



Testing of lubricants – Determination of low boiling components in used engine oils

PD210



- Analysing low-boiling fuel components in engine oil
- Meets full DIN 51454 / ASTM D3524 requirements
- Factory tuned and tested

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Fuel dilution analyser

DIN 51454 / ASTM D3524 defines a gas chromatographic method for quantifying low-boiling fuel components (e.g. petrol, diesel, biodiesel/FAME, and vegetable oil) in used engine oils. This method is essential for monitoring fuel dilution resulting from combustion inefficiencies, wear diagnostics, or maintenance planning.

Application scope

This standard applies to internal combustion engine oils potentially contaminated by petrol, diesel fuel, FAME (biodiesel) and vegetable oils. Gas fuels and ethanol-rich fuels (e.g. E85) are not covered. Use cases include:

- Monitoring fuel dilution in fleet maintenance
- Engine wear diagnostics
- Validating biofuel compatibility and stability
- Supporting oil change interval decisions

Principle

The sample is diluted with a suitable solvent and injected into a capillary column and separated by boiling point. A flame ionisation detector (FID) records total signal area. Specific boiling point “cutpoints” separate fuel types:

- Petrol: < 254 °C (C14)
- Diesel: < 344 °C (C22)
- FAME: 344–365 °C
- Vegetable oil: 570–630 °C

Calibration is carried out using defined alkanes (C₁₄ to C₆₀) and matrix-matched biogenic fuel blends.

Instrument specification (figure 1)

- Thermo Trace GC1600
- InstantConnect PTV (Programmable Temperature Vaporiser) with back-flush option
- InstantConnect FID (Flame Ionisation Detector)
- Restek Rtx-1 Simdist column

Results

The fuel content is evaluated after blank subtraction of the solvent and integrating each fraction from the baseline. Depending on the type of fuel, petrol or diesel, the cut-points of the fractions differ. For Diesel, the integration starts after the solvent peak until C₂₀. For the petrol, the same volatility range is integrated but divided into 2 fractions. The petrol area from the beginning to C₁₄ and the high boilers from C₁₄ to C₂₀. This area is then divided by the area of the used engine oil (from C₂₀ to C₆₀). See also figure 2,3 and 4.

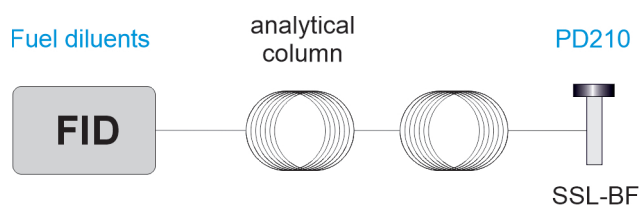


Figure 1 Analyser diagram with back-flush option

The instrument has been factory-tuned and tested using the following test mixtures:

- Retention time calibration standard for ASTM D7213
- Calibration solution for the cut points to check column separation quality and discrimination of high-boiling alkanes (see 8.2 in DIN 51454) *
- Calibration solution for biogenic fuel components (see 8.3 in DIN 51454)

Group Area			
Drag a column header here to group by that column			
#	Name	Start Time	End Time
1	Petrol	1.285 [min]	8.441 [min]
2	Diesel or high boiler content	8.442 [min]	14.529 [min]
3	FAME content	12.000 [min]	15.000 [min]
4	Vegetable oil content	25.000 [min]	40.000 [min]

Figure 2 Cutpoints for different sample types

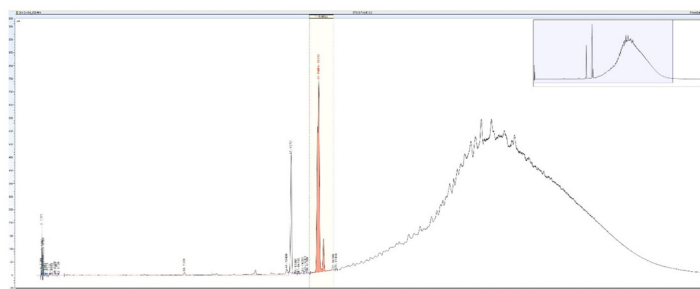


Figure 3 For the quantification of the FAME percentage in the used engine oil, a one-point calibration at 5% is used

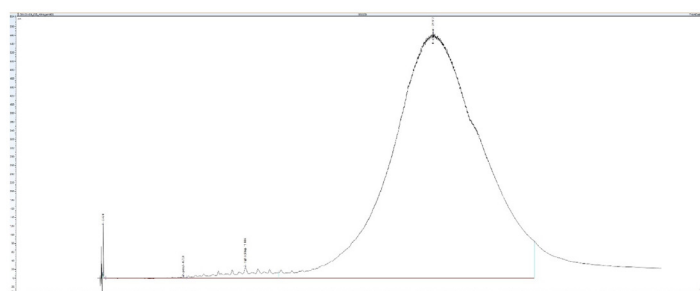


Figure 4 Chromatogram of used engine oil with 1.11% fuel

Ordering information PF21X - ABCDE				
code X	0	1	2	3
GC model, power	1600, 230V	1610, 230V	1600, 115V	1610, 115V

For the selection of options (e.g. GC oven cryo valves, Power plug type and more), see the options table in the order guide.

About GAS

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