

Fluorinated Solvent

**ZEORORA®**

**ZEORORA® H** **ZEORORA® HTA**



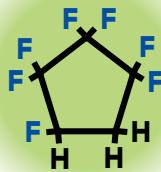
*Environmentally Friendly*

**ZEON**

**ZEON CORPORATION**

## What is "ZEORORA®H" ?

### C-HFC

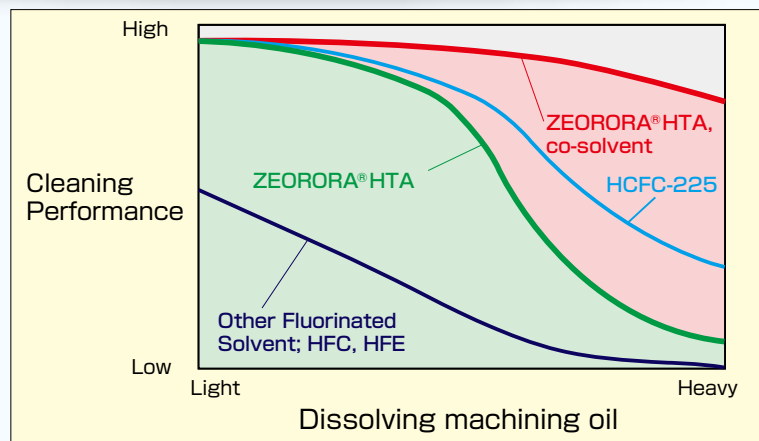


### [ZEORORA®H]

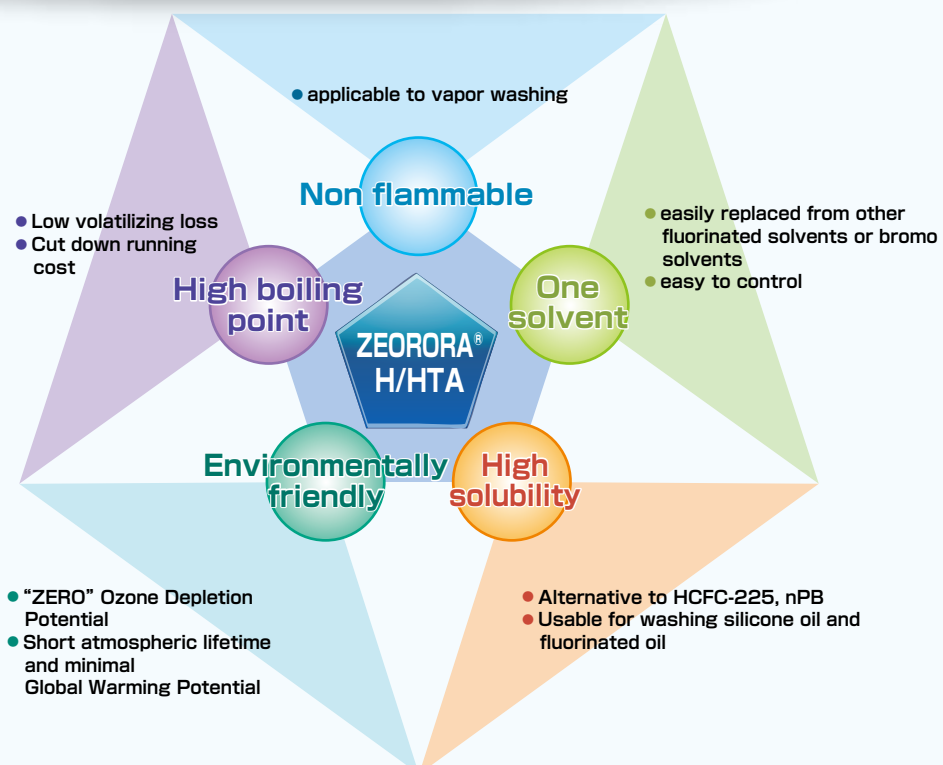
"ZEORORA®" is Fluorinated Solvent developed by Zeon & AIST\*. This solvent is non flammable and environmentally friendly. "ZEORORA®H" is used as solvent for many applications, and "ZEORORA®HTA" is cleaning solvent.

AIST\*: National Institute of advanced industrial; science and technology

## Cleaning performance of ZEORORA®HTA



## Features of ZEORORA®H & ZEORORA®HTA





## Physical Properties of ZEORORA® H/HTA

	Neat	Azeotrope
	ZEORORA® H	ZEORORA® HTA
Specific Gravity [25°C]	1.58	1.50
Boiling Point (°C)	82.5	82
Viscosity (mPa·S) [25°C]	1.59	1.47
Surface Tension(mN/m) [25°C]	19.6	19.2
Specific Heat (kJ/kg·K)	1.11 (19°C) 1.23 (35°C)	1.28 (25°C)
Vapor Pressure (MPa) [20°C]	0.0083	0.0083
Evaporative Latent Heat (kJ/kg) [boiling point]	144	161
Vapor Density (air=1)	6.81	6.65
Melting Point(°C)	20.5	6~10
Flash Point(°C)	None	None
Range of Explosion (vol%) [82°C]	None	4.9~12.9
Solubility to Water (g/100g Water)	0.072	—
Decomposition Test (ARC test)(°C)	None(under 350°C)	—
KB value	14	20



## Comparison of Environmental Properties

Category	C-HFC	HCFC	HFC	HFC	HFE	HFE
	ZEORORA® H	HCFC-225	HFC-43-10mee	HFC-365mfc	HFE-449s1	HFE-347pc-f
Formula	c-C <sub>5</sub> F <sub>7</sub> H <sub>3</sub>	CClF <sub>2</sub> CF <sub>2</sub> CHClF	CF <sub>3</sub> CF <sub>2</sub> CHFCF <sub>2</sub> CF <sub>3</sub>	CF <sub>3</sub> CH <sub>2</sub> CF <sub>2</sub> CH <sub>3</sub>	C <sub>4</sub> F <sub>9</sub> OCH <sub>3</sub>	CF <sub>3</sub> CH <sub>2</sub> OCF <sub>2</sub> CF <sub>2</sub> H
Ozone Depletion Potential (ODP)	0	0.03	0	0	0	0
Atmospheric Lifetime (year) [IPCC AR5]	2.8*	5.9	16.1	8.7	4.7	6.0
Global Warming Potential(GWP) 100years [IPCC AR5]	175**	525	1650	804	421	889

\* N.Zhang, et al, Chem. Phys. Lett., 619(2015). 199-204

\*\* A. Sekiya, JSPS, 155-104, April 2016.



## Toxicity

<b>Impact on fish</b>	Low fish toxicity, No fish bioaccumulation
<b>Acute Toxicity (Inhalation)</b>	LD50 = 14213 ppmV (Rat, 4 hours)
<b>Acute Toxicity (Oral)</b>	LD50 > 2g/kg (Rat)
<b>AMES study</b>	Negative
<b>Chromosomal aberrtion test</b>	Negative (Mouse)
<b>Teratogenicity</b>	Negative
<b>Skin Corrosion/Irritation</b>	No irritation
<b>Eye damage/irritation</b>	Weak



## Effect on elastomers & plastics

Test piece	Rate of dimensional variation(%)	Rate of weight variation(%)	Test piece	Rate of dimensional variation(%)	Rate of weight variation(%)
Polyacetal	0.3	0.0	PPS	-0.4	0.0
Polystyrene	0.1	0.0	PTFE	0.0	0.1
Acrylonitrile Butadiene Styrene	0.1	3.4	PU	2.5	8.4
Polycarbonate	0.2	0.0	Glass epoxy	-0.4	0.0
Polyvinyl Chloride soft	-3.5	0.1	Acrylic resin	Melting	-
Polyethylene	0.2	0.5	CR	0.5	-0.1
Phenol Formaldehyde(Resin)	0.0	-0.1	NBR	10.7	5.4
Polyvinyl Chloride hard	-1.9	0.1	SBR	1.0	0.4
Nylon 66	0.0	-0.3	Fluororubber	8.3	11.3
Polypropylene	0.3	0.1	Silicone rubber	4.5	8.7

Size of test piece:50×25×2mm

Washing Condition : Immersion in boiling ZEORORA®HTA for 5 min ⇒ in cool bath (25℃) for 5min ⇒ Vapor cleaning

Measurement condition : Measure in 5min after cleaning



## Applications of ZEORORA®H/HTA

### Cleaning

- Object ; Precision metal parts, Electronic parts or elements, Ceramic parts, Glass parts or lens,
- Purpose ; Degreasing, Removal of liquid crystal, flux, particles, fluorocarbon oil, epoxy resin (uncured), pigment.

### Solvent of reaction, polymerization, Electronics materials.

- Solution : Solvent of fluorocarbon polymers
- Purpose : Water-repellent, Oil-repellent, Lubrication, Release

### Admixture of fluorine type solvent

- Purpose ; Improving Cleaning, Non-flammable, Drying performance



# Washing System of ZEORORA® HTA

ZEORORA® HTA can degrease engineering oil (light - medium) with “single solvent system” and can achieve higher cleaning level with “co-solvent system”

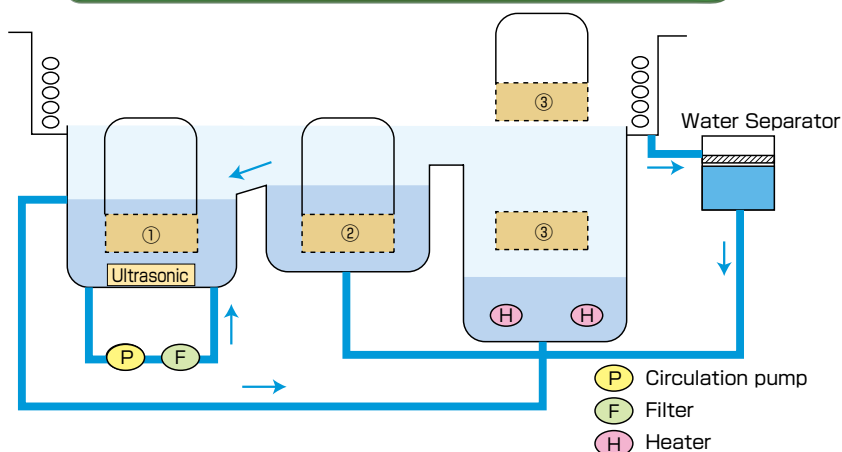
\* Co-solvent system : Rinse and vapor cleaning with ZEORORA® HTA after cleaning with hydrocarbon type combination solvent (for example)

## Cleaning System

### Single solvent system with ZEORORA® HTA

Cleaning → Rinse → Vapor cleaning~drying

#### ZEORORA® HTA



#### Cleaning Method :

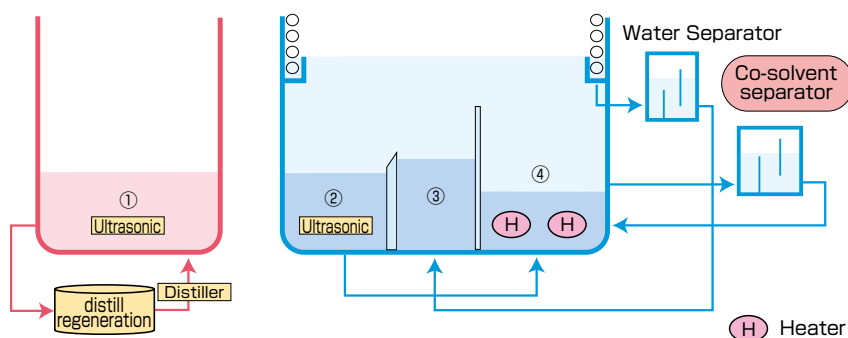
- ① Hot bath with Ultrasonic vibration remove smear.
- ② Cool bath acts as immersion rinse and cool downing objects for enhancing vapor cleaning effectiveness.
- ③ Vapor cleaning~drying provide fineness finish.

### Co-solvent system with ZEORORA® HTA

Co-solvent cleaning → Ultrasonic cleaning → Rinse → Vapor cleaning~drying

Hydrocarbon type  
combination solvent

#### ZEORORA® HTA



#### Cleaning Method :

- ① Hydrocarbon type combination solvent remove smear.
- ② Hot bath with Ultrasonic vibration rinse hydrocarbon type combination solvent.
- ③ Cool bath acts as immersion rinse and cool downing objects for enhancing vapor washing effectiveness.
- ④ Vapor cleaning~drying provide fineness finish.

## Solubility of oil

Engineering oil	HCFC-225	ZEORORA®HTA			HFE-449s1			HFE-449s1+IPA		
	25℃	25℃	40℃	boiling point	25℃	40℃	boiling point	25℃	40℃	boiling point
Daphne punch oil	100	100	100	100	100	100	100	100	100	100
G-6050	100	3.5	5.4	100	1.9	2.7	4.4	2.8	3.3	5.2
G-6040	100	2.9	3.6	100	2.3	3.5	5.6	3.0	3.7	6.7
C-126	100	100	100	100	×	×	×	×	×	×
P-1600	100	4.5	5.4	100	5.8	6.8	8.6	5.9	7.2	9.3
Castor oil	100	0.6	1.0	6.9	×	×	×	×	×	×
Olive oil	100	0.2	0.7	3.8	×	×	×	×	×	×

grams of oil dissolve in 100 grams of solvent  
 "100" means "the oil is compatible to the solvent"

"×" means "the oil is not dissolved to the solvent"

Products	Maker	Category	Kinetic Viscosity (40℃)	Add-in material
Daphne punch oil	IDEMITSU KOSAN CO.,LTD.	Blanking oil	1.06	Extreme pressure agent (phosphorus)
G-6050	NIHON KOHSAKUYU CO.,LTD.	Blanking oil	3.43	Oiliness agent, Chlorine compound, Anti rust agent, Anti-corrosive agent
G-6040	NIHON KOHSAKUYU CO.,LTD.	Blanking oil	5.17	Chlorine compound
C-126	NIHON KOHSAKUYU CO.,LTD.	Cutting fluids	20	Semidry, Fatty acid ester
P-1600	JX NIPPON OIL & ENERGY	Anti-rust oil		
Castor oil	reagent of KANTO CHEMICAL CO.,INC.	Vegetable oil		
Olive oil	reagent of KANTO CHEMICAL CO.,INC.	Vegetable oil		

## Cleaning of silicon grease



Silicone Grease : Shin-Etsu G40 Ultrasonic, 50℃x1min

## Cleaning of epoxy resin

	JU-100-5 (Maker: KOKI)	JU-41P (Maker: KOKI)	JU-R2S (Maker: KOKI)	Result
ZEORORA®HTA				OK
HFE-449s1+IPA				NG
HFC-43-10mee+EtOH				NG
n-Decane				NG
IPA				NG
HCFC-225				OK
Ethyl acetate				OK

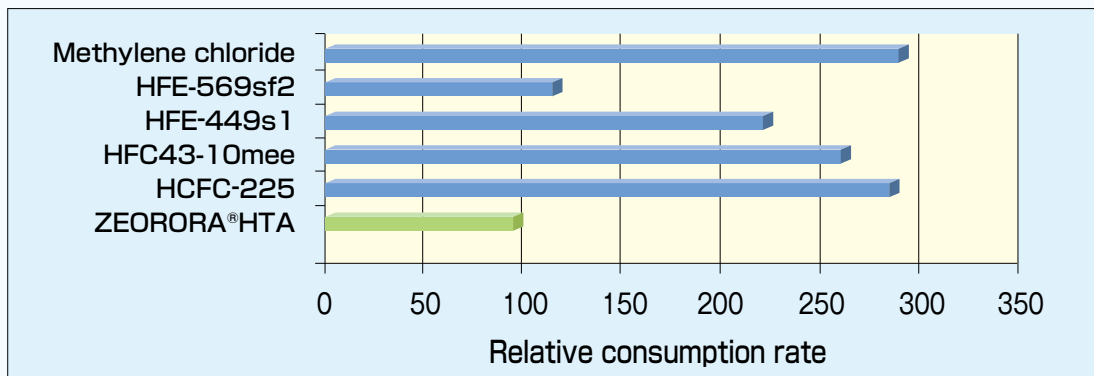
Epoxy resin adhesives applied to a slide was left for 24 hours before cleaning test (uncured) Ultrasonic, 20℃x10seconds





## Decrease Emission and Cost

### Consumption at reflux condition



Fluorine-based solvents are required to reduce evaporation loss, in order to reduce running cost and protect environment.

ZEORORA®HTA consumption achieves less than 1/3 of HCFC-225. It is much smaller than the other Fluorine-based or Chlorine-based solvents.

### Applications



Polygon mirror



HD parts



Precision metal parts



Lead frame



Printer roller



Bearing



## Technical Support



R&D center

We set up solvent cleaning laboratory in Zeon R&D center, which provides technical support and cleaning evaluation.



Cleaning test room

## **SNAP\* identified ZEORORA®H as “acceptable (to be produced without limitation)” substitute for the ozone-depleting chemical**

SNAP\*: The Significant New Alternatives Policy (SNAP) Program is a program of United States Environmental Protection Agency (EPA)'s program to evaluate and regulate substitutes for the ozone-depleting chemicals that are being phased out under the stratospheric ozone protection provisions of the Clean Air Act (CAA).

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