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THERMAL DISINFECTION OF COOLANT LUBRICANTS

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Thermal Disinfection of Coolant Lubricants

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Those engaged in working with coolant lubricants will be familiar with a particular issue that surfaces when entering the production hall in the morning – a pungent odour emanates due to the coolant in one of the tooling machines having deteriorated.

This unpleasant situation is commonly attributed to microorganisms, specifically fungi and bacteria, thriving in the coolant. Notably, water-soluble coolants are more susceptible to these microorganisms, with their prevalence intensifying in warmer conditions, especially during the summer and in regions with higher temperatures.

In addition to the offensive odour, bacteria and fungi yield undesirable consequences by diminishing the efficiency of the coolant, thereby impairing its overall performance. Occasionally, fungal threads and mucus bacteria obstruct pipes and tubes.

Recognising the need for targeted maintenance, it becomes evident that proactive care is essential to preserve the coolant's performance over an extended period and consequently prolonging its lifespan. This approach translates into substantial cost savings by:

- Reducing the amount of coolant purchased
- Reduction in disposal costs
- Reduced machine downtime during coolant replacement.

Good Maintenance Practices do Work

A comprehensive coolant maintenance regime typically involves employing specific coolant filters for filtration and utilising skimmers and oil separators to remove surface oils. While these mechanical methods are effective in their respective tasks, they fall short in combatting existing microorganisms. Consequently, thermal disinfection becomes a crucial step in safeguarding the coolant against bacterial and fungal contamination.

For instance, a thermally disinfected coolant shows a significant reduction in bacteria (10^4 cfu/ml) and fungi (10^4 cfu/ml) – see images below. Monitoring the coolant's nitrite levels, as well as its pH value, provides crucial indicators for determining the necessity of further measures when required. This holistic approach not only addresses the immediate bacterial problems but also contributes to the sustained efficiency and longevity of the coolant while minimising operational interruptions during coolant changes.

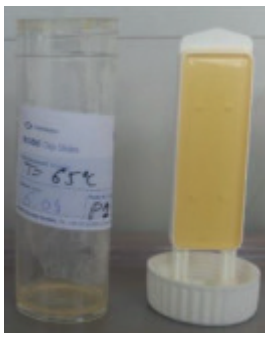
Fluid sample from coolant tank without Thermal Disinfection

bacteria 10^4 cfu/ml

fungi 10^4 cfu/ml

(cfu = colony-forming units)

Fluid sample (from same tank) after Thermal Disinfection



bacteria 10^0 cfu/ml

fungi 10^0 cfu/ml

(cfu = colony-forming units)

More extensive test results are available by contacting European Filter Solutions Ltd.

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Combatting Fungi, Yeasts, and Bacteria – Strategies and Challenges

Addressing the presence of bacteria and fungi in coolant poses a challenge, with only a limited array of methods available.

The most common and widely adopted method involves the use of biocides, encompassing bactericides and fungicides. Undoubtedly, these agents offer cost-effectiveness and high efficiency.

However, it is imperative to recognise that biocides fall under hazardous substances and come under the GB Biocidal Products Regulation (GB BPR). Consequently, addressing one issue introduces another, as biocides can lead to significant health concerns ranging from the easy infection of everyday wounds to more severe conditions like eczema, allergies, and irritations of the skin, eyes, and mucous membranes.

Notably, even the slightest contact with concentrated biocides can result in considerable health issues, underscoring the importance of stringent safety measures.

Consideration of alternative approaches becomes imperative for a safer and more employee-friendly coolant maintenance strategy.

Implementation of Thermal Disinfection & its Benefits

What holds paramount importance for users is the tangible efficacy of thermal disinfection in real-world scenarios and over extended periods. Most companies employing this system have successfully eliminated the need for biocides entirely, experiencing a substantial extension in the lifespan of their coolants through consistent disinfection practices. This positive outcome has garnered acknowledgment from coolant producers, further reinforcing the viability and benefits of thermal disinfection in coolant maintenance.

Thermal disinfection stands out as one of the most efficient methods for disinfecting coolants. Notably, its effectiveness is coupled with a health and environmentally friendly profile and can eliminate the need for chemicals and biocides. Furthermore, thermal disinfection proves to be particularly cost-effective, requiring a relatively modest investment in machines such as the Thermo EK. Operating costs are minimised, predominantly confined to electricity expenses, notably, the recommendation for conducting disinfection during full production to ensure comprehensive disinfection of tubes and pipes, thereby eliminating any downtime costs during the disinfection process.

Because of the practical and simple implementation of thermal disinfection, the machines employed for this purpose are designed to be mobile and easily transported to the specific tooling machine in use. The process involves extracting coolant from the tooling machine's tank, subjecting it to disinfection, and subsequently reintroducing the disinfected coolant back into the tooling machine's tank. With a disinfection capacity ranging from 5 to 6 litres per minute, the fluid in a 500-litre tank, for instance, will pass through the Thermo EK in approximately three hours, killing the bacteria in the fluid. Furthermore, integration into a central cooling system is a viable option, showcasing the versatility of thermal disinfection methods.

The table on the next page shows the outcomes from extensive trials conducted on a diverse selection of coolants across various customer settings. The results confirm there is remarkable effectiveness across the board.

Ideally, the sterilised coolant would be transferred to a sterile container, and the machine tool should undergo thorough cleaning and sterilisation before reintroducing the coolant. However, this ideal scenario is often impractical. In practice, the disinfected coolant is directly reintroduced into the existing bath and mixed with non-disinfected coolant. This results in the persistence of non-disinfected coolant in the machine tool's tank, especially in the form of biofilm on the machine tool's floor and walls. It's important to note that this situation is not unique to thermal disinfection; it is a common occurrence with other methods, including the use of biocides.

To address this, it is recommended to perform three consecutive disinfections in quick succession, if possible, with some mixing to agitate and disinfect germ-contaminated residues in corners, pipes, and on the floor. Depending on the specific application, it may take weeks or even months before the metalworking fluid is heavily contaminated again, necessitating a new round of disinfection.

Despite this, regular thermal disinfection should be a part of the maintenance routine, occurring, for example, on a monthly basis, to proactively prevent excessive germ formation. Importantly, as this process can be conducted in bypass mode, the ongoing operation remains unaffected during the disinfection procedure.

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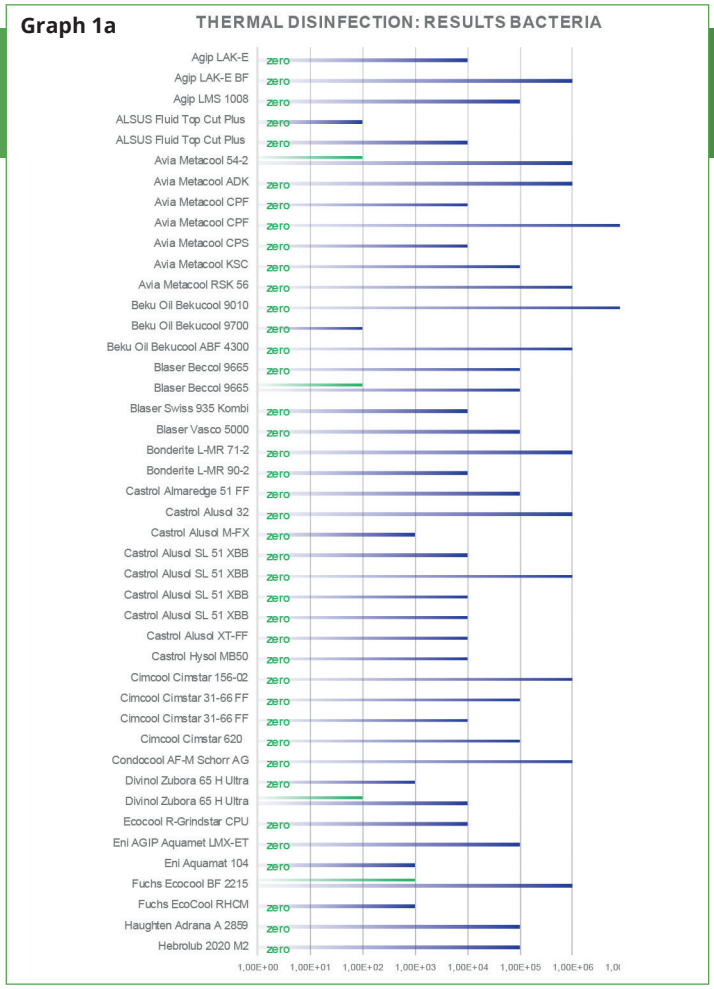
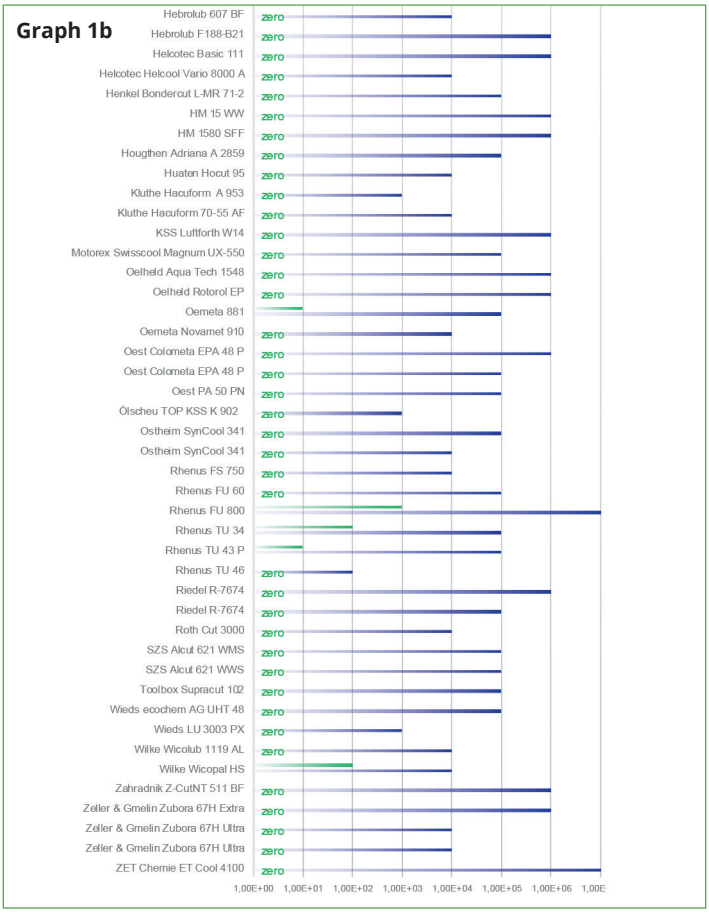
Graph 1a

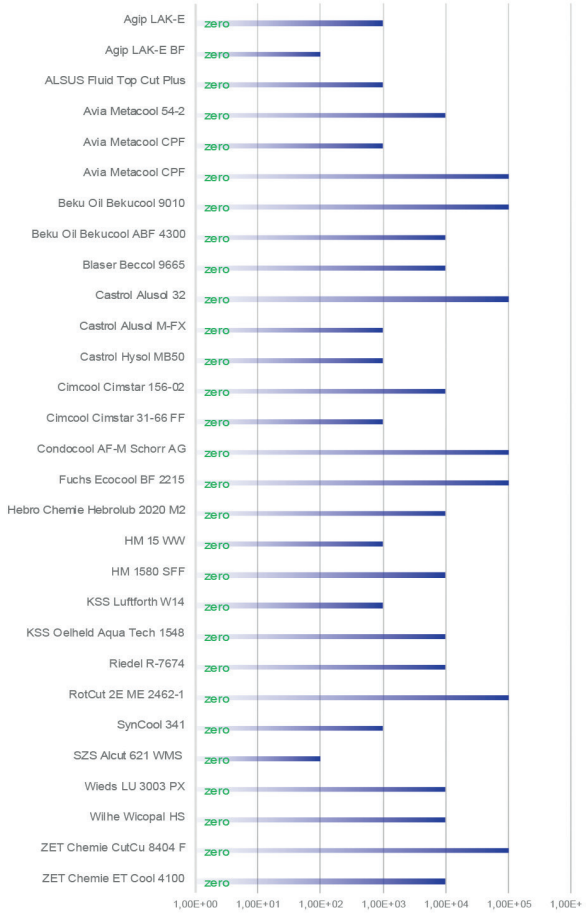


Graph 1b



Graph 1a & 1b:
Test results with 88 customers from October 2017 to date
Key: Blue bars: prior to disinfection, Green bars: post disinfection

Graph 2



Graph 2:
Test results of ph-cleantec GmbH with diverse customers from October 2017 to date
Key: Fungi: Blue bars prior to disinfection; Green bars post disinfection