

Flash Point Testing – The Definitive Test Method

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About the author

Mike Sherratt is the Director of Research at Stanhope-Seta, and Chair of the Joint CEN/ISO Working Group on Flash Point

Classifying the flammability of fuels and other materials by their flash point value has been an established practice for more than 100 years. Today mandatory international and national regulations are set by bodies such as the UN, IATA, EPA, EU, and Health and Safety executives.

The fundamental reason for measuring flash point is to assess the safety hazard of a liquid with regard to its flammability and then classify the liquid into a recognized hazard group. This classification is used to warn of a risk and to enable the correct precautions to be taken when manufacturing, storing, transporting or using the liquid. Flash point requirements are listed in regulations and product specifications.

What is flash point?

The flash point of a fuel is essentially the lowest temperature at which vapours from a test portion combine with air to give a flammable mixture and 'flash' when an ignition source is applied.

Specifications quote flash point values for quality control purposes as well as for controlling the flammability risk. The lower the flash point temperature the greater the risk. A change in flash point may indicate the presence of potentially dangerous volatile contaminants or the adulteration of one product by another.

The measurement of flash point is defined in test methods that are maintained by standardization bodies such as the Energy Institute in the UK, ASTM in the USA, CEN in Europe and ISO internationally. Over the last few years the focal point for flash point test methods has become the CEN/ISO Joint Working Group on Flash Point.

Which flash point test?

In general flash point is measured by apparatus named "open cup" or "closed cup". "Open cup" tests are required in some specifications and regulations, and are intended to mimic conditions in open spaces whereas "closed cup" tests are closer to most situations, where space is restricted. "Closed cup" tests are more usually specified as the test results are less affected by laboratory conditions and give a more precise and lower (safer) result.



Digital display



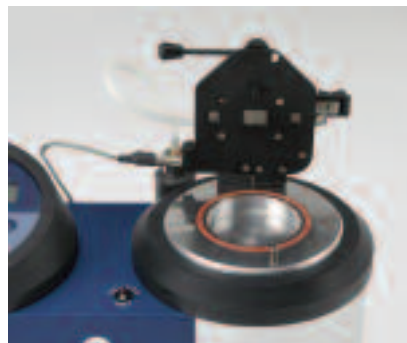
Setaflash Series 3
Closed Cup Tester

There are 4 major "closed cup" flash point tests which are specified nationally and internationally for testing fuels and other materials: Pensky-Martens, Small Scale (rapid equilibrium), Abel and Tag.

The Small Scale Closed Cup test is specifically identified by the following test methods: ASTM D3278, ASTM D3828, IP303, IP523, IP524, EPA 1020 A and B, ISO 3679 and ISO 3680.

The table below gives some examples where the Small Scale test is specified or mandated.

Material to be tested	Test method	Who says so
Aviation turbine fuel	Abel, Tag, Small Scale	ASTM D1655 and Def Stan 91-91
Gas turbine fuel	Pensky-Martens, Small Scale	ASTM 2880
Diesel fuel	Pensky-Martens, Small Scale	ASTM D975
Kerosines	Tag, Small Scale	ASTM D3699
Biodiesel (100% FAME)	Small Scale	EN14213 and EN14214
Transport regulations	Small scale, Other closed cups	UN, IATA, regulatory bodies
General ignitability	Small Scale	EPA 1020 A and B
Fuel oil	Pensky-Martens A and B, Small Scale	ASTM D396
Naphthas	Tag, Small Scale	ASTM D3734 and D3735
Raw Tung Oil	Small Scale	ASTM D12
Water borne paints	Small Scale	ISO 3679, ISO 3680
Waste products	Small Scale	European Waste Directive



Small sample

recorded statements:

"ASTM evaluation studies of the Setaflash Tester demonstrate the excellent correlation between the Setaflash and the Tag Closed and Pensky-Martens Testers. In addition "the repeatability and reproducibility of the Setaflash are definitely better than values found using Pensky-Martens" and "the precision of the Setaflash is equivalent or slightly better than the Tag Closed Tester".

Note: Initially the Small Scale test method had the name Setaflash in the title.

This performance and proven equivalence for specific materials has resulted in the adoption of the Small Scale test method in a wide range of product specifications and regulations. Today Setaflash Testers are in daily worldwide use by thousands of laboratories to test hundreds of different liquids.

The small scale test family

The original small scale tester has evolved into a modern family of manual and automated instruments incorporating automatic temperature control and flash detection. A version with an electric ignitor has also been announced. In addition an open cup tester is available for mandated combustibility testing.

Is the Small Scale test the referee?

International transport regulations allow the use of a number of so called "non-equilibrium" closed cup tests such as the Pensky-Martens, Tag or Abel to assess "flammability" criteria. However, if a result is within 2°C of a defined limit, the use of an equilibrium test is mandated. In this instance the Small Scale test or another equilibrium test is the referee. Under these circumstances the Small Scale test is usually selected because its one minute test is preferable to the 2 hours taken by other equilibrium tests. In product specifications it will be made clear which test method is the referee.

Choosing which flash point method can be difficult, however a new CEN/ISO document, Petroleum products and other liquids – Guide to flash point testing, gives advice and will be available in 2005.

Benefits of the Small Scale test

The concept of the Small Scale test eliminates the possibility of heating the test sample above the test temperature, avoids the loss of volatile constituents, is the fastest test available, has excellent available precision and an in depth history of comparative tests and equivalent results. From these facts it is clear that the Small Scale test is The Definitive Test.

To view a small scale test online please visit www.stanhope-seta.co.uk/setaflash.html

Why is the Small Scale accepted universally?

The Small Scale test method and the uniquely approved Setaflash Tester have been in use for over 30 years, primarily for a one minute test with 2 ml of sample to carry out a flash no-flash test, and more recently for automatic flash point determinations.

During these 30 years, comparative tests and collaboration with bodies such as the Institute of Petroleum, ASTM D01 and D02, British Railways, Commission of the European Communities, National Research Council Canada, BSI, UK Ministry of Defence, Transport and Road Research Laboratory, Paint Research Association and the major international oil refiners, may be summarized by the following well



Multiflash Small Scale Module

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