Coolant concentration measurements: Variants and possibilities on site and in the laboratory

Regular coolant monitoring is not just required by law in some countries — it also has a positive impact on preservation of the coolant emulsion.

Continuously measuring the coolant concentration is the only way to enhance process safety and protect human health, and to make long-term savings in relation to machine downtime, personnel costs and waste disposal costs.

In this newsletter, we present the simplest variants of on-site coolant concentration measurement for your customers and explain three possibilities for coolant measurement in the laboratory.

Simple and practical: The refractometer measurement

In order to detect changes in coolant quality at an early stage, concentration measurement using a manual refractometer is recommended. This variant involves adding a few drops of the emulsion to the refractometer. The fluid's index of refraction can then be read off. The result is multiplied by the product-specific factor to obtain the coolant concentration in vol.%.

Before using the manual refractometer, we suggest that you and your customers perform a baseline calibration with a drop of water to prevent measuring errors. To do this, turn the small screw on the top of the refractometer until the display shows zero.

The advantage of refractometer measurement is the fact that it can be used easily on site for up to 95% of all measurements and the results are sufficiently accurate. Using refractometer measurement, it is relatively easy to measure the percentage volume of the coolant concentration in the emulsion.

At what point is refractometer measurement no longer viable?

Regular monitoring of the coolant concentration is important when it comes to maintaining lubricating effect and corrosion protection. The older the emulsion, the more difficult it will be to read out the fluid's index of refraction. This property depends on the size of the oil droplets in the emulsion. Tramp oils can influence the droplet size or dispersity. An acceptable reading can gradually deteriorate.

Once manual refractometer measurement is no longer possible, an emulsion sample offset with supporting emulsifier can help. This variant involves adding 0.1–0.2% of the supporting emulsifier to the emulsion sample being measured to finely disperse the emulsion. Afterwards, the same amount of supporting emulsifier is added to a water sample. The measured index of refraction is then deducted again from the refraction that was previously measured in the same way. The difference is multiplied by the refractometer factor.

If it is still not possible to read off a clear line on the refractometer at this point, we recommend that you and your customers contact us as the manufacturer.

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Three possibilities for coolant measurement in the Siebert laboratory

When manual refractometer measurement via the addition of the supporting emulsifier is no longer possible, coolant concentration measurement in the laboratory can be useful. Here we can obtain highly accurate results that allow us discuss recommended actions with the customer.

Possibility 1: Acid split using a soluble oil tester

With this variant, the portion that can be separated with acid is measured in the water-mixed coolant. As part of this process, 100 ml of an emulsion sample is offset with 30 ml of concentrated acid in a special measuring piston — the soluble oil tester. To ensure that acid split is effective, the emulsion-acid mixture must stand for 24 hours at 90°C.

Afterwards, the laboratory staff can read off the separated volume of oil using the scale on the soluble oil tester because the water and oil have been separated again via this process.

Multiplying the volume of the oil phase by the product-specific splitting factor allow us to calculate the coolant concentration.

Possibility 2: Continuous flow analysis (CFA)

Continuous flow analysis is a specialised and automated wet-chemical flow analysis procedure. The advantage of this measuring variant is the fact that it is not affected by tramp oil.

The CFA analysis system draws in samples of the coolant emulsion and directs each individual sample into „method manifolds“ before dividing the samples into aliquots, i.e. dividing them proportionally, for simultaneous determination of each sample.

With this variant, it is possible to measure seven different parameters, of which two are used for the concentration measurement. For instance, it is possible to determine how much potassium or how much boron is contained within the coolant concentration.

Possibility 3: Titration

Using the „titrator“, the alkalinity of the coolant emulsion is determined. Based on the quantity of required acid, the coolant concentration in the emulsion is recorded. The advantage of this measuring variant is the same as the CFA variant, i.e. that it is not affected by tramp oil.

Make use of the support available

You must never base coolant concentration measurements on estimates. After all, this approach can produce results that are completely incorrect and thus have fatal consequences for your machine or plant.

Our Siebert experts will be happy to help. Please write to: gerwen@siebertgmbh.com