

Environmentally Friendly Fluorinated Fluids

# ***ASAHIKLIN***<sup>®</sup>

***AE-3000 AC-2000 AC-6000***



# ASAHIKLIN® is a range of environmentally friendly fluorinated fluids

## Non-flammable

The ASAHIKLIN® series has no flash point, and therefore does not require explosion proof equipment.



## Stable

The ASAHIKLIN® series is chemically and thermally stable.

## Reliability

The ASAHIKLIN® series has a broad range of material compatibilities.

## General purpose

The ASAHIKLIN® series can be used for a variety of customer applications.



## ODP zero \*1

The ASAHIKLIN® series does not affect the ozone layer.

## Lower GWP \*2

The ASAHIKLIN® series has a minimal effect on global warming.

## Cost Saving

The ASAHIKLIN® series has energy saving advantages and can reduce waste.

## Recyclable

The ASAHIKLIN® series can be recycled by using distillation.

\*1 ODP : Ozone Depletion Potential  
\*2 GWP : Global Warming Potential

### AGC Chemicals company vision

## Chemistry for a Blue Planet

Creating a safe, secure, comfortable and environmentally friendly world with chemical technology.

The ASAHIKLIN® series meets the AGC Chemicals company vision.

### ASAHIKLIN® Product Range

#### ASAHIKLIN® AE-3000

Non ODP and low GWP

#### ASAHIKLIN® AC-2000

Non ODP and good material compatibility

#### ASAHIKLIN® AC-6000

Non ODP, lower GWP and high boiling point

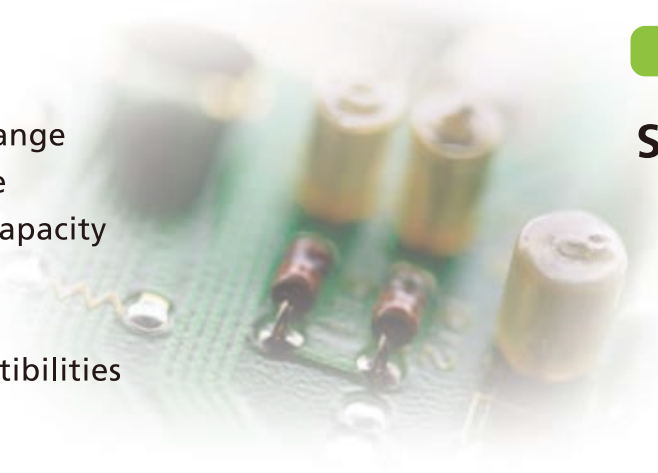
	AE-3000	AC-2000	AC-6000
ASHRAE No.	HFE-347pc-f	HFC-52-13p	HFC-76-13sf
Molecular Structure	$\text{CF}_3\text{CH}_2\text{OCF}_2\text{CF}_2\text{H}$	$\text{CF}_3(\text{CF}_2)_4\text{CF}_2\text{H}$	$\text{CF}_3(\text{CF}_2)_5\text{CH}_2\text{CH}_3$
Boiling Point (°C)	56	71	115
Freezing Point (°C)	-94	-85	-76
Ozone Depletion Potential (CFC-11 = 1)	0	0	0
Global Warming Potential (CO <sub>2</sub> = 1 100yr ITH)	580 *1	2,000 *2	136 *2
Packaging	1kg Plastic Bottle 20kg Pail 300kg Drum	1kg Plastic Bottle 20kg Pail	1kg Plastic Bottle 20kg Pail

\*1 Intergovernmental Panel on Climate/Technology & Economic Assessment Panel Report in 2007  
\*2 Calculated Value by the National Institute of Advanced Industrial Science and Technology (AIST)

## Application 1

### Heat Transfer Fluids

- Liquid at a wide temperature range
- Thermally and chemically stable
- High unit heat transportation capacity
- High electrical insulation
- Non-flammable
- Broad range of material compatibilities
- Reduced pump load



## Application 2

### Solvents

- Good coating performance
- Good drying performance
- Good dispersibility
- Non-flammable

### Dilution Solvents

#### 【Examples】

- ◇ Lubricant for HDDs
- ◇ Fluorinated greases
- ◇ Water-repellent agents
- ◇ Anti-fouling agents



### Dispersion Agents and others

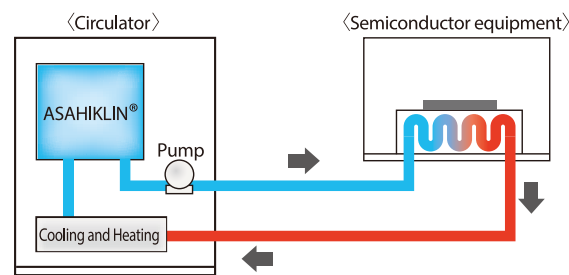
#### 【Examples】

- ◇ Fluoropolymers
- ◇ Graphite, nano-carbons
- ◇ Fireproof agents
- ◇ Reaction solvent for fluoropolymers

### Brine for Semiconductor Devices

#### 【Examples】

- ◇ Dry etching equipment
- ◇ Stepper
- ◇ Plover
- ◇ CVD lithography
- ◇ IC tester



### Other Brines

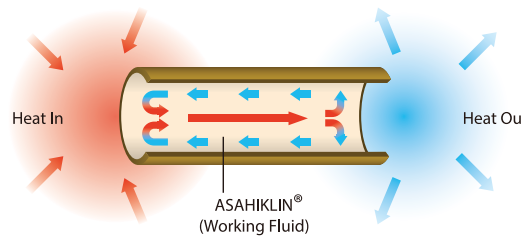
#### 【Examples】

- ◇ Coolant for computer servers, condensers, sensors, precision and electronic devices
- ◇ Coolant for chemical and medical industrial equipment
- ◇ Temperature control for environmental test rooms
- ◇ Heat transfer fluid for thermostat chamber

### Working Fluids

#### 【Examples】

- ◇ Working fluid for heat pipes
- ◇ Coolant for rectifiers, LEDs and laser generators

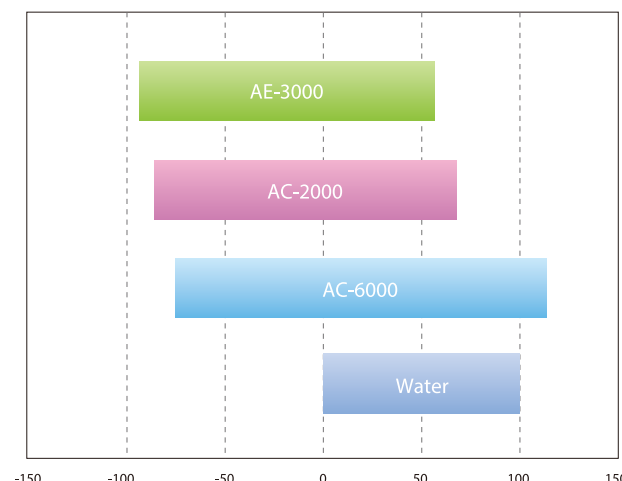


### Other Applications

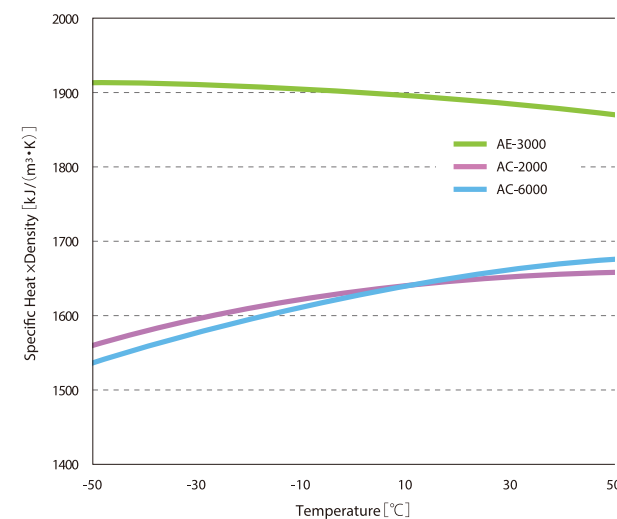
#### 【Examples】

- ◇ Working fluid for exhaust heat from manufacturing plants
- ◇ Leak tester for filters and bulbs
- ◇ Reliability testing for electronics

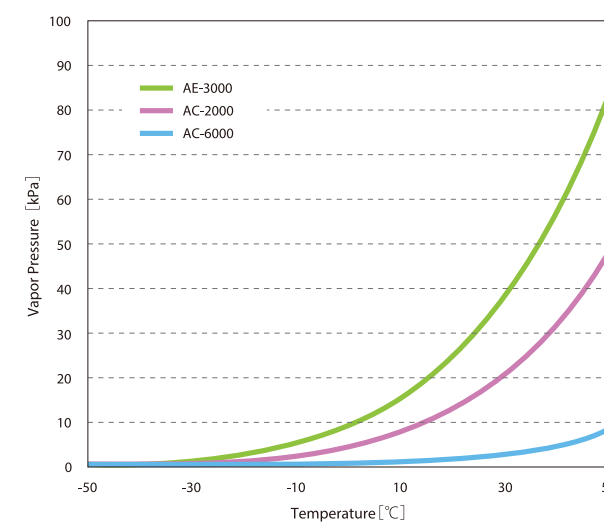
### Liquid Temperature Range of the ASAHIKLIN® series



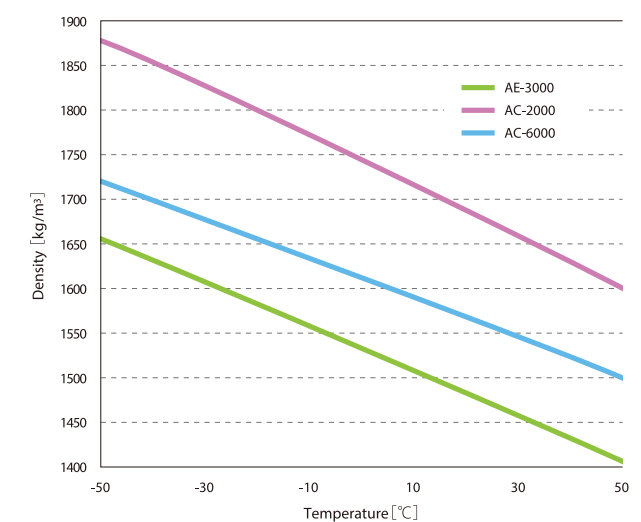
### Heat Transfer Ratio



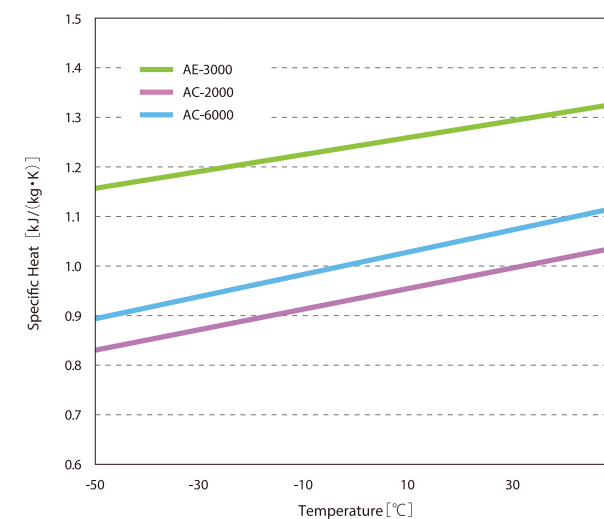
### Vapour Pressure - Temperature Curve



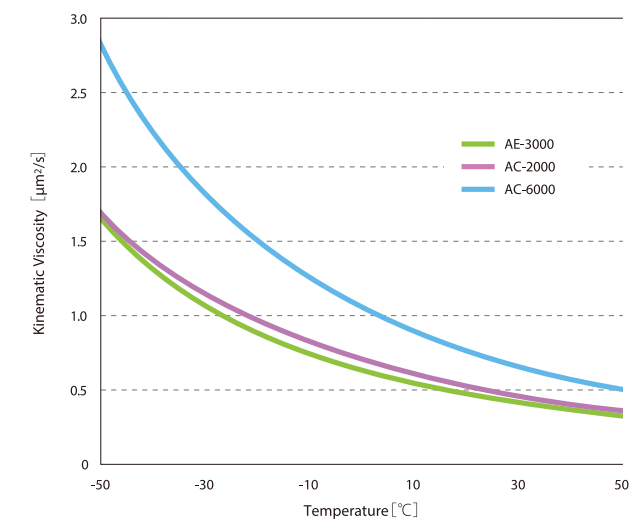
### Density - Temperature Curve



### Specific Heat - Temperature Curve



### Kinematic Viscosity - Temperature Curve

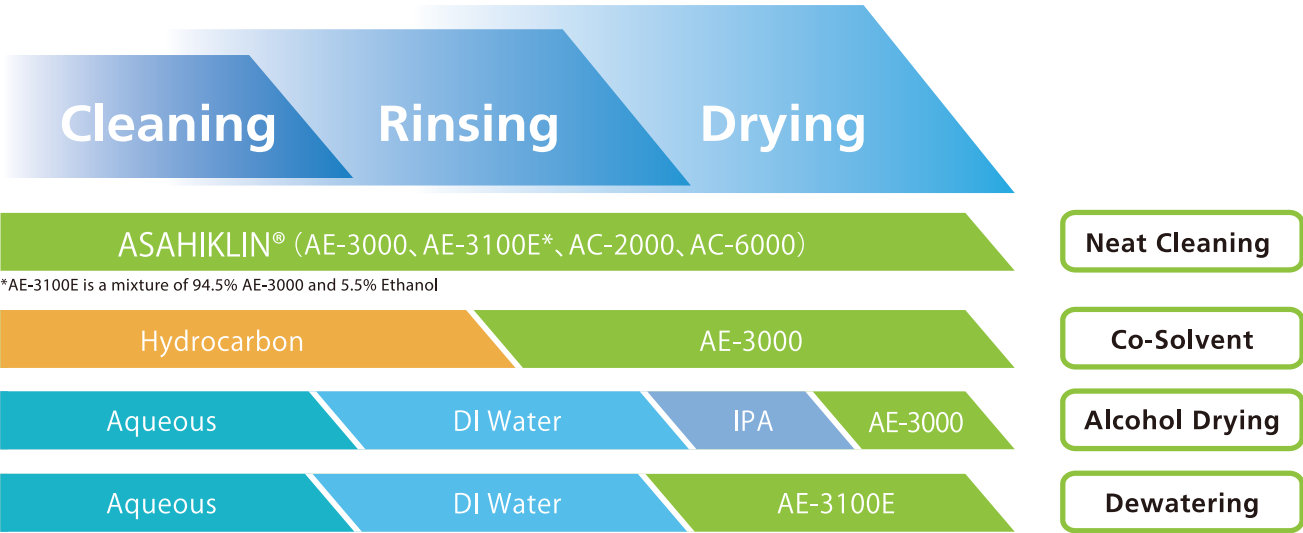




Application 3

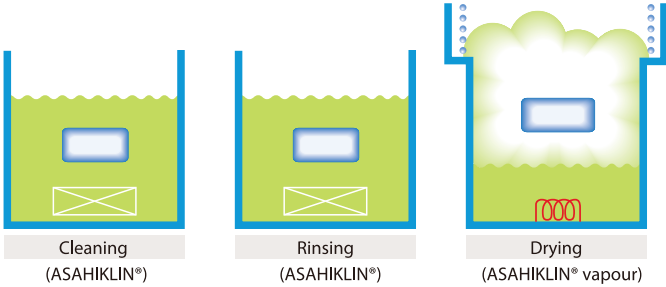
Cleaning

- Good cleaning performance in tight spaces
- Reduced drying temperature and drying time
- No spots after drying
- Compatibility with a wide range of materials
- Non-flammable



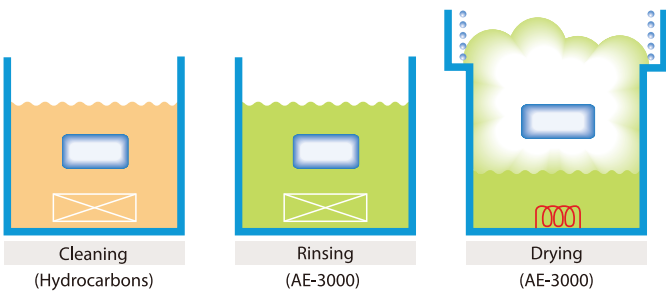
Neat Cleaning

- 【Examples】
- ◇ Particle Removal  
(Image sensors, crystal oscillator devices, wafers, plastic moldings)
  - ◇ Cleaning of refrigeration equipment
  - ◇ Removal of fluorinated oils and greases
  - ◇ Dry cleaning



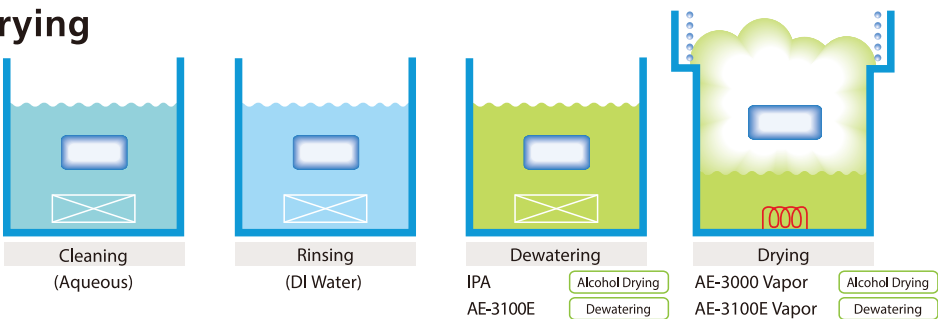
Co-Solvent

- 【Examples】
- ◇ Degreasing of precision metal parts  
(lead frames, automotive engines)
  - ◇ Flux removal for printed circuit boards
  - ◇ Wax and pitch removal for lens manufacture
  - ◇ Removal of liquid crystal and organic EL materials



Dewatering, Alcohol Drying

- 【Examples】
- ◇ Drying after aqueous cleaning  
(Glass lenses, glass substrates, quartz)
  - ◇ Drying after wet plating
  - ◇ Drying of carbide metal before coating



Physical Properties

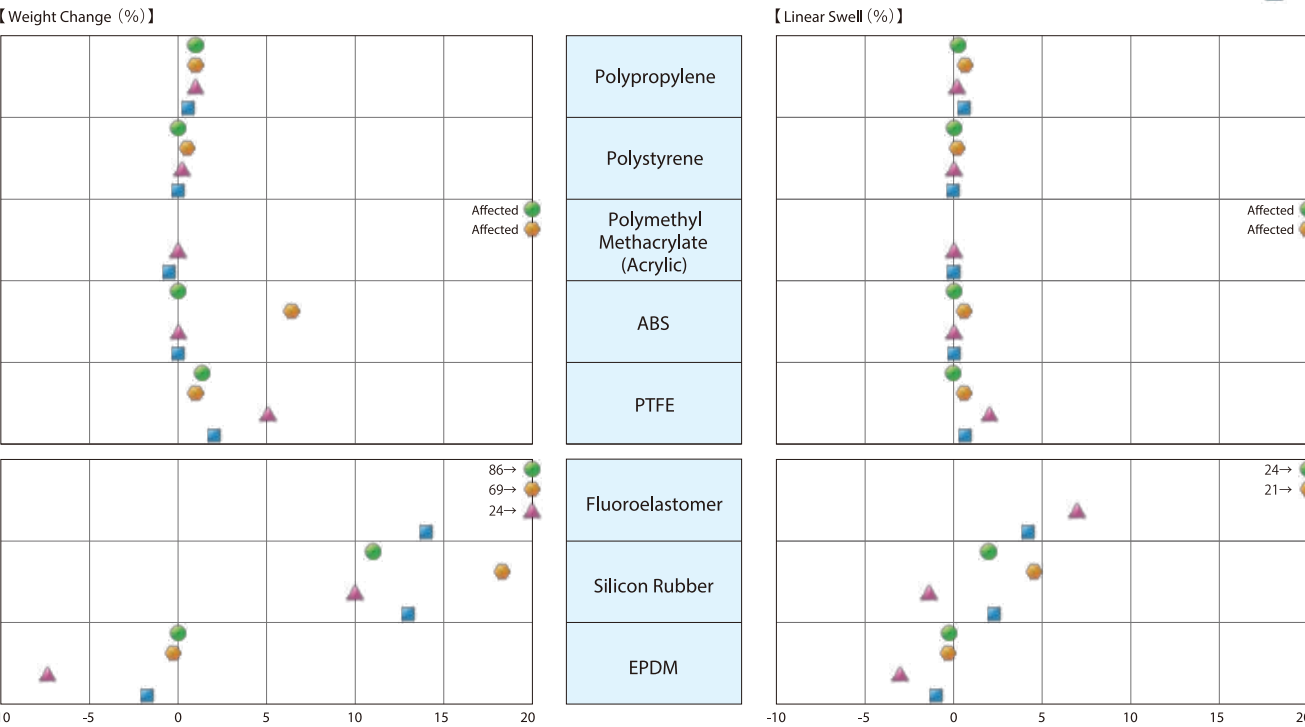
Items	Unit	AE-3000	AE-3100E	AC-2000	AC-6000
Boiling Point	°C	56	54	71	115
Freezing Point	°C	-94	-86	-85	-76
Density (25°C)	kg/m <sup>3</sup>	1,470	1,400	1,675	1,556
Surface Tension (25 °C)	mN/m	16.4	16.1	13.4	15.5
Viscosity (25 °C)	mPa·s	0.65	0.60	0.81	1.08
Kinematic Viscosity (25 °C)	μ m <sup>2</sup> /s	0.44	—	0.49	0.71
Kinematic Viscosity (-40°C)	μ m <sup>2</sup> /s	1.31	—	1.30	1.65
Vapour Pressure (25°C)	kPa	31	28	16.7	2.6
Specific Heat (25 °C)	kJ/kg·K	1.28	—	1.10	1.19
Thermal Conductivity (25 °C)	mW/(m·K)	89	—	90.9	66.8
Latent Heat of Vaporisation (Boiling Point)	kJ/kg	163	—	123	78
Relative Evaporation Rate	Ether=100	67	66	57	11
Critical Temperature	°C	190	—	198	245
Critical Pressure	MPa	2.7	—	1.9	1.8
Solubility of Water	ppm	900	5,300	200	50
Solubility in Water	ppm	700	—	—	—
Flash Point	°C	None	None	None	None
Range of Inflammability	vol%	None	None	None	None
Dielectric Constant (23 °C)	—	6.6	—	3.3	5.1
Electrical Resistivity	Ω·m	1.3×10 <sup>-9</sup>	—	2.9×10 <sup>-10</sup>	3.4×10 <sup>-8</sup>
Electrical Conductivity (23 °C)	μ S/m	7.7×10 <sup>-4</sup>	—	3.4×10 <sup>-5</sup>	2.9×10 <sup>-3</sup>
Dielectric Breakdown Voltage (23 °C)	k V	39.5	—	58.8	27.0

Material Compatibility

【Effect on Metals】 No detrimental effects when the ASAHIKLIN® series is used to clean stainless steel, aluminium, copper, brass or other metals.

【Effect on Plastics and Elastomers】

Test Conditions Samples were immersed for 3 days in AE-3000, AE-3100E, AC-2000 at boiling point, and in AC-6000 at 50°C.



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