CENTRAL GLASS

# 1233Z

## 1233Z is a nonflammable HFO solvent

**with a GWP less than 1, designed for advanced cleaning**

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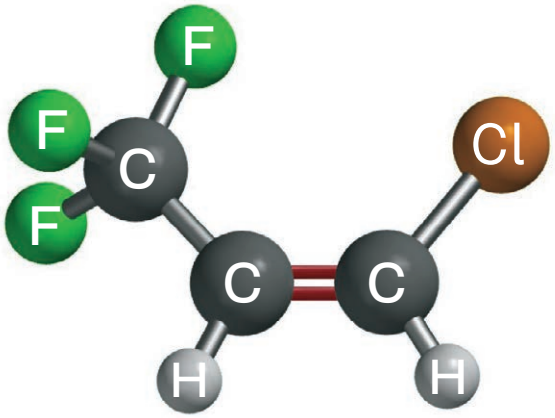



**Central Glass offers**
**a nonflammable HFO (Hydrofluoroolefin) solvent**
**with a GWP less than 1, designed for advanced cleaning**

## Foreword

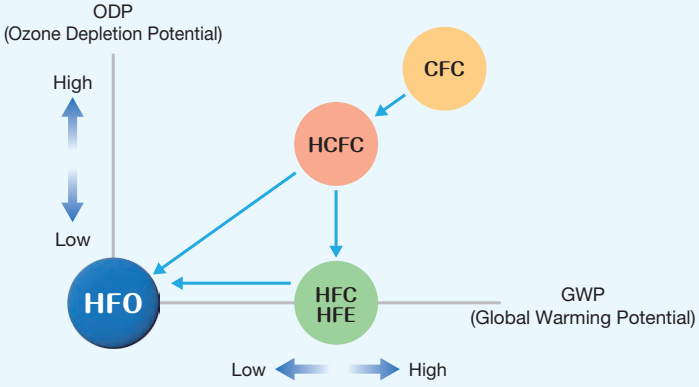
CFCs (Chlorofluorocarbons) and HCFCs (Hydrochlorofluorocarbons) were widely used as industrial fluorinated solvents due to their non-flammability and cleaning performance. However, their high ozone depletion potential (ODP) led to international efforts to protect the ozone layer, resulting in the discontinuation of their production. As replacements, HFCs (Hydrofluorocarbons) and HFEs (Hydrofluoroethers), which do not contain chlorine atoms, were developed. Nevertheless, these alternatives have relatively poor cleaning performance and high global warming potential (GWP), leaving challenges in both solvent performance and environmental impact.

In the field of non-fluorinated solvents, there is a growing demand to shift from flammable hydrocarbon-based solvents to non-flammable alternatives, driven by the need to reduce fire risks in cleaning operations and heightened compliance awareness. Additionally, concerns over toxicity have led to strong calls for replacing brominated solvents such as 1-bromopropane with safer options.

In response to these needs, Central Glass has developed an HFO (Hydrofluoroolefin) solvent through proprietary molecular design. This innovative solvent achieves a balance of cleaning performance and ultra-low GWP, while maintaining safety through non-flammability and low toxicity.

Central Glass offers a nonflammable HFO (Hydrofluoroolefin) solvent with a GWP less than 1, designed for advanced cleaning.

### Evolution of Fluorinated Solvents




HFO (Hydrofluoroolefin) is a fluorinated compound composed of carbon (C), hydrogen (H), and fluorine (F), featuring a carbon–carbon double bond within its molecular structure. Due to its extremely short atmospheric lifetime, HFO achieves both zero ODP (Ozone Depletion Potential) and ultra-low GWP (Global Warming Potential), making it a new substance that addresses key environmental concerns such as ozone layer depletion and global warming.

HFO is a fluorinated compound developed to replace HCFCs (regulated CFCs), HFCs (alternative CFCs), and HFEs.

**1233Z**
**||**
**Achieves zero ODP and a GWP less than 1**

## Feature

### ① Low GWP
The Global Warming Potential (GWP) is lower than that of carbon dioxide ($CO_2$), resulting in minimal impact on global warming.

### ② Zero ODP
The Ozone Depletion Potential (ODP) is effectively zero, meaning it does not harm the ozone layer.

### ① Cleaning and Solvent Performance
Excellent solubility for various types of oil enables use in both cleaning and solvent applications.

### ② Fast Drying
Shortened drying process contributes to improved production efficiency.

### ③ Wettability
Low surface tension allows cleaning of fine gaps and intricate areas.


### ① Non-Flammable
No flash point or flammable range, eliminating fire risk.

### ② Low Toxicity
The allowable exposure limit (manufacturer-recommended value) is 100 ppm.

### ① Single Solvent (Stabilizer-Free)
No compositional changes like mixed solvents, allowing long-term use with distillation regeneration.

### ② Cleaning Equipment Compatibility
Compatible with existing cleaning and recovery systems for fluorinated, chlorinated, and brominated solvents.

## Main Physical Properties

| Property | Unit | 1233Z |
|---|---|---|
| Boiling point | °C | 39 |
| KB Value | — | 34 |
| ODP | — | ≈0 |
| $GWP_{100}$ | — | ＜1 |
| Flash point | °C | None |
| The allowable exposure limit[1] | ppm | 100 |

[1] Manufacturer-recommended value (8h-time-weighted average concentration)

## Applications

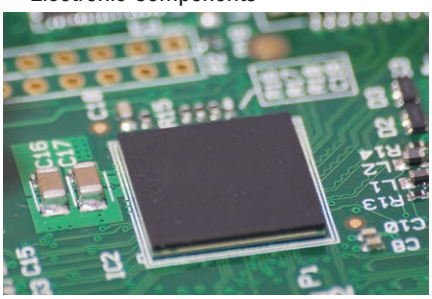
●Oil Cleaning for Metal Components

●Dilution Solvent for Silicone Oil Coating

●Dry Cleaning

●Final Drying of Optical Lenses

●Particle and Flux Cleaning for Electronic Components



●Precision Cleaning of Aerospace Components

## Solubility & Miscibility (1233Z has excellent solubility and miscibility with the oils and solvents listed below)

| Oil[1] |
|---|
| Cutting & Grinding Oil |
| Punching Oil |
| Rust Preventive Oil |
| Refrigeration Oil |
| Compressor Oil |
| Turbine Oil |
| Silicone Oil |

| Solvent | | | | | |
|---|---|---|---|---|---|
| Hydrocarbon | n-Hexane | Alcohol | Methanol | Chlorine-based | Methylene chloride |
| | Cyclohexane | | Ethanol | | Trichloroethylene |
| | Methylcyclohexane | | Isopropyl alcohol | Fluorinated | HCFCs |
| | Cyclopentane | Ketone | Acetone | | HFCs |
| | n-Heptane | Ester | Ethyl acetate | | HFEs |
| | n-Decane | Ether | Diethyl ether | Bromine-based | 1-Bromopropane |
| | Toluene | | | | |

[1] The results may vary depending on the manufacturer and model number, we recommend that you check in advance with the materials you will use.

## Cleaning Ability (Demonstrates excellent cleaning performance against the oils listed below.)

- Comparison of Cleaning Ability of Various Solvents
- ○: Effective △: Partially Effective ×: Ineffective

| Solvent | Contamination (Oil) | | | | |
|---|---|---|---|---|---|
| | Cutting Oil | Rust Preventive Oil | Refrigeration Oil | Compressor Oil | Silicone Oil |
| 1233Z | ○ | ○ | ○ | △ | ○ |
| 1-Bromopropane | ○ | ○ | ○ | ○ | ○ |
| HCFC-225ca/cb | ○ | ○ | ○ | △ | ○ |
| HFC-365mfc | × | × | △ | × | × |

* The results may vary depending on the manufacturer and model number, we recommend that you check in advance with the materials you will use.

## Thermal Stability (It has good thermal stability for 28 days×40°C and will not decompose when mixed with water)

- **Test method:** Hold 1233Z at 40°C for 28 days, with or without water addition.
- **Evaluation method:** Purity, acidity, $F^-$, $Cl^-$, hue

| Solvent | Water addition | Purity | Acidity | $F^-$ | $Cl^-$ | Hue |
|---|---|---|---|---|---|---|
| 1233Z | No addition | No change | No change | No change | No change | No change |
| | Addition[1] | No change | No change | No change | No change | No change |

[1] solvent:water=100:1(weight)

# Compatibility with Various Materials

## Resin

●**Test Method:** A sample material is immersed in 1233Z and maintained at 40°C for two durations: 10 minutes and 7 days.
Changes in dimensions and weight are measured before and after immersion.

| Material[1] | Rate of change | 10 minutes 1233Z (40°C) | 10 minutes HCFC-225ca/cb (54°C) | 7 days 1233Z (40°C) | 7 days HCFC-225ca/cb (54°C) |
|---|---|---|---|---|---|
| PTFE | Dimension(%) | 0.1 | 0.2 | 0.3 | 1.5 |
| | Weight(%) | 0.0 | 0.1 | 2.1 | 4.9 |
| Polyethylene (High density) | Dimension(%) | 0.1 | 0.0 | 0.5 | 0.8 |
| | Weight(%) | 0.3 | 0.2 | 3.3 | 4.7 |
| Polyethylene (Low density) | Dimension(%) | 0.2 | 0.3 | 1.1 | 1.5 |
| | Weight(%) | 0.3 | 0.8 | 5.2 | 9.1 |
| PVC (Hard) | Dimension(%) | 0.0 | 0.1 | 0.1 | -0.1 |
| | Weight(%) | 0.0 | 0.0 | 4.0 | 0.1 |
| PVC (Soft) | Dimension(%) | 1.1 | 0.6 | -3.8 | -0.2 |
| | Weight(%) | 8.4 | 2.4 | -0.1 | 14.5 |
| Nylon66 | Dimension(%) | 0.0 | 0.0 | -0.2 | -0.4 |
| | Weight(%) | 0.0 | 0.1 | -0.5 | -1.0 |
| Nylon6 | Dimension(%) | 0.0 | 0.0 | -0.2 | -0.4 |
| | Weight(%) | 0.0 | 0.0 | -0.7 | -1.1 |
| PVDF | Dimension(%) | 0.1 | 0.2 | 0.4 | 0.1 |
| | Weight(%) | 0.0 | -0.1 | 1.5 | 0.5 |
| Phenol | Dimension(%) | 0.0 | 0.0 | 0.0 | -0.1 |
| | Weight(%) | 0.0 | -0.1 | 0.0 | -0.7 |
| PET | Dimension(%) | 0.1 | 0.1 | 0.1 | -0.1 |
| | Weight(%) | 0.3 | 0.0 | 1.6 | 0.4 |

| Material[1] | Rate of change | 10 minutes 1233Z (40°C) | 10 minutes HCFC-225ca/cb (54°C) | 7 days 1233Z (40°C) | 7 days HCFC-225ca/cb (54°C) |
|---|---|---|---|---|---|
| Polyacetal | Dimension(%) | 0.1 | 0.2 | 0.4 | 0.1 |
| | Weight(%) | 0.0 | 0.0 | 2.2 | 0.9 |
| Polypropylene | Dimension(%) | 0.1 | 0.2 | 1.4 | 1.8 |
| | Weight(%) | 0.1 | 0.1 | 7.9 | 12.2 |
| Polyester Glass | Dimension(%) | 0.0 | 0.0 | 0.0 | 0.1 |
| | Weight(%) | 0.4 | 0.0 | 16.2 | 2.6 |
| Polycarbonate | Dimension(%) | 0.5 | 0.1 | 0.2 | 0.2 |
| | Weight(%) | 8.9 | 0.0 | 40.0 | 1.1 |
| Acrylic (PMMA) | Dimension(%) | -0.4 | -0.8 | Dissolution | Dissolution |
| | Weight(%) | -10.9 | -13.8 | Dissolution | Dissolution |
| ABS | Dimension(%) | Dissolution | 0.2 | Dissolution | 3.2 |
| | Weight(%) | Dissolution | 2.7 | Dissolution | 107.9 |
| Polystyrene | Dimension(%) | Dissolution | 0.0 | Dissolution | 1.3 |
| | Weight(%) | Dissolution | 0.6 | Dissolution | 26.8 |
| PU | Dimension(%) | 2.6 | 2.1 | 18.0 | 20.7 |
| | Weight(%) | 12.1 | 7.7 | 84.2 | 108.1 |
| Epoxy | Dimension(%) | -0.1 | 0.1 | 0.0 | 0.0 |
| | Weight(%) | 0.0 | 0.0 | 0.0 | 0.3 |
| Polyimide | Dimension(%) | 0.0 | 0.1 | -0.1 | -0.3 |
| | Weight(%) | 0.0 | -0.1 | -0.2 | -0.7 |

[1] Results may vary depending on the manufacturer and model. We recommend verifying compatibility with your specific materials in advance.

## Elastomer

●**Test Method:** A sample material is immersed in 1233Z and maintained at 40°C for two durations: 10 minutes and 7 days.
Changes in dimensions and weight are measured before and after immersion.

| Material[1] | Rate of change | 10 minutes 1233Z (40°C) | 10 minutes HCFC-225ca/cb (54°C) | 7 days 1233Z (40°C) | 7 days HCFC-225ca/cb (54°C) |
|---|---|---|---|---|---|
| SBR | Dimension(%) | 1.3 | 0.6 | 2.1 | 1.1 |
| | Weight(%) | 7.6 | 4.4 | 13.5 | 17.1 |
| Chloroprene | Dimension(%) | 1.1 | 0.8 | 2.8 | 1.8 |
| | Weight(%) | 5.6 | 3.7 | 17.5 | 15.7 |
| Butyl rubber | Dimension(%) | 0.2 | 0.4 | -1.3 | 0.1 |
| | Weight(%) | 2.0 | 3.4 | 1.1 | 12.0 |
| EPDM | Dimension(%) | 1.2 | 0.4 | 1.0 | 1.2 |
| | Weight(%) | 4.4 | 4.4 | 8.9 | 14.3 |
| CSM | Dimension(%) | 0.7 | -0.2 | 1.1 | -0.3 |
| | Weight(%) | 3.2 | 1.2 | 10.2 | 7.5 |
| Silicone rubber | Dimension(%) | 12.3 | 11.8 | 30.9 | 33.0 |
| | Weight(%) | 59.6 | 66.8 | 170.6 | 220.1 |

| Material[1] | Rate of change | 10 minutes 1233Z (40°C) | 10 minutes HCFC-225ca/cb (54°C) | 7 days 1233Z (40°C) | 7 days HCFC-225ca/cb (54°C) |
|---|---|---|---|---|---|
| Natural rubber | Dimension(%) | 0.7 | 0.8 | 3.5 | 4.8 |
| | Weight(%) | 4.0 | 4.0 | 14.4 | 23.6 |
| HNBR | Dimension(%) | 8.1 | 3.2 | 23.6 | 29.5 |
| | Weight(%) | 35.7 | 17.2 | 162.5 | 180.7 |
| NBR | Dimension(%) | 6.4 | 3.2 | 26.8 | 23.9 |
| | Weight(%) | 27.7 | 16.0 | 122.6 | 147.1 |
| Fluorine rubber | Dimension(%) | 4.3 | 2.2 | 25.0 | 16.6 |
| | Weight(%) | 15.5 | 8.5 | 90.5 | 64.5 |
| Urethane rubber | Dimension(%) | 3.8 | 2.2 | 27.7 | 24.4 |
| | Weight(%) | 24.4 | 15.7 | 135.5 | 138.1 |

[1] Results may vary depending on the manufacturer and model. We recommend verifying compatibility with your specific materials in advance.

## Metal

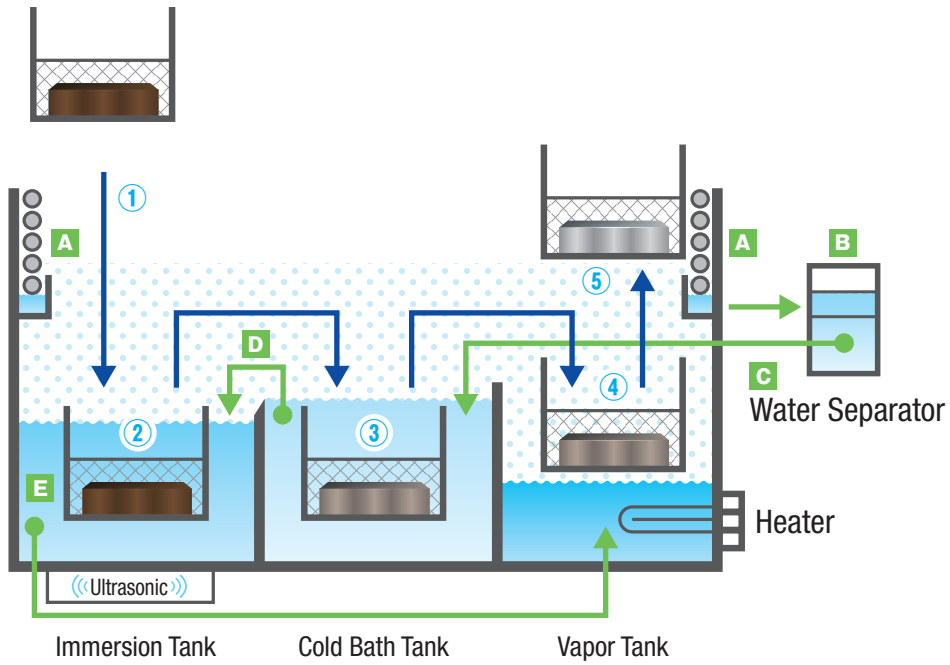
●**Test Method:** A sample material is immersed in 1233Z and held at 40°C for 7 days.

●**Evaluation Method:** Corrosion rate and appearance

No corrosion or change in appearance observed in the following metal materials.

Iron, Copper, Aluminum, SUS304, SUS316, Titanium, Nickel, Zinc, Tin, Brass, Magnesium, Nickel-Chromium Plating, Solder, Silver, Sulfate Anodizing, Tungsten, Tantalum

## Example of Cleaning Equipment (Horizontal Three-Tank Type)




**Features**

- For large components
- Automatic continuous cleaning
- Rinsing function

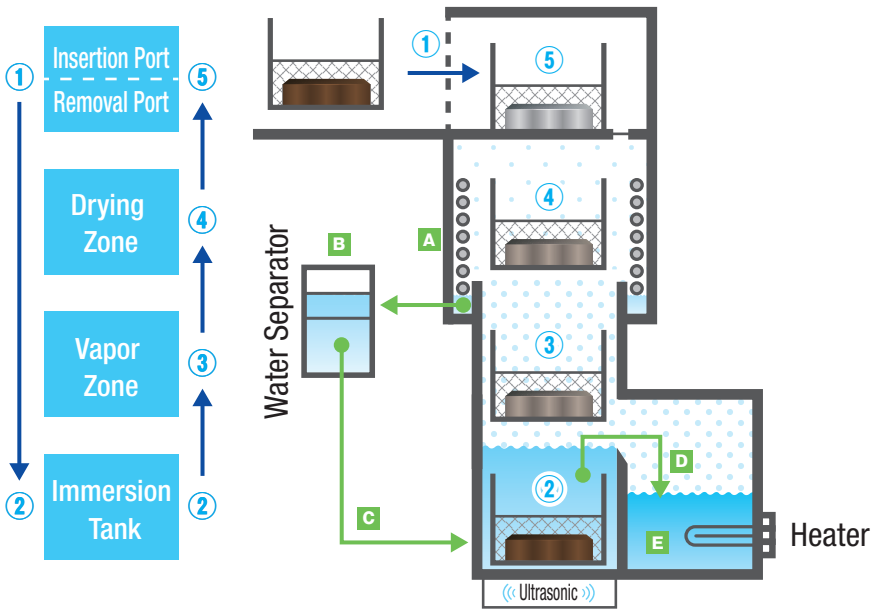
**Cleaning Process**

①Insert Workpiece
↓
②Immersion Cleaning (Heated Bath + Ultrasonic)
↓
③Rinsing
↓
④Vapor Cleaning
↓
⑤Drying

**Solvent Recovery Process**

- **A** Condense and recover solvent vapor
- **B** Separate water from recovered solvent
- **C** Return recovered solvent to cold bath tank
- **D** Overflow from cold bath tank to immersion tank
- **E** Transfer liquid from immersion tank to vapor tank for vapor cleaning

## Example of Cleaning Equipment (Vertical Two-Tank Type)




**Features**

- Compact design
- Minimal solvent leakage
- For batch cleaning applications

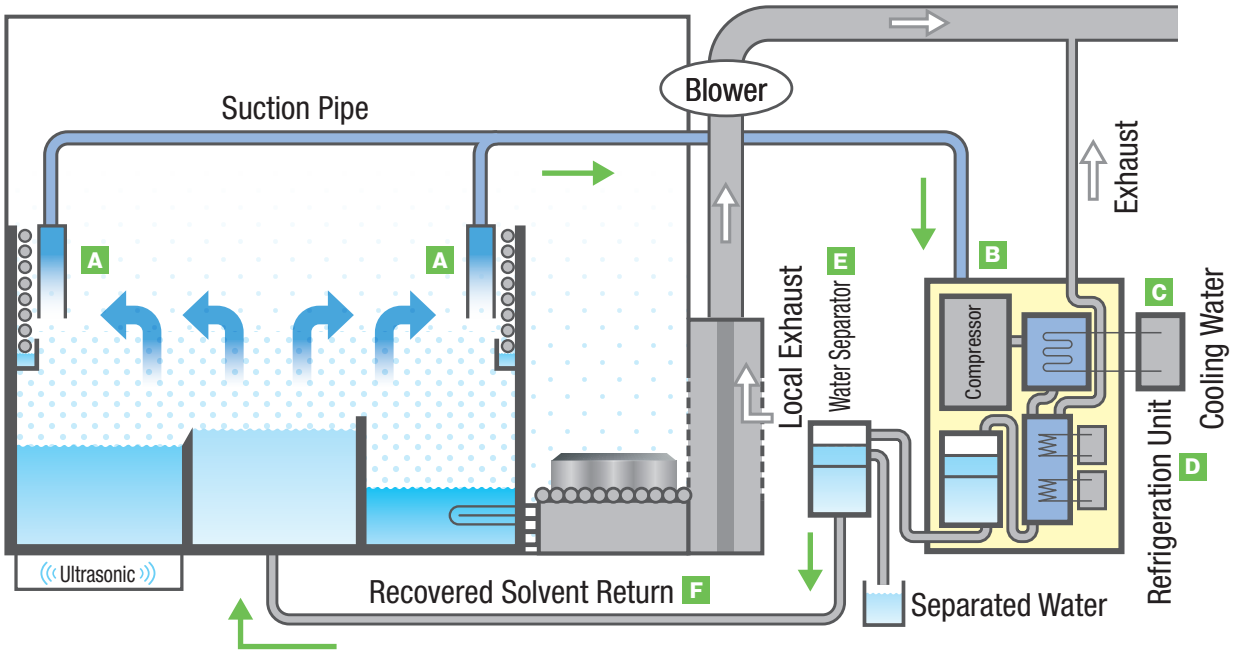
**Cleaning Process**

①Insert Workpiece
↓
②Immersion Cleaning (Heated Bath + Ultrasonic)
↓
③Vapor Cleaning
↓
④Drying
↓
⑤Removal

**Solvent Recovery Process**

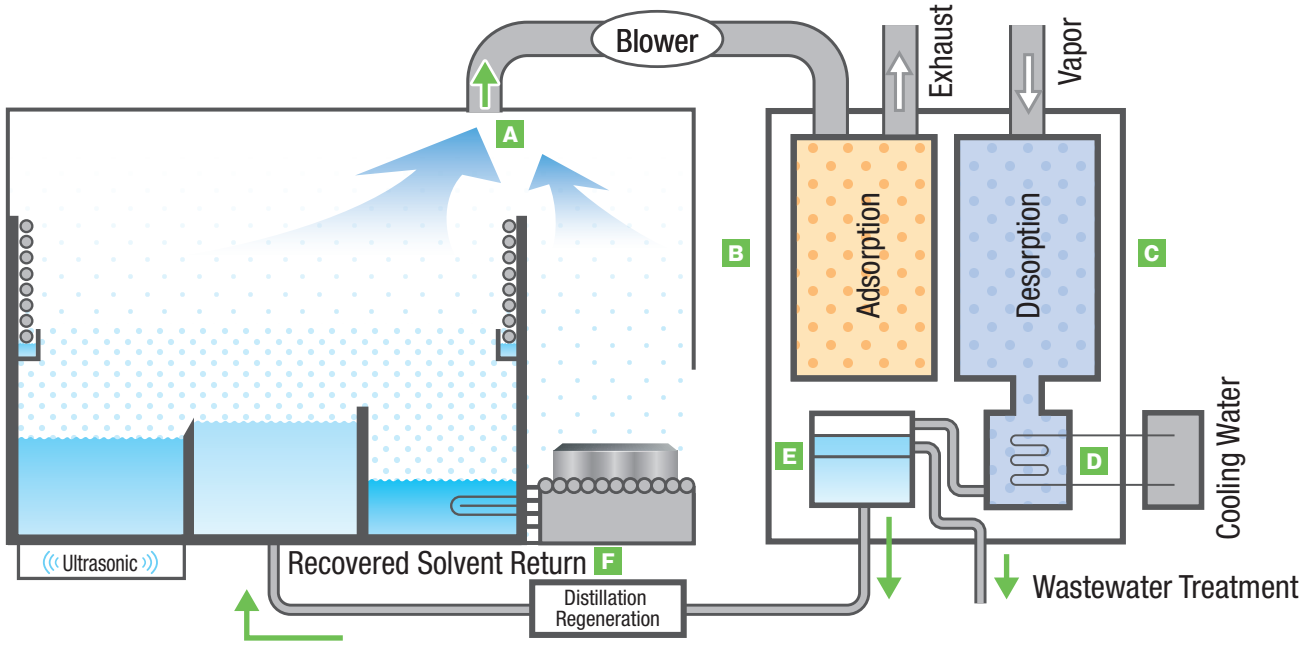
- **A** Condense and recover solvent vapor
- **B** Separate water from recovered solvent
- **C** Return recovered solvent to Immersion tank
- **D** Overflow from Immersion tank to vapor tank
- **E** Heat in the vapor tank and use for vapor

## Example of Recovery Equipment (Pressurized Cryogenic Method)




| Solvent Recovery Process | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | Suction of high-concentration solvent gas | ▶ | B | Compression of solvent gas using a compressor | ▶ | C | Liquefaction of solvent gas using a water-coole | ▶ | D | Further liquefaction of solvent gas using a cryogenic condenser | ▶ | E | Separation of water from the recovered solvent | ▶ | F | Reuse as a solvent |

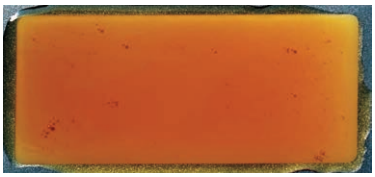
## Example of Recovery Equipment (Activated Carbon Adsorption–Desorption System)




| Solvent Recovery Process | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | Suction of gas containing solvent gas | ▶ | B | Adsorption of solvent gas using activated carbon | ▶ | C | Desorption of the adsorbed solvent gas using steam | ▶ | D | Liquefied using a condenser | ▶ | E | Separation of water from the recovered solvent | ▶ | F | Reuse after distillation regeneration |

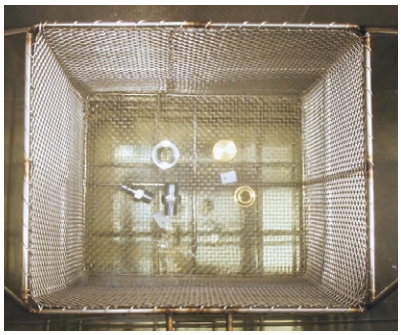
## Example of Cleaning Procedure

●**Cleaning Conditions:** After applying various types of oil to a resin substrate, the sample was immersed in solvent at 20°C for 2 minutes for cleaning.

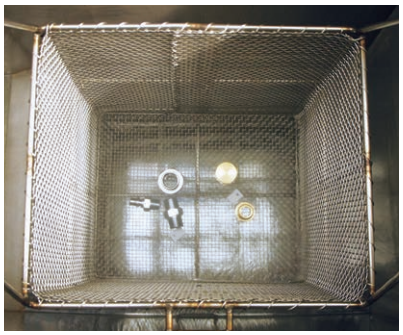
| Oil | *Before cleaning* | *After cleaning (1233Z)* |
|---|---|---|
| Processing oil  |  |  |
| Silicone oil  |  |  |
| Flux  |  |  |

## Example of Cleaning Using a Three-Tank Cleaning System

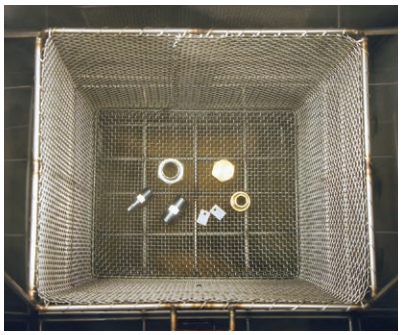
At Central Glass, we not only evaluate cleaning performance, but also provide comprehensive technical support by experienced engineers—including proposals for optimal cleaning and recovery systems tailored to customer needs, and guidance on solvent management after system implementation.



1st tank: Immersion cleaning (ultrasonic)



2nd tank: Rinsing (ultrasonic)

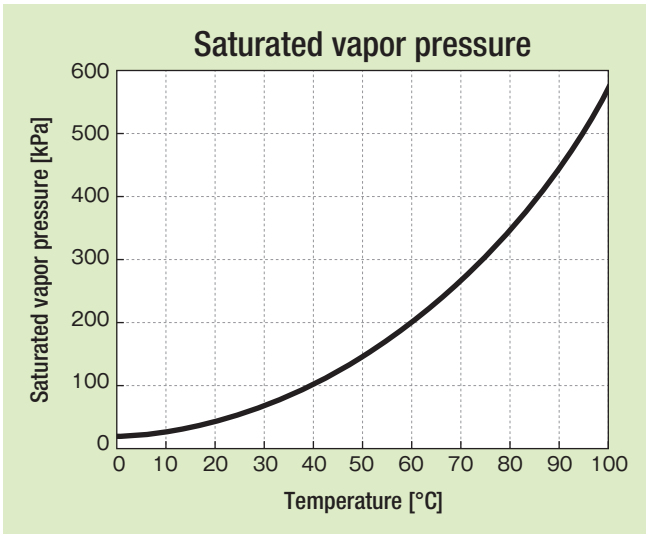


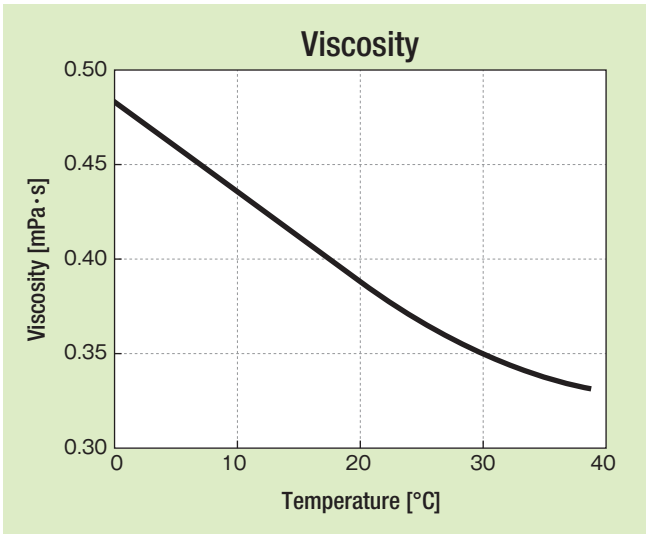
3rd tank: Vapor cleaning

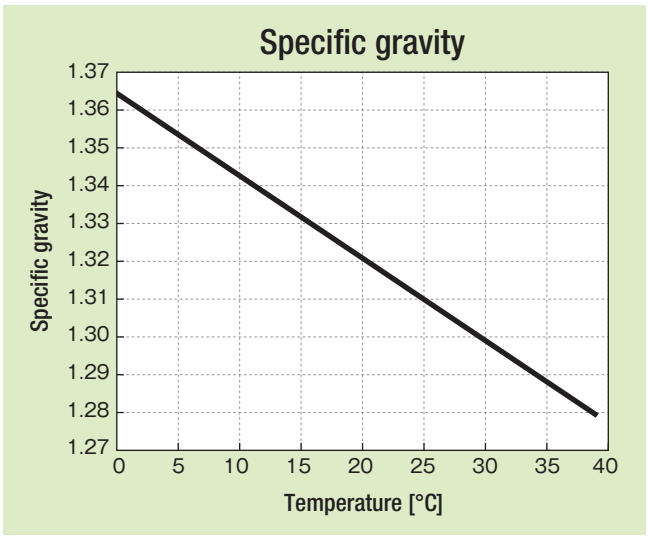
Before cleaning

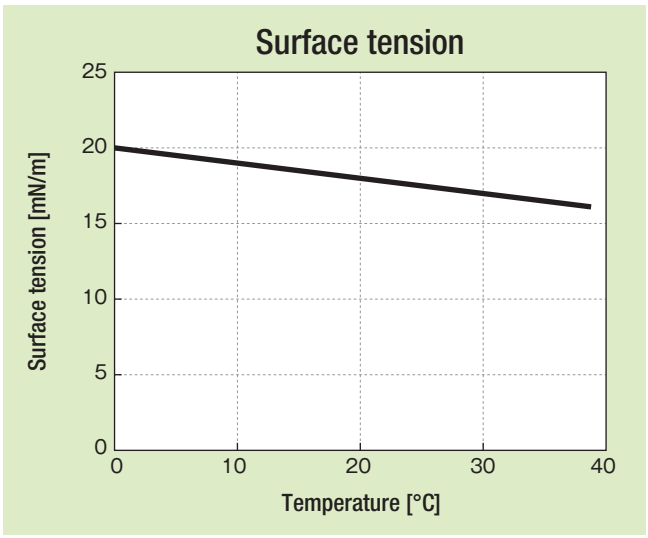
After cleaning

## Temperature Dependence Data

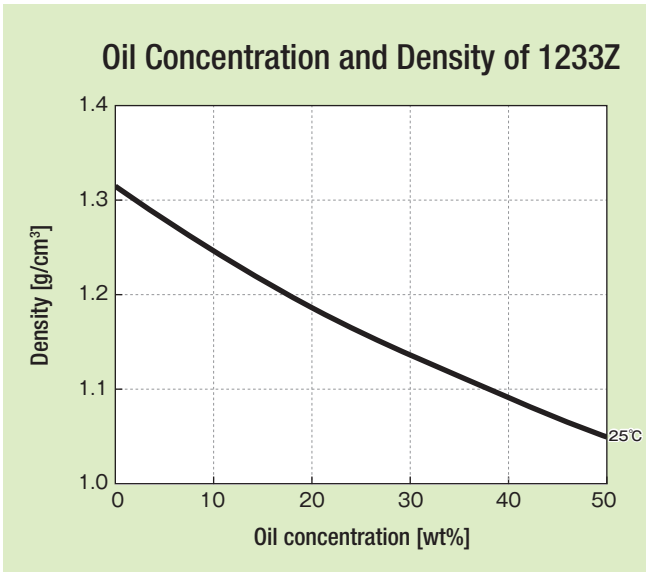


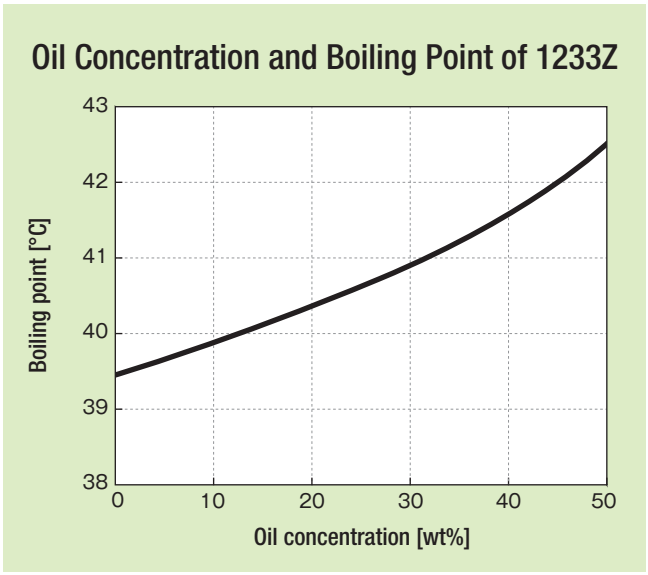




## Solvent management data




Used Oil: Cutting and Grinding Oil / Product Name: RELIACUT AM30 (ENEOS Corporation)

* This data is an example of solvent management. Results may vary depending on the type of oil used. Please conduct measurements using the actual oil intended for use.

## Comparison of Main Physical Properties

| | Property | Unit | 1233Z | HCFC-225ca/cb | HCFC-141b | HFC-365mfc | 1-Bromopropane | Dichloromethane |
|---|---|---|---|---|---|---|---|---|
| Basic Physical Property Values | Molecular Formula | — | $C_3H_2ClF_3$ | $C_3HCl_2F_5$ | $C_2H_3Cl_2F$ | $C_4H_5F_5$ | $C_3H_7Br$ | $CH_2Cl_2$ |
| | Boiling Point | ˚C | 39 | 54 | 32 | 40 | 71 | 40 |
| | Freezing Point | ˚C | -101 | -131 | -104 | -35 | -110 | -95 |
| | Heat of Vaporization (at Boiling Point) | kJ/kg | 210 | 145 | 221 | 177 | 246 | 329 |
| | Density (25˚C) | g/cm$^3$ | 1.31 | 1.55 | 1.23 | 1.26[4] | 1.35 | 1.32[4] |
| | Viscosity (25˚C) | mPa·s | 0.37 | 0.59 | 0.42 | 0.53[4] | 0.49 | 0.43[4] |
| | Solubility in Water (25˚C) | ppm | 640 | 310 | 420 | 900[4] | 500 | 1400 |
| | Water Solubility (25˚C) | ppm | 950 | 330 | 660 | 5000[4] | 2500 | 13000 |
| | Surface tension (20˚C) | mN/m | 18 | 16[3] | 19 | 15 | 26 | 28 |
| Cleaning | KB Value (Kauri-Butanol Index) | — | 34 | 31 | 58 | 13 | 125 | 136 |
| | SP Value (Solubility Parameter) | [cal/cm$^3$]$^{1/2}$ | 7.9 | 6.9 | 7.6 | 7.3 | 8.9 | 9.7 |
| Environmental Performance | Ozone Depletion Potential (ODP)[1] | CFC-11=1 | ≈0 | 0.03 | 0.11 | 0 | 0.0049 | 0.007 |
| | Global Warming Potential (GWP)[2] | $CO_2$=1 | ＜1 | 137/568 | 860 | 914 | ＜1 | 11 |
| | Atmospheric Lifetime[2] | — | 12days | 1.9/5.9years | 9.2years | 8.7years | 11days | 0.4years |
| Safety | Flash point | ˚C | None | None | None | None | None | None |
| | Flammable range | vol% | None | None | 9.4～15.5 | 3.6～13.3 | 4.0～7.8 | 14～22 |
| | The allowable exposure limit (manufacturer-recommended value) | ppm | 100 | 100 | 500 | 1000 | 0.5[5] | 50[5] |

[1] Ministry of Economy, Trade and Industry (METI) website, etc.

[2] IPCC Sixth Assessment Report (2021), etc.

[3] Measured value at 25°C

[4] Measured value at 20°C

[5] Recommended value by the Japan Society for Occupational Health (JSOH)

## Container

| Pail：20 L | Drum：200 L |
|---|---|
| Net Weight：22 kg | Net Weight：230 kg |

## Handling Precautions

### Please read the Safety Data Sheet (SDS) carefully before use.

Wear protective mask

Wear safety goggles

Wear chemical-resistant protective gloves

Do not store at high temperatures

**【Handling Precautions】**

- Avoid skin exposure. Handle with protective mask, safety goggles, and chemical-resistant gloves.
- Minimize vapor release, ensure proper ventilation, and maintain a safe working environment.
- Do not subject the container to impact, dropping, or rough handling.
- When opening the cap, the solvent may spurt out. Please open and close the container gently.
- Store in a cool, well-ventilated area away from direct sunlight and sources of ignition.
- Avoid unnecessary release into the environment.
- Dispose of contents and container in accordance with relevant regulations.

### First-aid measures

- **Inhalation**: Remove to fresh air immediately. Lay patient down. If breathing has stopped, apply artificial respiration. Get medical attention immediately.
- **Eye Contact**: Immediately flush eyes for at least 15 minutes. Get medical attention immediately.
- **Skin contact**: Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes. Get medical attention immediately.
- **Ingestion**: Do not induce vomiting. Get medical attention immediately.

*In all cases, symptoms may appear with a delay. Please seek medical attention immediately.

* The data presented in this catalog are based on measurements or literature values and are not guaranteed.
* The contents of this catalog are subject to change without prior notice.