# OptiFlash PM: Flashpoint measurement according to ASTM D93


- Renewable diesel vs. Biodiesel
- Biodiesel measurement according to ASTM D93 Procedure C
- Repeatability and Reproducibility for ASTM D93 Procedure C

**Keywords**: OptiFlash PM, ASTM D93, Procedure C

## Introduction:

With mounting economic, social, and regulatory pressure, the search for alternatives to petroleum-based fuels is intensifying. One promising path forward is the development of sustainable, renewable energy sources that have reduced carbon footprint and minimize GHG (greenhouse gas) emissions.

Renewable diesel also known as hydrotreated vegetable oil or HVO, is produced by using a method called hydrotreating, which involves hydrogenating triglycerides (fats) to remove the oxygen. Renewable diesel can directly substitute for petroleum diesel in existing vehicles because it is chemically identical to petroleum diesel. This means that renewable diesel can be blended in any proportion into petroleum diesel and be readily operated by vehicles without any modifications in engines or distribution infrastructure.

It is noted that both renewable diesel and biodiesel are produced from vegetable oils, greases, animal fats, or other agricultural waste products. However, unlike renewable diesel, biodiesel, also known as fatty acid methyl ester or FAME, is created through transesterification and contains oxygenates. Biodiesel is not chemically identical to petroleum diesel and can only be blended with petroleum diesel in relatively low concentrations (5% to 20%, known as B5 to B20 respectively). Higher blend ratios run risks of cold flow issues, or engines have to be specially adapted.

New fuel types are challenging existing processes. The customers are used to test the samples as they did in the past. This implementation is not working smoothly all the time. When the first Renewable Fuel has been introduced to the market, beginning of the century, customer struggle a lot to test their samples with the existing procedures listed in the Flashpoint method ASTM D93.

## Method description

The flash point temperature is one measure of the tendency of the test specimen to form a flammable mixture with air under controlled laboratory conditions.

Flash point values are a function of the apparatus design, the condition of the apparatus used, and the operational procedure carried out. Flashpoint can therefore only be defined in terms of a standard test method, and no general valid

correlation can be guaranteed between results obtained by different test methods, or with apparatus from different form than specified.

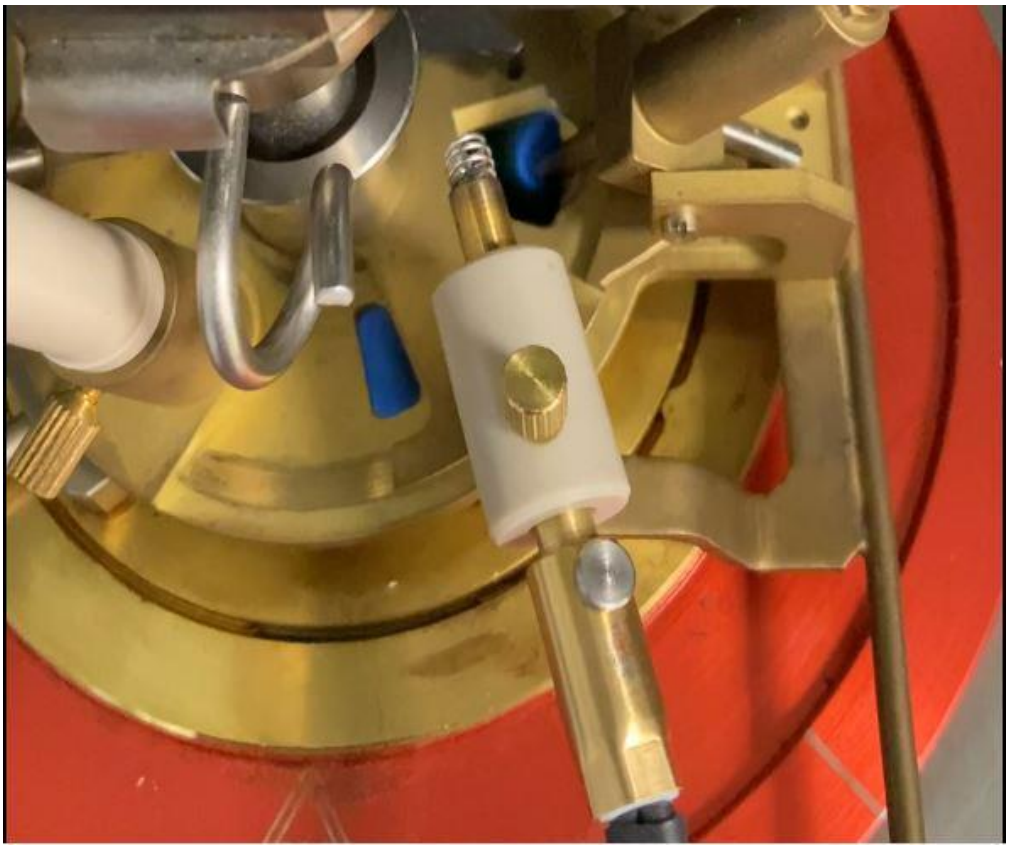
Procedure A is dedicated for homogeneous samples like distillate fuels (for e.g., diesel, heating oil or lubrication oils. The procedure works with a high heat rate (5 to 6 °C/min) and slow stirring speed of 90 to 120 rpm.

Procedure B is applicable to residual fuel oils, cutback residual, used lubricating oils, mixtures of petroleum liquids with solids, petroleum liquids that tend to form a surface film under test conditions, or are petroleum liquids of such kinematic viscosity that they are not uniformly heated. The procedure works with a low heat rate (1 to 1,6 °C/min) and slow stirring speed of 240 to 260 rpm.

Using Procedure A has the downside of getting a bad repeatability when testing biofuels, while Procedure B has a much longer test time. As well the manual detection of the Biodiesel Flash points was very challenging.

In 2010 Procedure C was implemented in ASTM D93. Procedure C is applicable to biodiesel (B100). The procedure works with a moderate heat rate (2,5 to 3,5 °C/min) and slow stirring speed of 90 to 120 rpm.

Since the flash point of residual alcohol in biodiesel is difficult to observe by manual flash point techniques, automated apparatus with electronic flash point detection have been found suitable.



## Repeatability and Reproducibility for Procedure C:

Repeatability would, in the long run, in the normal and correct operation of the test method, exceed the following value in 1 case in 20: **8.4 °C**

Reproducibility would, in the long run, in the normal and correct operation of the test method, exceed the following value only in 1 case in 20: **14.7 °C**

The precision data for biodiesel were developed in a interlaboratory test program using 9 samples of biodiesel (B100) and 17 samples of the same biodiesel dosed with concentrations of alcohol from 0.1 % to 0.3 %. Various automated apparatus in 11 laboratories participated. The precision was calculated on the flash point range from 60 °C to 190 °C. Information on the type of samples and their average flash point are available in the related research report.

## Conclusion:

The Optiflash PM, in the different models provided, is by default delivered with all 3 Procedures described in ASTM D93. The customer can choose, based on the sample type, the most suitable Procedure. Since safety is very important, the factory default products have the recommended safety procedure included. As a safety practice, it is strongly advised that, for expected flash point above 130 °C, to dip the ignitor every 10 °C throughout the test until the sample temperature reaches 28 °C below the expected flash point. This practice has been shown to reduce the possibility of a fire, and, on average, not to significantly affect the result.

With a measuring range from 30°C up to 400°C, high safety standards with ultra-fast fire detection and extinguishing system, OptiFlash Pensky Martens is the powerful tool for any kind of Flashpoint measurement.