



7 ways to optimize cutting liquid for optimal sectioning

The quality of your cutting liquid determines the quality of the sectioning, and thereby the risk of introducing structural damage in the sample.

In this guide, you will learn how to:

- Make the optimal cutting liquid mix
- Control and minimize corrosion and bacterial growth
- Avoid unintended consumption of cutting liquid components

The quality of your cutting liquid determines the quality of your sectioning

The quality of your cutting liquid is very important in the performance of the cutting process. Factors such as the concentration of sectioning additive, type of sectioning additive, water quality, microbial contamination, and contents of dissolved minerals all influence the quality of the cutting liquid.

Here are seven factors that will optimize your cutting liquid.

Water quality is determined by the water hardness (the amount of calcium and magnesium) and the pH value. A pH value close to 7.0 and the lowest possible amount of calcium and magnesium are optimal.

Microbial contamination is bacterial and fungi growth. Recognize it by the bad odor and fungi/bacteria film on top of your cutting fluid and/or at the edge of the vessel, just above the water level.

1 Choose the right type of section additive for your job



Cutting liquid for both sectioning and grinding

For those of you who want an optimal cutting liquid for both sectioning and grinding with a grinding stone, Cooli Additive cutting fluid is the optimal and cost-efficient choice.

Cutting liquid for a high throughput

For those of you who work with very high throughput, the high-performance cutting liquid Cooli Additive Plus is the right choice for both optimal cooling and top performance. Cooli Additive Plus is not suitable for grinding.

2 Make the cutting liquid last: Get the right mix

When mixing a new batch of cutting liquid, three factors are important.

1. Clean recirculation tank

Ensure that the recirculation tank is clean.
This is easily achieved with UnitClean.

2. Quality of mixing water

Ensure that the mixing water is of sufficiently high quality. The recommended values are:

Minimum requirements for the mixing water

Water components	Metal chipping
pH value	Approx. 7
Conductivity (µS/cm)	Max. 1000-1500
Total hardness (d)	5 - 20
Nitrite (ppm)	Max. 5
Nitrate (ppm)	Max. 50
Chloride (ppm)	Max. 250
Microbial count (cfu/ml)	Max. 10

3. Correct concentration of additive

Ensure that the correct concentration of Cooli Additive or Cooli Additive Plus is added to the cutting liquid. See the bottle for the recommended concentration.

If these criteria are fulfilled, the base for a good and longer-lasting cutting liquid is created.



Get tips: Avoid these 3 costly mistakes when cutting large workpieces.

3 Prevent corrosion and minimize foam by measuring the concentration of Cooli additive products

To achieve the best result, longest life span, and most cost-efficiency, there are five simple tests to which you should expose your cutting liquid. One of them is measuring the concentration of Cooli Additive products.

- **Measuring the concentration**

Start measuring the Brix value of the cutting liquid, using a refractometer. The recommended concentration is 4.0% and concentrations between 3.0-6.0% are acceptable. If the measured concentration is beyond this range, it must always be corrected.

- **The concentration is too low**

If the concentration is too low, you should add more cooling additive.

- **The concentration is too high**

If the concentration is too high, you should add demineralized water until the desired concentration is achieved. If you use demineralized water, you should always measure the pH value afterwards to make sure, that the new mix of water and additive has a pH value above 8.5.



Calculate the concentration

The concentration of Cooli Additive products is calculated by multiplying the Brix value with the refractometer factor, which is 2.4 for Cooli Additive and 2.2 for Cooli Additive Plus.

$$\text{Conc}_{\text{Cooli Additive}} = {}^{\circ}\text{Brix} * 2,4$$

$$\text{Conc}_{\text{Cooli Additive Plus}} = {}^{\circ}\text{Brix} * 2,2$$

4 Control the pH value to minimize corrosion



The alkalinity of the cutting liquid is important for preventing corrosion of the cooling tank and cutting the machine parts. When mixing the solution, the pH of the mixing water is important for the resulting pH

of the final cutting liquid. The cutting liquid pH value should be between 8.5 and 10.5. You can easily measure the pH either with the pH strips, enclosed with Cooli Additive Plus 4 L, or a pH meter.



Which material do you work with?

See **how to perform materialographic analysis** quickly and accurately on different materials

5 Control water hardness to avoid unintended consumption of cutting liquid components

If the cooling water is too hard, it will result in the consumption of some vital components in the cutting liquid, which again will result in foam generation and reduced efficiency of the additive.

The hardness of the cooling water can increase if evaporated water is replenished with tap water. Therefore, we recommend measuring the hardness value and always using demineralized water for topping up.

The hardness of the water can be measured using a water hardness strip enclosed with Cooli Additive Plus 4 L, or a pH meter. If the measurement exceeds the scale for the strip measurement system, the recirculation system may be adjusted by adding low hardness water (preferably, demineralized). If a high concentration of cutting additive is also measured (more than 6.0%), we recommend changing the cutting liquid.



See our **cooling systems**, designed to ensure you high quality cuts without thermal damage



Find the right cut-off wheel for your task with **our cut-off wheel selection guide**

6 Check cutting liquid for bacterial growth to avoid foam and corrosion

It is important to control the microbiological activity in the cutting fluid reservoir. Both bacteria and fungi are an issue, as they can metabolize the components of the cutting fluids.

The result will be biofilm/mucus which, in big amounts, can lead to both increased foaming problems and sticky surfaces, as well as secondary metabolites in the form of short-chain organic acids.

The latter can be the cause of decreasing pH in the cutting fluid and provide an increased risk of corrosion. It is also important to bear in mind that larger amounts of bacteria and fungi can cause health problems for those who operate the machines.



If the pH value decreases to less than 8.5, it can be an indicator of bacterial growth in the cutting additives. In this case, we recommended measuring bacterial growth and to change the cutting liquid if the test is positive.

Other signs of bacterial growth are bad odor and fungi/bacteria film on top of your cutting fluid.

The dip slide test

To measure bacterial growth, use a dip slide test. The dip slide stick contains growth media for bacteria on one side and for fungi on the other side. Dip slide test kits are commercially available at many distributors.



Find out how to **choose the right clamping tools**

7 Test your foam: Is it the problematic kind?

Foam formation in the cutting liquid is, in general, undesirable for several reasons:

- Foam does not lubricate well
- Foam does not cool well
- Foam decreases the filtration efficiency
- Foam contributes to chemical odor and mist difficulties

In short, foam decreases the efficiency of the cutting liquid and may lead to an overflow in the cutting machine or recirculation unit, finally causing a moist and unhealthy working environment.

2 types of foam: Mechanically and chemically related

There are basically two kinds of foam: The mechanically and chemically related foams. Mechanically related foam is less stable and will typically fall fast, thereby disappearing by itself without causing further problems.

Chemically related foam, on the other hand, will take a long time to disappear, which means challenges with too much foam and reduced cooling are created.

The 3-step bottle test

To test the stability of the foam in order to distinguish between mechanically and chemically related foam, a simple test can be performed. It is called a bottle test.

1 Fill 50% of an empty bottle with cutting fluid.



2 Shake it for 15 seconds and wait 30 seconds.



3 Check the foam. If the generated foam is still stable, it indicates that the foam is chemically related, and it is recommended to change the cutting fluid.

