



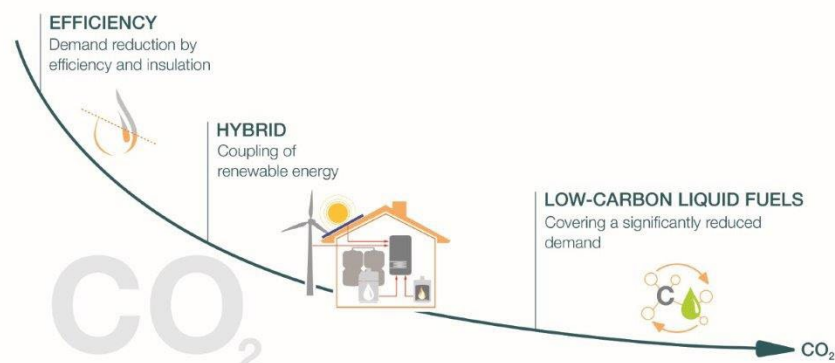
# Fuel Heating Oil EL

## 1 Introduction

Today, heating oil provides a safe and reliable heat supply for 20 million people, about a quarter of all Germans. To put it another way: around 5.5 million oil-fired heating systems are in use in Germany, which is more than every fourth heating system. Oil heating systems are particularly widespread in single- and double-family houses in rural areas. This information sheet is intended to show the range of standardised liquid energy sources that can be used in Germany, especially in the field of heat generation - for example in condensing oil boilers. In addition to a description of the most important properties of the different liquid fuels, there is also a cross-manufacturer classification of which fuel can be used in which equipment technology.

## 2 Future prospects for liquid energy sources

### » Reduction of Greenhouse Gases



Source and illustration (Nr. 230): en2x



Through the interaction of building insulation and efficient heating systems – the integration of solar energy and the use of greenhouse gas-reduced or greenhouse gas-neutral liquid fuels – greenhouse gas emissions can be reduced or avoided and thus future climate protection requirements can also be met. The high energy density and ease of handling in the transport, storage and use of liquid energy sources are of elementary importance for the flexibility and stability of the energy supply system in Germany.

## 3 Heating Oil Types and Standardisation

In recent years, heating oil has been continuously developed to meet the increased environmental requirements. For this purpose, grades with reduced sulphur and nitrogen content have been standardised and introduced to the market.

To reduce greenhouse gas emissions from the heat supply, liquid fuels can be used which are based on renewable energy (biomass or green electricity) and that are greenhouse gas reduced or greenhouse gas neutral, due to their closed carbon cycles. Depending on the type of energy source and the technology used, greenhouse gas-reduced/neutral liquid energy sources can be used pure or mixed with mineral heating oil. More detailed specifications are given in the respective fuel standards (see chapter 3.2) and by the manufacturers of the oil heating components (suitability information can be found in chapter 4).

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## **3.1 Chemical Classification of Liquid Energy Sources**

### **3.1.1 Mineral Oil**

Mineral oil is produced by refining crude oil. It consists largely of a paraffinic fraction and to a lesser extent of an aromatic fraction.

### **3.1.2 Esterified Oil (FAME)**

Regardless of the origin, esterified oils are referred to as FAME (Fatty Acid Methyl Ester). They can be produced from vegetable oils (e.g. rapeseed oil, which is esterified to rapeseed oil methyl ester (RME) with the help of methanol) or from used cooking oils (UCO), which are esterified with methanol to produce used cooking oil methyl ester (UCOME).

### **3.1.3 Paraffinic Oil**

Pure paraffinic oils can be produced as follows: by hydrogenation of vegetable oils (Hydrotreated Vegetable Oil (HVO)), by hydrogenation of biogenic residues and waste materials (Hydrotreated Used Cooking Oil (HUCO)) or via synthesis of hydrocarbon-containing gases (for example Fischer-Tropsch Synthesis).

## 3.2 Normative Classification of Liquid Energy Sources

### 3.2.1 Tabular Overview

	Components of the fuel mixture			Standardised in	Designations (D)	Often used designations (D)
	Mineral oil	Esterified oil	Paraffinic oil from hydrogenation or Fischer-Tropsch			
Mineral heating oil	yes	no	no	DIN 51603-1:2020-09	Heizöl EL, low sulfur Heizöl EL, low sulfur and low nitrogen	Heizöl
Blends of mineral oil and pure paraffinic oil	yes	no	yes	DIN 51603-1:2020-09 (Density min. 815 kg/m <sup>3</sup> ) DIN SPEC 51603-6:2017-03 (Density less than 815 kg/m <sup>3</sup> )	Heizöl EL, low sulfur Heizöl EL, low sulfur and low nitrogen Heizöl EL A	Heizöl
Esterified oil (FAME)	no	yes	no	DIN EN 14214:2019-05	Fatty Acid Methyl Ester (FAME)	Verestertes Öl, FAME, Biodiesel
Paraffinic oil	no	no	yes	DIN/TS 51603-8:2021-05	Heizöl EL P Heizöl EL P sulfur free	Paraffinisches Heizöl, hydriertes Öl, HVO, HUCO, PTL, GtL
Blends of mineral and esterified oils (FAME)	yes	yes	no	DIN SPEC 51603-6:2017-03	Heizöl EL A Bio	Bioheizöl
Blends of mineral, pure paraffinic and esterified oils (FAME)	yes	yes	yes	DIN SPEC 51603-6:2017-03	Heizöl EL A Bio	-

### **3.2.2 Heating oil EL low sulphur acc. to DIN 51603-1:2020-09**

For some years now, almost exclusively only low-sulphur heating oil with a maximum permissible sulphur content of 50 mg/kg has been offered in Germany.

To ensure the standardised properties, basic additives are added right from the refinery. This ensures, for example, the cold stability of the heating oil.

The reduction of the sulphur content has a positive effect on the combustion plant and the environment.

Since the September 2020 edition of DIN 51603-1, in addition to „EL low-sulphur heating oil“, there is also the heating oil grade „EL low-sulphur, low-nitrogen heating oil“, in which the nitrogen content is limited to a maximum of 140 mg/kg.

In the case of fuel oils according to DIN 51603-1:2020-09, paraffinic liquid fuels according to DIN/TS 51603-8:2021-05 may be added, provided that the mixture does not fall below the minimum density of 815 kg/m<sup>3</sup>.

### **3.2.3 Heating oil EL low-sulphur with FAME content – Heating oil EL A Bio acc. to DIN SPEC 51603-6:2017-03**

This fuel is a low-sulphur EL heating oil to which at least three percent by volume of an esterified liquid fuel, made from renewable raw materials, is added, e.g. rapeseed methyl ester. In esterification, the starting product is split with the addition of alcohols and special catalysts and chemically converted – transesterified – to a fatty acid methyl ester (FAME, also known as biodiesel).

### **3.2.4 Heating oil EL low-sulphur with „higher“ paraffinic contents – Heating oil EL A acc. to DIN SPEC 51603-6:2017-03**

As soon as the admixture of the paraffinic heating oil results in a density of the mixed product that is less than 815 kg/m<sup>3</sup>, this mixture falls within the range of the DIN SPEC 51603-6:2017-03.

### **3.2.5 Paraffinic Heating oil – Heating oil EL P acc. to DIN/TS 51603-8:2021-05**

Heating oil EL P is the term used for pure paraffinic heating oils produced by means of synthesis or hydrogenation processes.

With the appropriate use of raw materials/energy, these can have high greenhouse gas savings compared to mineral oil. In the future, fully greenhouse gas-neutral paraffinic products are also available, for example if renewable, emission-free energies are used in the entire production and supply chain.

### **3.2.6 Premium Quality**

Generally, all fuel oil qualities are additivated to improve the product. Various fuel oil additives are used in this process (e.g. labelling agents, flow improvers – correctly: filterability improvers – etc.).

Each of the fuels mentioned above is also offered in a so-called premium quality. The reason for this is, among others, the following conditions:

- High demands on energy exploitation and clean combustion in modern heating installations usually require mixing and combustion systems, that cause a higher thermal load on the fuel oil in the burner. Therefore, a high thermal resilience of the fuel is advantageous.
- Improvements in the thermal insulation of buildings, more efficient heating technology and the coupling of solar energy are increasingly reducing annual fuel consumption. With fuel storage often remaining the same size, this leads to a longer residence time of the fuel in the storage tank. Stable fuels are therefore advantageous.

In premium quality heating oils, the following optimisations are realised by additive packages with different combinations of active ingredients:



- Long-term stability
- Thermal stability
- Corrosion protection
- Cleaning/Keep Clean effect
- Odour masking

The TEC4FUELS quality label displayed on this page confirms compliance with the advantageous properties of premium heating oils by means of a special heating oil performance test.

The BDH welcomes the offer of premium qualities. These increase the operational safety of heating systems even when the fuel is stored for a longer period of time or under higher temperature loads in modern combustion systems.

However, the improvement of fuels does not replace the annual inspection of the firing system. Maintenance ensures a consistently high level of energy utilisation and clean combustion.



## 4 Application: Which heating oil can be used where?

### 4.1 Mineral heating oil according to DIN 51603-1:2020-09

Pure mineral, low-sulphur heating oil EL in accordance with 51603-1:2020-09 is suitable for the entire heating oil consumer system without any restriction of the warranties for operational safety, reliability and equipment availability.

### 4.2 Mineral heating oil with an admixture of pure paraffinic heating oil and a density of min. 815 kg/m<sup>3</sup> acc. to DIN 51603-1:2020-09

A mixture of mineral, low-sulphur EL heating oil and pure paraffinic heating oil that complies with the requirements of 51603-1:2020-09 is suitable for the entire oil installation without limiting the guarantees for operational safety, reliability and equipment availability.

### 4.3 Mineral heating oil with an admixture of pure paraffinic heating oil and a density of less than 815 kg/m<sup>3</sup> acc. to DIN SPEC 51603-6:2017-03

A mixture of mineral, low-sulphur heating oil and pure paraffinic heating oil, which complies with the requirements in accordance with 51603-6:2017-03, is only permissible in oil installations if a corresponding release has been obtained from the equipment manufacturer.

### 4.4 Paraffinic heating oil acc. to 51603-8:2021-05

Pure paraffinic heating oil, which complies with the requirements according to 51603-8:2021-05, is only permissible in oil installations if a corresponding release has been obtained from the equipment manufacturer.

### 4.5 Mineral heating oil with FAME content acc. to DIN SPEC 51603-6:2017-03

The background experience to date with low-sulphur heating oil with bio-components currently allows the use of heating oil EL A Bio 10 according to DIN SPEC 51603-6:2017-03 with a maximum of 10.9 % biogenic components in low-sulphur heating oil EL without limiting the guarantees for operational safety, reliability and availability of the entire heating oil consumer system in new and existing systems. The use of heating oils with a proportion of more than 5 % biogenic components may, however, require special measures with regard to the materials used and the installation, especially in existing installations. In this respect, the manufacturer's instructions must be observed. For recommendations for use and practical tips for trades and commerce, see

[https://www.zukunftsheizen.de/docs/uploads/2021/11/Anforderungen\\_zum\\_Einsatz\\_von\\_Heizol\\_mit\\_FAME-Anteilen.pdf](https://www.zukunftsheizen.de/docs/uploads/2021/11/Anforderungen_zum_Einsatz_von_Heizol_mit_FAME-Anteilen.pdf)

#### 4.6 „Green Fuels Ready“-Product label

With the „Green Fuels Ready“ product label shown below, manufacturers identify products such as heating installations, storage tanks and other components of an oil system that are suitable for greenhouse gas-neutral liquid fuels (= „Green Fuels“) and any mixtures with fossil liquid fuels. A concrete example of this are purely paraffinic heating oils and mixtures with mineral heating oils in accordance with the fuel standards referred to by the manufacturers in the respective product documentation (in Germany, for example, DIN 51603-1/-6/-8).



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