorous abrasion using a cloth or brush; alcohol-based solvents enhance the cleaning. Melted coatings are more durable; use heat, salt baths or pickling to remove them.

Micro Care packages a family of microdispersions for use in dip, wipe and aerosol applications. The VDX aerosol is for pinpoint lubrication, and is most widely used when oils and silicones fail due to their tendency to migrate.

Simple Equipment Requirements

In normal use, most Micro Care microdispersions are applied using simple dipping systems such as modified vapor degreasers. Such equipment is simple to use, easy to maintain and will accommodate even the most difficult shapes. This contrasts favorably with water-based lubricants which require large, complex and expensive dipping systems. In addition, water-based systems also promote rust and biological growth. Alcohol-based lubricants have similar complexities, plus environmental and safety issues.

Non-Migrating Coverage

Micro Care dry lubricants are nonmigrating—the dry film stays where the operator puts it, without clumps, drips or streaks (see photo, Page 1). In contrast, the viscosity of oil and/or silicone lubricants vary with temperature, allowing those lubricants to migrate to undesirable locations. Micro Care's dry lubricants eliminate the problems of migrating wet lubricants, dramatically improving the performance, reliability and cost-effectiveness of the system.

Superior Materials Compatibility

All of the microdispersions from Micro Care are inert chemically and safe for most components. In general, they can be used on glass, ceramic, metals, plastics, cured epoxies, flex laminates, solder masks and alloys. However, certain carrying agents may not be completely plastic-safe; check the product specifications for details.

Environmental Savings

The dry lubricant microdispersions from Micro Care offer superior environmental attributes. In particular, the microdispersions using HFCs offer low global warming, maximum ozone protection and low VOC content. Some products contain regulated Volatile Organic Compounds (VOC). Micro Care can provide assistance with solvent recovery, emission reductions and disposal of spent fluids.

Important Advantages, continued

Chemical Stability

In laboratory tests, PTFE coatings proved completely resistant to attack by strong, concentrated corrosives such as concentrated nitric acid, hydrochloric acid, sodium hydroxide, and potassium hydroxide up to 100˚ C (212˚ F).

Biomedical Compatibility

A number of major medical manufacturers use microdispersions from Micro Care on selected medical instruments. These microdispersions were chosen because of their low costs, excellent lubricity, ease of application, superior plastic compatibility, excellent cosmetic results, superior toxicity ratings and pyrogen-free characteristics. However, Micro Care does not recommend these products for applications involving permanent implantation or permanent contact with the human body, bodily fluids or tissues. For background on this restriction, contact Micro Care.

Health & Safety

The microdispersions from Micro Care do not have personal safety exposure limits assigned to them, but the individual components have toxicity ratings ranging from 200 ppm to 1,000 ppm. None of the ingredients are listed by NTP, IARC or OSHA as known or suspected carcinogens. See MSDS sheets for details.

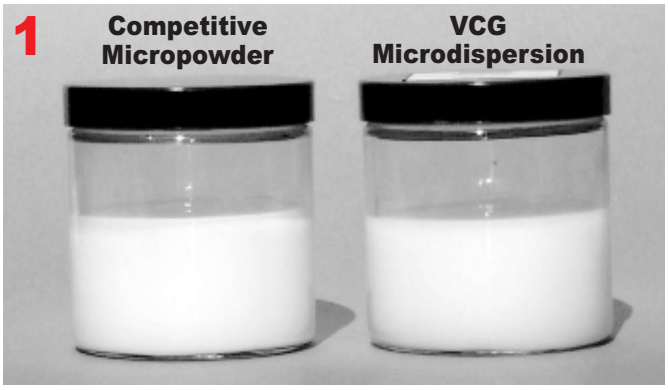
Unique Applications

As a dry lubricant, dry lubricants have found homes in many unusual applications:

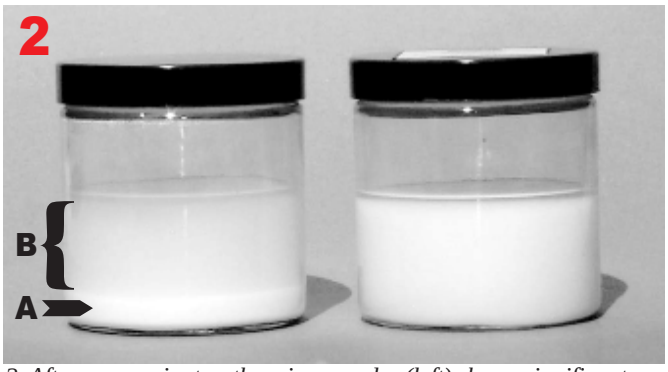
- On medical instruments, because of their ease of application, compatibility and environmental compliance.
- Precision equipment such as musical instruments, audiovisual gear, camera equipment, magnetic recording tapes and film.
- On leather, plastics and elastomers for use in drive belts, gaskets, gears, bearings and chain drives.
- Coating both natural and synthetic fibers used in fabrics, thread, cord, twine and rope.
- On extruded cable coatings.
- On machined parts and fittings, including nuts and bolts, linkage and connectors, locks, power saw blades, electrical equipment and office machines.
- Metalworking operations, including extrusion, rolling, drawing and sizing.
- Processes in the manufacture of glass and paper.
- Home furniture and hardware, including door hinges, locks, catches, window guides, slide channels on storm windows and antique furniture drawer guides.
- As a mold release, for all plastics and elastomers.

A Thousand Words...

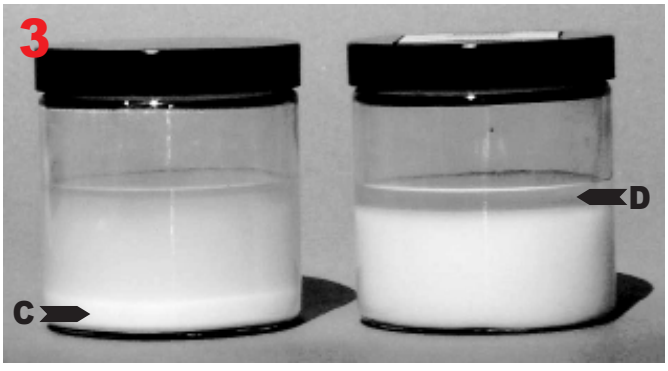
If a picture is worth a thousand words, then three pictures are invaluable in demonstrating the stability of Micro Care microdispersions. In this series of time-lapse images, the stability of a traditional micropowder (left) is compared to the Micro Care VCG dip. Both mixtures are at a 3% concentration.



1. Initially, both suspensions demonstrate uniform mixing, although in the few seconds it took to capture this image the micropowder (left) already shows some settling, as demonstrated by the thin, clear layer of carrying agent on top of the mixture.



2. After seven minutes, the micropowder (left) shows significant band of solids, settling(arrow A) out of the carrying agent. The remaining mixturing is smoothly graduated, ranging from nearly clear (at the top) to a more concentrated mix immediately at the bottom (bracket B). These variations make smooth, even lubrication difficult.



3. After 20 minutes, the micropowder has settled almost completely (C) and will need significant agitation to return to a mixed state. Meanwhile, below a small layer of carrying agent (right, D), the rest of the VCG mix remains an even, consistent suspension.

VDX Aerosol

VDX Aerosol is a "pinpoint" dry lubricant packaged in an aerosol can. The product uses an instant-drying HFC carrying agent at 1.5% solids. This delivers a high-quality spot coating with excellent lubricity. VDX is very well suited for use on metals, plastics, ceramics and other materials. VDX delivers a smooth, even layer of lubricant across all surfaces — even vertical or curving shapes — without clumps, drips, or runs. It also is an effective mold release at room-temperature applications. VDX mold release coatings typically endure up to 25 cycles before requiring additional lubricant.

The carrying agent is a nonflammable HFC which dries almost instantly. This low-aroma blend is ozone-safe, plastic-safe, non-migrating, nonflammable, nonconductive and essentially nontoxic.

Selected VDX Technical Data

Product	VDX Spray
Primary Use	Dry Lubricant
Chemical Family	Mix of PTFE, alcohol and HFCs
Appearance (Dry)	Translucent Wax-like Dispersion
Compatibility:	Compatible with all materials
% solids:	1.5%
Odor	Mild alcohol
Boiling Point	-26˚C / -15˚F
Vapor Density	3.18 (Air = 1)
Specific Gravity	n/m
pH	Neutral
Percent Volatile	98.5%
Carrier Evaporation Rate	100% within 20 Secs.
Flashpoint (TCC)	None
Flammability Rating	Nonflammable
PEL (Carrying Agent)	1,000 ppm
NFPA Ratings:	
Health:	1
Fire:	0
Reactivity:	1
Ozone Impact	Zero
Organics, Per Liter	51 g/l
Carrier/Propellant	HFC-134a
TSCA Listed	Yes
Packaging:	
MCC-VDX	12 oz./340 g aerosol

The solid PTFE ingredients in the VDX Spray will settle during shipping and storage. For best results, the aerosols should be shaken briskly prior to the initial use, and further agitated if there are prolonged delays between uses.

KTX Dry Lubricant Dip

KTX Dip uses 1.5% solids and a fast-drying carrying agent to produce a high-quality, low-cost coating. The product is most often recommended for metal parts, but has been successfully used on glass, ceramics, strong plastics and other advanced materials. This lubricant film is non-migrating, nonflammable, nonconductive and essentially non-toxic. This is Micro Care's lowest-cost microdispersion product.

While the lubricant is completely inert on all types of plastics, the mixture relies on a highly affordable carrying agent which is *not* plastic-safe. The carrying agent is dichlorofluoroethane (HCFC-141b) which is a non-toxic, nonflammable liquid which dries almost instantly at room temperatures. The carrier is a Class II ozone-depleting material (see footnote). Test thoroughly before widespread deployment.

Selected KTX Technical Data

Product	KTX Dry Lubricant Dip
Primary Use	Dry Lubricant
Chemical Family	Mix of PTFE, alcohol, HCFC-141b
Appearance (Dry)	Translucent Wax-like Dispersion
Compatibility:	Good, except on plastics, gaskets
% Solids:	1.5%
Odor	Mild, ether-like odor
Boiling Point	>28˚C / 86˚F
Specific Gravity	1.4
Vapor Density	4.1 (Air=1)
pH	Neutral
Percent Volatile	98.5%
Carrier Evaporation Rate	100% within 40 Secs.
Flashpoint (TCC)	None
Flammability Rating	Nonflammable
PEL (Carrying Agent)	400 ppm
NFPA Ratings:	
Health:	1
Fire:	0
Reactivity:	1
Ozone Impact	0.10
Organics, Per Liter	30 g/l
TSCA Listed	Yes
Packaging:	
MCC-KTXL	2.5 lb./1.1 k (1 liter) bottle
MCC-KTXG	10 lb./4.4 k minipail
MCC-KTXP	50 lb./22.3 k pail
MCC-KTXD	500 lb./223.2 k drum

Special note: The HCFC-141b carrying agent used in the KTX Dip offers low Global Warming Potentials but is regulated as a Class II ozone depleting substance. It has a phase-out date of 2002. In addition, the product contains 38 grams/liter of alcohol which may be regulated as a Volatile Organic Compound (VOC).

KFX Dip (Concentrate)

KFX Concentrate uses a fast-evaporating carrier loaded with 9% solids.The mix can be tailored for unique production requirements by diluting with additional carrying agent to reduce the solids content down to as low as 0.5% solids, although the recommended range from Micro Care is 1.5-3.0%. The mixture is completely plastic-safe on all normal materials of construction. The carrier is an ozone-safe, nonflammable hydrofluorocarbon solvent with a small proportion of alcohol. This mixture is safe for people, safe for the environment, nonflammable and completely inert on all types of plastics. KFX is the best choice for engineers needing customized dry coatings.

The material is available at the 9% concentration suitable for dilution by the customer, or at customized blends prepared to the client's requirements.

Selected KFX Technical Data

Product	KFX Dry Lubricant Dip
Primary Use	Dry Lubricant Concentrate
Chemical Family	PTFE, alcohol and HFC mix
Appearance (Dry)	Translucent Wax-like Dispersion
Compatibility:	Compatible with all materials
% Solids:	9% for concentrate
Odor	Slight alcohol
Boiling Point	>54˚C / 129˚F (calc.)
Specific Gravity	1.42 @ 20˚C
Vapor Density	4.0 (Air=1)
pH	Neutral
Percent Volatile	91%
Carrier Evaporation Rate	100% within 2 minutes
Flashpoint (TCC)	None
Flammability Rating	Nonflammable
PEL (Carrying Agent)	200 ppm
NFPA Ratings:	
Health:	1
Fire:	0
Reactivity:	1
Ozone Impact	Zero
Organics, Per Liter	68 g/l
TSCA Listed	Yes
Packaging (for 9% concentrate):	
MCC-KFXCL	2.5 lb./1.1 k (1 liter) bottle
MCC-KFXCG	10 lb./4.4 k minipail
MCC-KFXCP	50 lb./22.3 k pail
MCC-KFXCD	550 lb./245.5 k drum

VCG Dry Lubricant Dip

The VCG Dip uses a fast-evaporating carrier and 2% solids for a high-quality dry coating.This mixture is unique due to the proprietary carrier. But the mix also delivers more uniform coverage than traditional lubricants, without streaks or clumps. The cosmetic improvement alone may, in some applications, justify the switch to VCG (see photo, Page 1) but there also is a performance improvement. When compared to traditional lubricants, tests demonstrate the smoother, more even coverage produced by VCG can deliver a 20% reduction in the breakaway force required to actuate precision instruments.

The nonflammable carrier is a unique, proprietary mixture of ozone-safe HFC solvents. This mixture is completely safe on all types of plastics, nonflammable, non-toxic and environmentally progressive.

Selected VCG Technical Data

Product	VCG Dry Lubricant Dip
Primary Use	Dry Lubricant
Chemical Family	PTFE, alcohol and HFC mix
Appearance (Dry)	Translucent Wax-like Dispersion
Compatibility:	Compatible with all materials
% Solids	3%
Odor	None
Boiling Point	54˚C / 129˚F
Specific Gravity	1.42 @ 20˚C
Vapor Density	4.0 (Air=1)
pH	Neutral
Percent Volatile	98%
Carrier Evaporation Rate	100% within 1 minute
Flashpoint (TCC)	None
Flammability Rating	Nonflammable
PEL	200 ppm
NFPA Ratings:	
Health:	1
Fire:	0
Reactivity:	1
Ozone Impact	Zero
Organics, Per Liter	38 g/l
TSCA Listed	Yes
Packaging:	
MCC-VCGL	2.5 lb./1.1 k (1 liter) bottle
MCC-VCGG	10 lb./4.4 k minipail
MCC-VCGP	50 lb./22.3 k pail
MCC-VCGD	500 lb./223.2 k drum

Technical Notes About Dry Film Lubricants

About PTFE

Polytetrafluoroethylene (PTFE) is a generic name for Teflon®. In general, this is a highly fluorinated material with a fairly wide range of molecular weights, up into the hundreds of thousands. PTFE lubricants offer an extremely low static coefficient of friction, which is at the heart of their effectiveness as lubricants. PTFE also is extremely stable and nonflammable; clean, dry, non-oily and nonstaining. The material is biologically inert and does not support biological growth (it is non-pyrogenic).

Usually PTFE is packaged as a dry powder, or as pellets, or as a dispersion in a carrying agent. To improve lubricity, many companies take PTFE solids and split them into micropowders. These particles will have an irregular shape and be of an inconsistent size. Although inexpensive, these are generally inferior dry lubricants.

The carrying agents used on PTFE micropowders usually are based on alcohol, water or fluorinated solvents. Water-based and alcohol-based carrying agents require expensive and maintenance-intensive machinery to apply the lubricant safely and cost-effectively. Space is also a consideration: water-based systems always require a larger footprint than solvent-based carrying agents.

Micro Care uses a unique form of PTFE which is manufactured at the lowest molecular weight — typically one-tenth of the grades of PTFE used by other manufacturers. These materials never need further grinding or processing. A proportion of these materials are so small they are able to dissolve into the carrier solvent. In additon, the molecular weight of these materials are nearly identical to the molecular weight of fluorinated solvents, making it easy for these fine, light and ultra-pure materials to stay in suspension and form the smoothest, most even microdispersions. When dried, they leave a thin, continuous film of PTFE on the substrate. Micro Care microdispersions are, overall, superior lubricants.

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Application Methods

Most Micro Care microdispersions are sold “ready to use” with the concentration of PTFE solids optimized for most uses (1%-2% solids, by weight, but up to 9% for specialized applications). Normal precautions (safety glasses, etc) should be used when moving, opening and using drums and pails of these materials.

All surfaces should be clean and dry prior to application of the microdispersions. Vertrel® solvents from DuPont are superior cleaners in most applications because they are nonflammable, fast-drying, residue-free and compatible with the carrying agents in the microdispersions.

Many customers prefer that the dry lubricants be applied as a dip. Dipping is particularly useful for smaller parts: complex mechanical shapes, coils of wire, intricate plastic assemblies. Product performance is determined by the concentration of PTFE solids, the rate of coating and/or extraction, rate of withdrawal, the number of applications, the carrying agent, agitation and evaporation, and heat treatment. A single dip is adequate for most applications.

In most instances, the most cost-effective dipping process uses a standard vapor degreaser system. With this technique, the heating subsystem is not used and the solvent is at room temperature. The refrigeration subsystem retains the carrying agent within the machine. The machine’s hoist plunges the parts into the carrying agent with a pre-programmed dwell time. Ultrasonics can be used to enhance dispersion. Some form of mechanical agitation (impellers, bubblers, under-surface sprays) is normally required. Contact Micro Care for machine details and manufacturers.

Other application techniques include wiping, brushing or aerosol sprays. These methods are especially useful for coating smooth continuous surfaces such as rods, tubing or sheets.

Airless sprays can be applied with a hand-held gun or with automatic spray heads. Best results are produced by a series of thin coats, allowing the surface to dry between applications. Single thick coatings, which will take longer to dry, result in uneven coverage and deliver poor adhesion. NOTE: Air spraying is not recommended as the solvent carriers evaporate too quickly for good adhesion.

Heat Treatment

Coated parts can be heat-fused if greater durability is desired. Heat treatment enhances the durability of the lubricant coating by melting the PTFE onto the substrate. The process is simple, and involves heating the surface to 305-316˚ C (581-600˚ F). Measure the surface temperature directly with a thermocouple. The coating appearance may change from an opaque white to a darker, translucent surface and finally appearing clear and wet. Maintain the temperature of the coated surface (not the temperature of the ambient air) at 305-316˚ C (581-600˚ F) for 5 to 10 minutes. If a white residue is left on the metal surface, buff with a soft cloth after cooling. No other treatment is required.

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