

### 3. NSK Clean Lubricant E-DFO

NSK clean lubricant E-DFO forms a hydrocarbon oil film directly on raceway surfaces of ball screws, linear guides and balls, resulting in lower particle emissions and outgassing, and a longer life than that of existing fluororesin coating or solid lubrication in vacuum environments.

E-DFO treatment technology by NSK is the first in the world to provide special lubrication coating to rolling surfaces (patent pending).

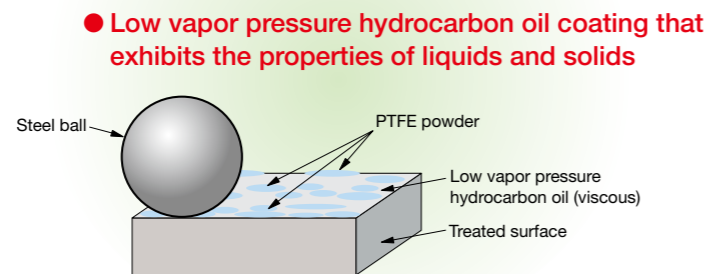
#### Features of Clean Lubricant E-DFO

**E-DFO lubricant coating: Thin lubricant film technology for low vapor pressure oil and absorbed substance holds its lubrication coating well.**

- Low particle emissions and superior outgassing properties compared to conventional fluororesin-coated products and solid lubricant products
- Far more durable than fluororesin-coated products



#### Structural illustration of E-DFO lubricant coating



● Low vapor pressure hydrocarbon oil coating that exhibits the properties of liquids and solids

● Retention intensity of lubricant coating increases due to the flake-shaped PTFE powder that has a large absorbed surface area of lubricant and retains a large quantity of lubricant coating

#### Notes:

**E-DFO coating:** E-DFO coating is a clear, colorless, low vapor pressure hydrocarbon-based, semi-dry coating that is viscous on the surface.

- To open and handle the product:** Open the package immediately before use in a clean space with the lowest possible humidity (less than 60%). Handle with gloves for clean rooms. Do not touch the product with bare hands.
- To store:** Store the product in a clean dry container such as a desiccator or vacuum chamber when not being used for a long period of time, or if not used immediately after opening. Do not use slushing oil or anti-tarnish paper on the product.
- Do not clean:** E-DFO coated products do not require cleaning. Do not clean or wipe the coating on the rolling surface—this will directly affect the lubricating function.
- Do not apply new lubricant:** E-DFO coated ball screws and linear guides do not require additional lubricant. Do not use NSK K1 lubrication unit, which will degrade E-DFO's lubricating property.
- Installation position:** When using ball screws and linear guides vertically, an oil receiver is required under the screw shafts and rails as the E-DFO coating may drop.

#### Comprehensive evaluation

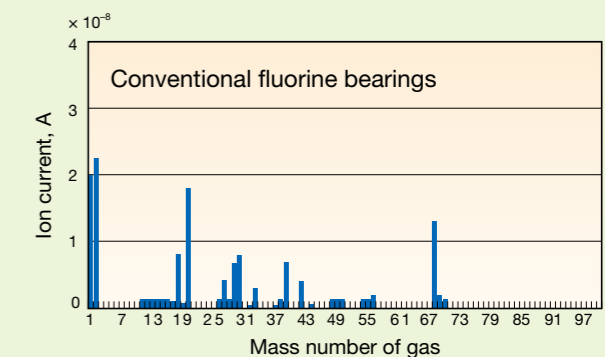
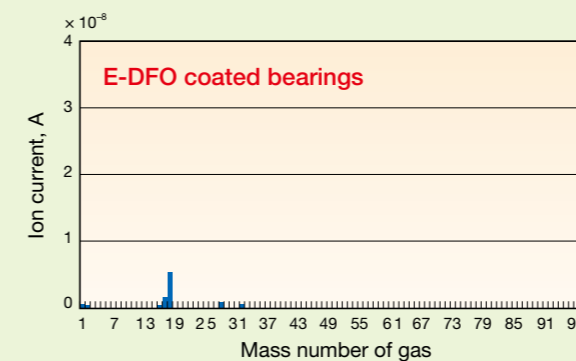
Lubricant	Performance			Compatible operating environment		
	Durability	Particle emissions	Outgassing	Operating environment	Ball screws	Linear guides
<b>E-DFO</b>	○	○	◎	Normal atmosphere, vacuum	●	●
Fluororesin	△	△	○	Normal atmosphere, vacuum	—	—
MoS <sub>2</sub>	○	△/○	○	Normal atmosphere, vacuum	●	●
Commercially available fluorine grease	◎	◎	△	Normal atmosphere, vacuum	●	●

◎: Excellent ○: Good △: Satisfactory ●: Applicable

#### Low outgassing properties

##### Outgassing property in high-temperature environments (measurement example with bearings)

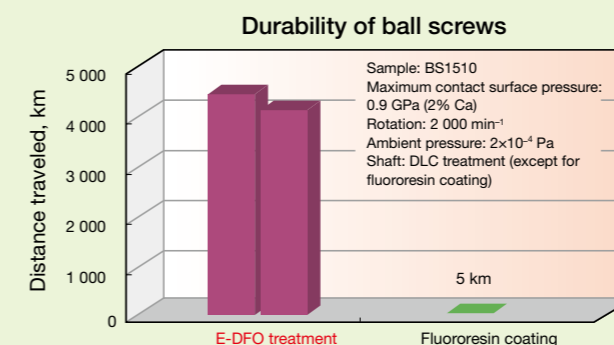
Outperforms conventional fluorine-coated bearings.



#### Long life

##### Durability of ball screws

E-DFO coating extends operating life of ball screws compared to fluororesin coating.



##### Durability of linear guides

E-DFO coating extends operating life of linear guides compared to solids lubricant.

