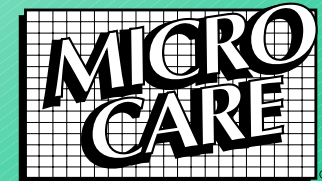


Introduction to Vapor Degreasing

- Part 1:** Critical Cleaning — Definitions, Applications and Case Studies
- Part 2:** Vapor Degreasers — The Equipment, the Process and the Cost/Benefit Equation In Critical Cleaning
- Part 3:** Choosing a Solvent for Vapor Degreasing in Critical Cleaning Applications

You Have Just Downloaded Part 3



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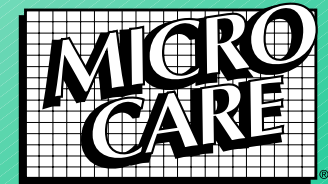
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Selecting a Solvent for Critical Cleaning

*Facts and Figures to Help Companies
Sort Through the Hype*

Rev. 9/2002

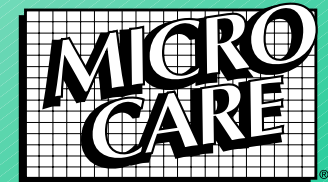


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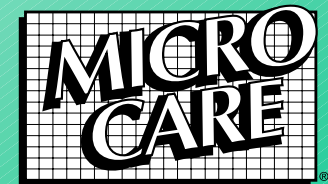
- Reviews SOLVENT NEEDS for Vapor Cleaning
- Compares the CHOICES
- Introduces Your Best Cleaning Choice: Vertrel[®] Solvents from DuPont

*This Presentation Focuses on the
Solvent Issues
Associated with Vapor Degreasing*



A Review of Solvent Choices

Rev. 9/2002

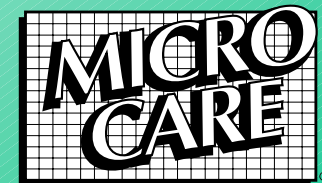


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The Optimal Solvent

- **Thoroughly Clean the Contamination**
 - **Dense, Low Surface Tension, Low Viscosity**
- **Be Compatible with Parts & Materials**
- **Easily Tailored for Your Cleaning Needs**
- **But Not Miscible with Water**
- **Be Easy & Safe to Store, Use and Handle**
- **Evaporate Completely, With No Residues**
- **Be Available Worldwide**
- **Be Environmentally Benign**
- **Be Affordable**

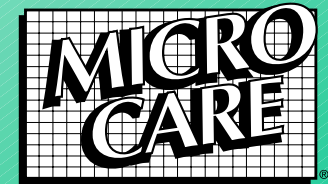
Let's Look at the Various Choices...



First, A few Words About **Water Cleaning**

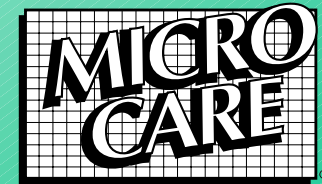
- **Very Safe, Nonflammable, But a “High Boiler” Not Suited to Vapor Cleaning**
- **High Surface Tension Makes It Difficult to Clean & Dry from under Tight Spaces**
- **Requires Additives to Hit Different Contamination**
- **Water-Treatment Issues Add to Cost, Complexity**
- **Systems Are BIG and Costly**

Everybody Would Like to Use Water, But It Doesn't Work in Many Advanced Applications...



Solvent Choices: **Hydrocarbons**

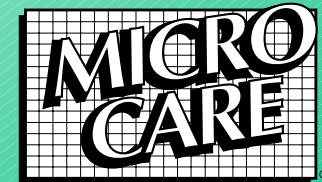
- **Good Degreasing Agents**
- **High-Boilers (Will Leave Residues on Parts)**
- **Often Used as Additives in “Co-Solvent Systems” to Target Cleaning Power**
- **Flammable, Smelly**
- **Waste Handling & Disposal Usually Is Not Difficult**
- **Many Vendors, Many Choices, Many Price Points**



Solvent Choices:

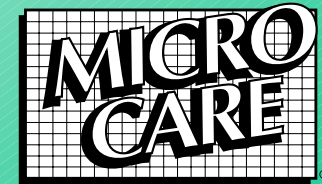
Chlorinated Solvents

- **Old-Style Choices: Perc, TCE, Methylene Chloride**
- **Great Cleaners**
- **Main Selling Point: Cheap**
- **Many Toxicity Worries** (Classified as Hazardous Air Pollutants, Require Sophisticated Machines for Safe Use)
- **Many Disposal Issues**
- **Will Mix with Water; “Turns Acid”**
 - Need Stabilizers
 - Constant Monitoring



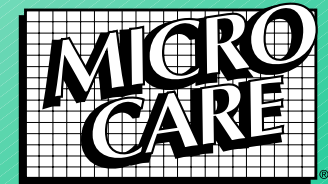
Solvent Choices: **nPB**

- **Based on “normal Propyl Bromide”**
- ***Very Aggressive* — Test on Plastics**
- **Very Strong Aroma**
- **Concerns About Toxicity**
- **Mixes with Water; “Turns Acid” Easily**
 - Needs Stabilizers, Constant Monitoring
- **Operates at Higher Temperatures**
- **Questionable Ozone-Depleter**
- **Many Vendors;
Quality Varies**



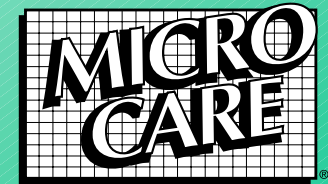
Solvent Choices: **HCFC - 225**

- **Very Good Cleaner, Good Degreaser**
- **Test on Plastics, Electronic Components**
- **Few Grades or Formulations**
- **Classified as Hazardous Waste**
- **Low VOC Ratings Boost Appeal in Some Areas**
- **Class II Ozone-Depleter**
 - Phase-Out Date of 2015
- **Some Concerns About Toxicity**
- **Single Source of Supply**



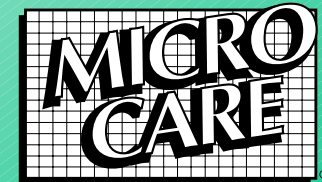
Solvent Choices: **Fluorinated (HFCs, HFEs, PFCs)**

- **Excellent, Mild Cleaners Ideal for Critical Cleaning Applications**
- **Easily Blended for Targeted Cleaning**
- **Low Surface Tension**
- **Easy to Heat & Distill**
- **Do Not Mix with Water, Do Not “Turn Acid”, No Stabilizers Needed**
- **Very Good Environmentally, Toxicity (Except PFCs)**
- **More Grades of HFCs Available, for Targeted Cleaning**



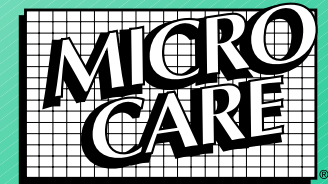
Summary: Your Cleaning Choices

- **Water** Not Suited — High Surface Tension, Low Density, Disposal & Treatment Costs, Large Machines, Energy Intensive
- **Hydrocarbons** Not Suited — Combustible, Slow to Clean, Slow to Dry, Energy Intensive
- **Chlorinateds** Not Suited — Many Environmental, Toxicity Worries
- **Brominateds** Suited in Special Applications. Powerful Degreaser. Toxicity Worries, Strong Aroma; Quality, Prices Vary
- **HCFC-225** Suited in Special Applications. Ozone-Depleter
- **HFCs, HFEs** Best Choices. Good Cleaners, Easily Blended



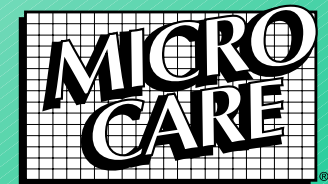
The Punchline

- **Vapor Degreasing with HFCs and HFEs Produces Results That Other Technologies Can't Deliver As Reliably & Effectively...**
 - **Great Cleaning**
 - **Easy to Use, Simple to Handle**
 - **Cost-Effective**
 - **Great Materials Compatibility**
 - **Safe for People and the Planet**
 - **Easy Disposal**
 - **Simple, Low-Maintenance Processes**



Introducing Vertrel®— Your Best Choice for Vapor Degreasing

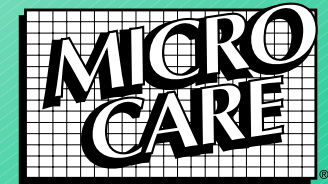
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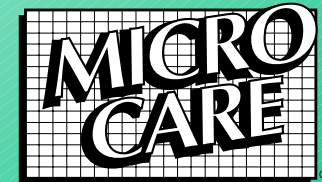
Vertrel[®] Properties

– Boiling Point	45-55° C (Grade-specific)
– Flash Point	None
– Thermal Stability	Very Stable up to 300° C
– Materials Compatibility	Excellent
– Drying Time	Fast
– Non-Volatile Residues	<10 ppm
– Azeotropes?	Yes
– Exposure Limit (8 Hr)	200 PPM
– Ozone Impact	Zero
– Global Warming Factor	Low (0.21)
– Volatile Organics (VOC)	Exempt



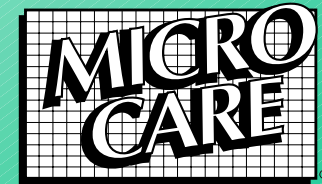
Important Features

- **All Vertrel® Cleaners:**
 - High Density, Low Surface Tension and Viscosity Make for Great Cleaning
- **Are Gentle on the Environment:**
 - Are Completely Ozone-Safe
 - Have Low Global Warming Potential
 - Many Blends Are VOC-Exempt
 - Air Permits Often Not Required (SCAQMD Regulations; Depends on Product)
 - Non-hazardous Waste Classification (Cal. EPA)
- **Can Be Used with “Best Available Cleaning Technology (BACT)”**



Vertrel® Details: The Wetting Index

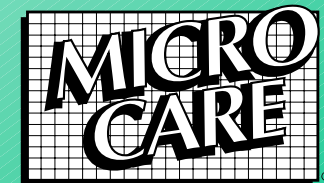
- Gauges the Efficiency of a Cleaner at *Particle Cleaning*
(e.g., Removing Insoluble Particulates)
- Higher Wetting Index =
Faster Cleaning In Tighter Spaces
- Wetting Index =
 - Density x 1000 Divided by...
 - Surface Tension x Viscosity



Vertrel® Details: Wetting Indices Compared

<u>Cleaning Media</u>	<u>Density</u>	<u>Surface Tension</u>	<u>Viscosity</u>	<u>Wetting Index</u>
Freon	1.48	17.4	0.70	122
TCA	1.32	25.9	0.79	65
IPA	0.79	21.7	2.40	15
DI Water	0.997	72.8	1.00	14
DI Water + Surfactant	0.998	29.7	1.08	31
Vertrel® XF	1.58	14.1	0.67	167
Vertrel® XP	1.53	14.2	0.68	158

*Since Vertrel® Has a Very High Wetting Index,
These Products Are Extremely Well-Suited to
Critical Cleaning in Vapor Degreasers*



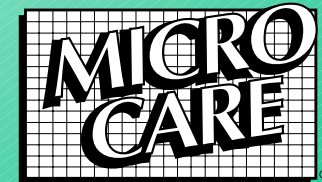
Vertrel Costs Less to Use

	Vertrel®	HCFCs	npb	Aqueous	Semi-Aq	High VP HC	Low VP HC
Drying Time	v. fast	v. fast	Fast	v. slow	v. slow	Fast to v. fast	Slow
Labor Costs	Low	Low	Low	Modest	High	Low	High
Operating Costs	Low	Low	Modest	High	High	Low	Low
Cleaning Cycle	Shortest	Shortest	Short	Long	Long	Long	short
Footprint	Small	Small	Small	Large	Large	Large	Modest
Capital cost	Low	Low	Modest	High	High	Highest	High

“High VP” = High Vapor Pressure = Fast Evaporation, More Flammable

“Low VP” = Low Vapor Pressure = Slow Drying, Less Flammability

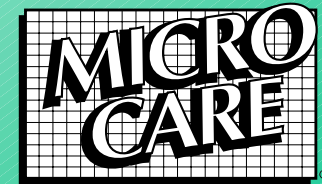
“HC” = Denotes Hydrocarbon Solvents



Vertrel® Details: Health & Safety Issues

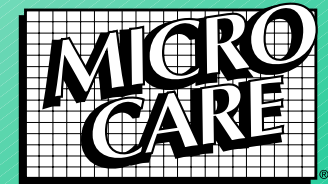
	Vertrel®	HCFCs	npb	Aqueous	Semi-Aq	High VP HC	Low VP HC
Flammability	No	No	No	No	Low/no	Low	v. high
Toxicity	Low	Low	Mod – High?	Modest	High	Low	High
Air Regs	v. Few	Many	Few	None	Few	Few	Few
Water Regs	None	None	None	Many	Many	None	None
Waste volumes	Low	Low	Low	Modest	Large	Large	Modest High

“High VP” = High Vapor Pressure = Fast Evaporation, More Flammable
“Low VP” = Low Vapor Pressure = Slow Drying, Less Flammability
“HC” = Denotes Hydrocarbon Solvents



Featured Vertrel® Products

- **For Precision Vapor Degreasing:**
Vertrel® CCA, MCA, MCA Plus
- **For Particulate Cleaning:**
Vertrel® XF, XM, XE and XP
- **For Defluxing:**
Vertrel® CMS, XMS Plus, SMT
- **As a Carrier Fluid** (for silicone and PTFE Lubricants)
Vertrel® CF, XF
- **For Cleanliness Verification:**
Vertrel® MCA, SMT

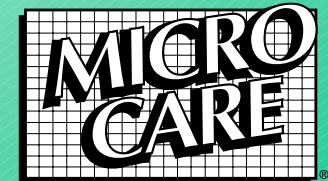


Vertrel® Specialty Products

Product

Applications

- **XB3**
Coolant and Lubricant for Precision Drilling of White Metals
- **XDA**
Displacement Drying of Excess Water
- **XP10**
Absorption Drying of Excess Water
- **XSi**
Silicone Tube Swelling



Vertrel® Applications

There are a number of other Vertrel® formulations available for special applications. For more details, contact Micro Care

	The Major Vertrel® Formulations												
	CF	CMS	CCA	XF	XSi	XDA	XM	XE	XP-10	MCA	MCA+	SMT	SMT+
CARRIER FLUIDS:													
Perfluorolubricants	●		●	●									
Silicones	●		●		●								
DRYING AGENTS:													
Displacement						●							
RINSING AGENTS:													
Ionic/Particulate	●			●			●	●	●				
DEGREASING AGENTS:													
Particulate	●	●	●	●			●	●	●			●	●
Light Oils		●	●				●	●	●	●		●	●
Oil and Lube			●						●	●	●	●	
Heavy Oil, Grease			●							●	●	●	
Silicones	●		●								●	●	
DEFLUXING AGENTS:													
Mild	●												
Medium		●											●
Strong (Test on Plastics)												●	

For Further Info

- Call Micro Care at—
(888) 595-4525
- Check Out—
www.VertrelSolvents.com
- Email Us at—
Info@MicroCare.com

**Micro Care Is Your Direct Source
for Vertrel® Solvents**

Only from DuPont

