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Meidensha Corporation

To members of the media

## Meiden expands the lineup of Ester-filled Transformer with the aim of realizing a sustainable society

Meidensha Corporation (Meiden) will add a transformer that uses rapeseed natural ester to its Ester-filled Transformer line of products, and will begin marketing it from July 2023.

Meiden has offered transformers using palm fatty acid ester (PFAE), soybean natural ester and synthetic ester as an insulating and cooling medium as part of the Ester-filled Transformer line-up. This means the company's lineup covers all three kinds of esters: modified ester derived from vegetable oil, natural ester (vegetable oil) and synthetic ester, which are stipulated as readily biodegradable insulating oils under the Japanese Industrial Standards (JIS)'s C 2390 series\*1.

Due to Japan's increasing need for eco-friendly substations, demand for plant-based ester filled-transformers is on the rise. In particular, less-flammable rapeseed natural ester has been increasingly used for transformers. To meet the diverse needs of its clients, Meiden has added a transformer that uses rapeseed natural ester to its product lineup after completing the in-house verification procedure for its usage.

### <Scope of rapeseed natural ester-filled transformer>

- Highest voltage for equipment: up to 300 kV
- Tap-changing: de-energized or on-load tap-changing
- Circulation for internal cooling medium: natural circulation

### Meiden's lineup of ester-filled transformers and their features

Name of Product	Esters under JIS classification	Type of ester	Features (esters & transformers)
<b>New:</b> Rapeseed natural ester-filled Transformer	Natural esters (Vegetable oils), JIS C 2390-2	Rapeseed natural ester	✓ Natural esters: high flash and fire points ✓ suitable for transformers for superior fire safety
Soybean natural ester-filled Transformer		Soybean natural ester	
PFAE-filled Transformer	Modified esters derived from vegetable oils, JIS C 2390-3	Palm fatty acid ester	✓ PFAE: excellent cooling property ✓ suitable for transformers with space-saving design
Synthetic ester-filled Transformer	Synthetic ester, JIS C 2390-1	Polyol ester	✓ Synthetic ester: extremely low pour point ✓ suitable for transformers in cold climates

### 1. PFAE-filled Transformer

Palm fatty acid ester\*<sup>2</sup>, which is modified ester derived from palm oil, has the best cooling property among esters for transformers. It is suitable for transformers that need space-saving design. Also, since palm fatty acid ester has the stable structure of saturated fatty acids, its oxidation stability is higher than that for mineral oil.

### 2. Rapeseed or soybean natural ester-filled Transformer

Rapeseed and soybean natural esters have high flash and fire points. That suits transformers at substations in which fire safety is prioritized. According to a notification (*Shoboyo* No. 205) issued in March 2023 by the Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications of Japan, substations installing transformers which use natural ester with fire point above 300°C, such as rapeseed and soybean natural esters, are permitted to substitute large-size fire extinguisher for the following fire-extinguishing systems: inert gas fire-extinguishing system, halogenated fire-extinguishing system, and dry chemical fire-extinguishing systems on condition that this substitution is subject to specific requirements stipulated in the notification. Rapeseed oil (canola oil) is the most in-demand vegetable fat and oil in Japan\*<sup>4</sup> where a large volume of the oil is produced, ensuring a stable supply.

### 3. Synthetic ester-filled Transformer

Among esters, synthetic ester has extremely low pour point, which makes it suitable for transformers in cold climates. With fire point higher than 300°C, it has improved fire safety. (Since it is not plant-based oil, the above notification is not applicable to it). Also, since it has a chemically stable molecular structure, its oxidation stability is higher than that of mineral oil.

As palm fatty acid ester, rapeseed and soybean esters are plant-based oil, they can reduce greenhouse gas emissions in the product lifecycle, including the stage involving disposal and incineration of used insulating oil, compared with mineral oil derived from fossil resources.

Meiden will take on the challenge of developing new technologies and creating new values for clients' peace of mind and happiness as a sustainability partner that can help realize a future society that is more affluent and a better place to live.

\*1 JIS C 2390: 2019 Readily biodegradable electric insulating oils.

JIS C 2390 series are comprised from Part 1: Synthetic ester (JIS C 2390-1: 2019); Part 2: Natural esters (Vegetable oils) (JIS C 2390-2); Part 3: Modified esters derived from vegetable oils (JIS C 2390-3: 2019).

\*2 Palm fat and oil can be produced with a high productivity and harvested all year around. Although

its production volume is rising year by year, it has led to various problems associated with human rights, labor and the environment. Meiden recognizes the risk that its business activities may impose negative effects on sustainable development. Meiden's policy is to procure palm fatty acid ester only from procurement partners that support or promote measures to solve these problems.

\*3 Notification issued by the director of the Fire Prevention Division, Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications of Japan: *Shoboyo* No. 205 (dated March 30, 2023) and titled "Regarding the sending of operational material with regard to fire equipment (notification)."

\*4 Ministry of Agriculture, Forestry and Fisheries of Japan