Water for coolants

The application properties of a coolant mixed with water depend largely on the quality of the water used. Therefore it is necessary to know the composition of the respective mixing water as accurately as possible.
Coolant concentrates are often mixed into tap water. Usually, information about tap water can be obtained from the waterworks. In the case of water from the factory's own well, an analysis by your coolant supplier or by an external laboratory that offers water analysis suggests itself.
Some important parameters can be checked simply and quickly with good precision by means of test strips, for example.

The table below gives the characteristic water parameters, and selected methods for determining them:

Parameter	**Detection method (example)**
pH value	pH meter; electrical instrument
Conductivity (µS/cm)	Conductivity meter
Total hardness (German hardness degrees)	Test strip
Nitrites (ppm)	Test strip
Nitrates (ppm)	Test strip
Chlorides (ppm)	Laboratory tests
Bacteria count (colony count per ml)	Dip slides

Tests microbiological contamination and the quantitative determination of the chloride content of the mixing water should be done in the laboratory.

pH-value

The neutral point is at pH 7, as is found in distilled water, for example. Alkaline media have a pH greater than 7, and acidic ones a pH less than 7. Cutting fluids from Oemeta are adjusted to a pH of 9.0-9.3 when freshly made up. Mixing water with a pH of about 7 is optimum for making up cutting fluid. Water for making up with a pH less than 6 is questionable, since it may be able to reduce the pH-value of the fresh cutting-fluid emulsion to a greater or lesser degree even when freshly made up, under certain circumstances. As a result, the corrosion protection is reduced and early growth of germs and thus instability of the emulsion is preprogrammed.

Conductivity

The conductivity provides information on the content of electrolytes of the make-up water; the dissolved salts in the coolant or in the water are detected. Higher conductivity values mean relatively high salt loads in the system, with a corresponding risk of corrosion. For metal cutting, the maximum value is about 1000 µS/cm.

TOTAL HARDNESS

The total hardness of the water is the sum of all calcium and magnesium salts. The calcium and magnesium contents are determined in the laboratory by means of AAS (atomic absorption spectroscopy). The hardness is categorized as follows:

German hardness [°d]	Water hardness
4-8	soft water
8-12	medium-hard water
12-18	hard water
18-30	very hard water
>30	extremely hard water

High hardness can cause precipitation of lime, which in turn can lead to corrosion, and white deposits on work pieces and tools. Lime is normally separated out in the filter, as well; after refilling, it is a good idea to change the filters of water-treatment systems after the first 50 to 120 hours of operation.
Too soft water can lead to the formation of foam when the coolant is freshly made up, since no foam-reducing calcium soaps are formed. The optimal hardness range for use in coolants is about 10 to 20 [°d].
In the case of soft water, its hardness can be increased in a controlled fashion when making up fresh lubricant by adding a hardness increaser containing calcium (ADDI-PROX AF/C). If the total hardness is high, the hardness can be reduced by adding demineralized water afterwards.

NITRITE/NITRATE

For used coolants, the guidelines of 20 ppm nitrite and 50 ppm nitrate determined by the BIA and adopted by the *Berufsgenossenschaft* (German employer's liability insurance association) and TRGS 611 apply. The background to this is the possible formation of nitrosoamines in the presence of secondary amines. In coolants from Oemeta, the formation of nitrosoamines is inhibited, and they are free of secondary amines.
In general, the concentrations of nitrites and nitrates in mixing waters should be as low as possible. The quality of drinking water meets these demands. According to EC Directives, it must be free of nitrites and with a nitrate content less than 5 ppm.

CHLORIDE

High contents of chlorides have a negative effect on the corrosion-protection behavior of coolants mixed with water. The German Drinking Water Directive specifies a recommended value of 25 mg per liter. However, substantially higher values may occur in the course of operation (for example, due to evaporation of water in summer or because of high temperatures of the machinery and environment). If the chloride value should rise above 100 mg/l, corrosion problems can occur.

BACTERIA COUNT

The make-up water should in principle be free of microbiological contamination, since otherwise the coolant is contaminated as soon as a new batch is made up. The German Statutory Regulation for Drinking Water prescribes a maximum count of 10^2 colony-forming units (CFU) per milliliter.

The minimum requirements for the mixing water are summarized in the table below:

Parameter	**Minimum requirement**
pH-value	ca. 7
Conductivity (µS/cm)	max. 1000
Total hardness	optimum 10-20
Nitrites (ppm)	max. 5
Nitrates (ppm)	max. 50
Chlorides (ppm)	max. 50
Bacteria count (CFU/ml)	max. 10^2