

## Shipboard Flashpoint Testing Of Fuels And Lube Oils

### *Grabner MINIFLASH Safely Confirms Quality And Detects Contamination While At Sea*

---

#### Need For Safe Flashpoint Testing

Large commercial, exploration and military ships often store, transport and utilize a variety of fuels and engine lubricants, especially when the ship supports aircraft or other surface vessels. While the potential for quality and contamination issues may be no greater on a ship than on land, the potential safety and financial consequences are much greater when at sea.

Fuel contamination may come from a refueling terminal, a resupply ship or from human error during shipboard operations. Main engine failure on a ship can have catastrophic consequences for the entire vessel. Aircraft engine failure at sea is most often fatal to those onboard. There are two possible causes of fuel-related failure that are detectable with flashpoint testing.

The first detectable cause is the contamination of an engine's fuel with an incompatible fuel. For example, the contamination of diesel fuel with more volatile turbine or combustion-ignition (e.g. gasoline) fuels results in a lower flashpoint temperature for the fuel. This type of contamination causes destructive pre-ignition, or detonation in the cylinders of the engine. If the contaminated fuel is a turbine fuel, the contamination can easily cause a significant change in the flame profile within the ignition zone of the turbine. This may result in damage to the turbine blades and premature engine failure or engine stalling.

The second possible cause is the contamination of the engine's lubrication oil with fuel. As an engine wears with normal use, it is not uncommon for small amounts of fuel to leak into and contaminate the lubrication oil in the engine. Fuel contamination reduces the ability of the lubrication oil to protect the bearings and other moving parts within the engine causing accelerated wear. The presence of fuel in lube oil dramatically lowers the oil's flashpoint temperature.

#### Problem

While there are many flashpoint methods available, the most common methods require sample sizes of 50 to 75 ml. During sample preparation, technicians must measure and pour the flammable liquid sample into the flashpoint tester's sample cup. These cups typically have a lid which is either continuously open or periodically opened during the course of the test. If the sample spills or splashes outside of the cup, it could easily be ignited by the tester's own ignition source resulting in a fire.

At sea, the unpredictable movement of the ship greatly increases the risk of spilling or splashing significant amounts of flammable liquid during throughout the sample preparation and testing procedure. Consequently, the use of traditional flashpoint testing methods in a shipboard laboratory poses a greater fire risk. Clearly, a better method of flashpoint testing is needed.

## Example Method for detecting amount of diesel leaked into engine oil

During continuous operation of diesel engines, the oil becomes contaminated with fuel through leaks in piping and fuel fittings as well as bad or worn-out piston rings. The result of fuel dilution is that the viscosity of the engine oil will rapidly decrease, resulting in a decline of its lubricating properties.

Originally MINIFLASH was developed on a request from the US-NAVY for fuel dilution measurements, and they bought several hundred units since then. Due to the very fast, accurate and convenient method of this application, many big engine service facilities such as Caterpillar use MINIFLASH for the testing of used oil.

### Evaluation of the dilution curve

Prepare samples of different fuel dilutions with the oil and fuel in use, either per weight- or volume-percent and determine the flash point.

Use the following measuring program:

Ti = 120 °C (250 °F)

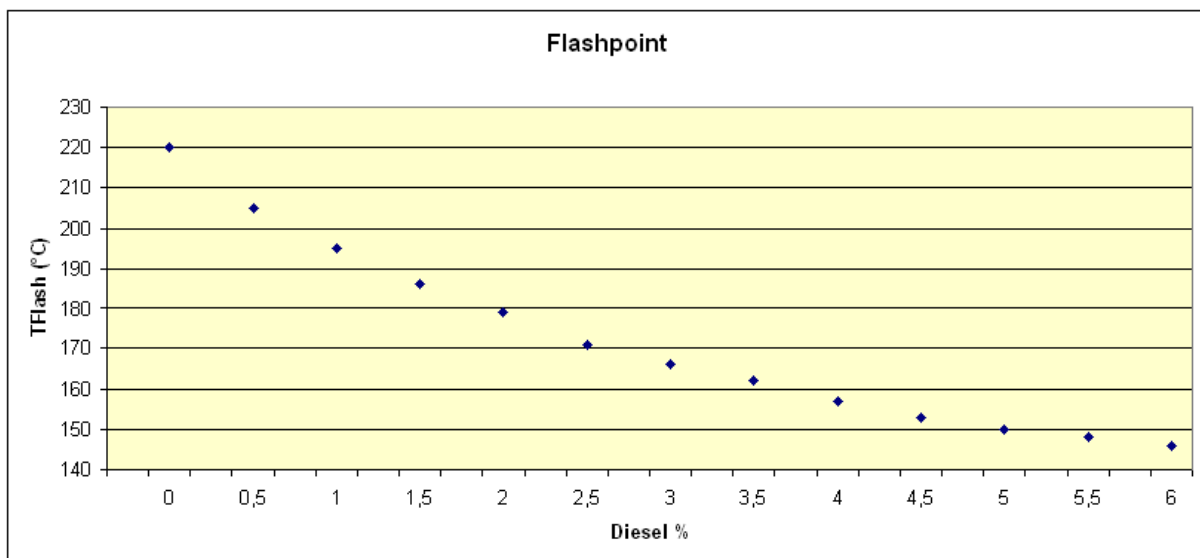
Tf = 230 °C (450 °F)

step = 2 °C (4 °F)

rate = 5 °C/min (10 °F/min)

air = 0,6 s

Example: The following values were evaluated for diesel in engine oil:



### Programming the dilution curve

Enter the dilution curve in the program used for the fuel dilution determination.

### Measurement of fuel dilution

Use the measuring program the fuel dilution curve was evaluated with and the curve is programmed. Fill 1 mL of the unknown sample in the sample cup and make the flash point measurement. From the detected flash point the percentage of fuel dilution is automatically calculated and displayed either in weight- or volume-percent.

## Summary

The MINIFLASH by Grabner Instruments provides the highest level of fire safety for shipboard laboratories. Due to the freely programmable methods MINIFLASH is a very versatile instrument and provides accurate flash point testing via a unique test method.

The flammable liquid sample is fully contained throughout the entire flashpoint test cycle thereby minimizing the risk of spilling and splashing. In a moving environment such as a ship, testing in a continuously closed sample cup simply makes more sense.

In addition to the heightened safety available from the MINIFLASH's closed cup test method, only 1 ml of sample is used in a test. This minimal sample size further minimizes the risk, and potential severity, of a fire during sample preparation and flashpoint testing.

Operation and maintenance of the MINIFLASH is very easy requiring little user training before operation. The combination of safety features and ease of use have resulted in the adoption of the MINIFLASH method by various naval defense groups and corporations.