White Paper

The Importance of Selecting the Correct Metalworking Fluid

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1 Introduction

Metalworking fluids (MWFs) are a value-added material used in the metalworking industry to reduce heat and friction in machining and forming/fabrication applications on metal. The selection of the MWF in your process is crucial for ensuring efficiency, maximizing tool life, improving product quality, and maintaining a safe working environment.

This white paper explores the importance of choosing the appropriate metalworking fluid, including the factors to consider during selection and the potential benefits of the optimal selection. These factors are all paramount to the success you can achieve in your daily operations.

2 Who is Metalloid

Working with Metalloid is an essential step towards a more sustainable and environmentally friendly future. We are your single source supplier for HVAC Manufacturing & Metalworking Fluids. Metalloid has been Formulating, Manufacturing, and Marketing MWFs to a broad Spectrum of Industries since 1951.

Metalloid is dedicated to delivering superior technology to ensure your manufacturing is accomplished with precision. By thoroughly analyzing our clients' operations, we excel at identifying opportunities for enhancing your success. With our extensive product range and innovative chemistries, Metalloid offers MFWs that set a new standard in the industry.

Metalloid has spent a great deal of time funding our R&D team to create products that will create a better working environment for our clients' workers and a more sustainable future for our environment. With over 25 lubricants registered in the USDA Certified Biobased Product Program it shows our commitment to our efforts to creating a better future in the industry.

For the HVAC Industry we developed a line of Low GWP products and consider ourselves experts in both VOC and Non-VOC chemistries for coil manufacturing. With worldwide OEM approvals and tooling/machine manufacturer's referrals, Metalloid sees themselves at the forefront of the industry.

3 Defining Metalworking Fluids

- Used to reduce heat and friction and to remove metal chips and fines.
- Control friction, wear rate, surface finish, temperature, shape of parts, and prevent corrosion
- They may contain oils, emulsifiers, corrosion inhibitors, EP additives, biocides, and more depending on the needed capabilities.

There are various types of metalworking fluids:

1. **Straight Oils**: Mineral or petroleum oils used without mixing them into a dilution.
2. **Soluble Oils**: Emulsions formed by mixing oil with water.
3. **Semi-Synthetic Fluids**: Contain both oil and synthetic raw materials.
4. **Synthetic Fluids**: Contain no oil, relying on synthetically derived raw materials only.
5. **Green/Botanical Fluids**: Environmentally friendly, biodegradable, renewable raw materials.

4 The Importance of Selecting the Correct MWF

1. Efficiency

- **Temperature Control**: Proper fluids provide effecting cooling, reducing heat and enhancing the efficiency of the operation.
- **Tool Life**: The right fluid reduces tool wear and extends tool life by minimizing friction and thermal stress.
- **Lubrication**: Optimal lubricity additives help control the friction and wear rate of the fluid on the metal and tooling through different lubrication regimes.

2. Surface Finish and Product Quality

- **Surface Finish**: Correct fluids ensure high-quality surface finishes by reducing surface roughness and preventing defects.
- **Tolerance**: Suitable fluids help maintain tolerances during metalworking by controlling heat and the thermal expansion process.

3. Cost Management & Savings

- **Consumption Rates**: Measured by analyzing lubricant usage over a specific period to make a certain quantity of parts. Higher-quality MWFs use superior lubricity additives, these additives allow for better lubrication in process allowing for reduced consumption rates over low-quality MWFs.
- **Tool Life and Machine Performance**: The quality of MWFs directly affects tool wear and machine efficiency. Higher-quality MWFs can extend tool life and improve machining performance, reducing downtime and 6 Optimizing Overall Costs
- **Operational Costs**: Optimizing your fluid use can lower operational costs by reducing tool wear, energy consumption, maintenance work, and downtime.
- **Fluid Longevity**: Proper fluid selection and maintenance extends the life of the fluid, reducing replacement and disposal costs.
- **Compatibility**: Proper selection of MWFs can significantly reduce the overall costs of parts and finished goods. If necessary, it is crucial that the lubricant undergoes thorough internal and/or external testing to ensure compatibility with components it will contact

early in the process or within the finished product. Ensuring compatibility can effectively lower defect rates and minimize the occurrence of rejected parts in the process or when a consumer uses the finished product.

4. Health and Safety

- **Worker Safety**: The right fluids minimize exposure to harmful chemicals, reducing the risk of skin irritation, respiratory issues, and other health hazards.
- **Environmental Impact**: Eco-friendly fluids reduce environmental contamination and disposal challenges, ensuring regulatory compliance.

5 The Selection Process

The selection process for MWFs involves numerous critical factors. It is essential for manufacturers and MWF suppliers to collaborate closely to identify the most suitable product for each specific operation. This collaboration enhances the efficiency and reliability of the machining & forming process and the quality of the finished parts. Key considerations during the selection process include:

1. Material Compatibility

- Different metals and alloys require specific fluid properties to prevent corrosion, staining, and material degradation.

2. Metalworking Process

- The type of metalworking process helps determine the appropriate product for the application. Conducting a thorough analysis of the process from start to finish can identify whether a lubricant will have adverse effects at various stages of manufacturing.

3. Fluid Properties

- **Lubricity**: The ability to reduce friction between the cutting tool and the workpiece, enhancing tool life and surface finish.
- **Cooling Capacity**: The ability to dissipate heat generated during machining, preventing thermal damage to both the tool and workpiece.
- **Viscosity**: A measure of the fluid's resistance to flow, affecting its ability to penetrate cutting & forming zones and provide effective cooling and lubrication.
- **Corrosion Inhibition**: The ability to prevent rust and corrosion on both the workpiece and machine components, ensuring longevity and maintaining part quality.
- **Biostability**: Resistance to microbial growth (bacteria and fungi) that can degrade the fluid, cause odors, and reduce performance over time.

- **Foam Control**: The ability to minimize foam formation during use, which can affect fluid delivery, cooling, and visibility of the workpiece.
- **Chemical Stability**: Resistance to chemical changes or breakdown under operational conditions, ensuring consistent performance and fluid life.
- **Wetting Ability**: The capacity to spread and adhere to surfaces, improving coverage and effectiveness in cooling and lubricating.
- **pH Stability**: Maintaining a stable pH level to prevent damage to machine components and the workpiece, and to ensure fluid stability and performance.
- **Additive Compatibility**: The ability to work effectively with various additives (such as anti-wear agents, extreme pressure additives, and emulsifiers) that enhance fluid performance for specific applications.

4. Operational & Storage Environment

- Temperature, humidity, and contamination levels in the metalworking environment affect fluid performance and stability.
- Storage conditions of your MWFs plays a large factor in extreme heat and cold environments.

5. Regulatory & Environmental Compliance

- Different locations around the world have regulations for controlling substances used in manufacturing regarding chemical composition, disposal, and environmental impacts, The adherence to these regulations can provide positive impacts on the environment and the health and safety of the workers.

6 Metalloid Case Study #1

Background

An HVAC OEM was experiencing persistent visibility issues in their leak testing tank due to the emulsification of process chemicals used in their coil manufacturing processes. These visibility issues were hindering their ability to effectively conduct leak tests, resulting in frequent downtime and increased operational costs. Metalloid was engaged to analyze the problem and provide a solution.

Problem Identification

The client's visibility issues were traced back to the current fin stamping lubricant, which emulsified into the water in the leak testing tank, creating a cloudy solution that obstructed visibility. This required routine cleanouts and refills of the tank, leading to significant downtime and maintenance costs.

Solution: Metalloid's Finworks 100C

Metalloid conducted a thorough inspection of the client's process and proposed the use of their Finworks 100C fin stamping lubricant. Laboratory tests were performed to compare the emulsification properties of Finworks 100C against the competitor's product. The results were conclusive shown in **Figure 1**:

- **Competitor's Product**: Emulsified into the water, causing cloudiness and visibility issues.
- **Finworks 100C**: Did not emulsify into water. Instead, it separated and floated on top of the water, as shown in the comparative pictures.

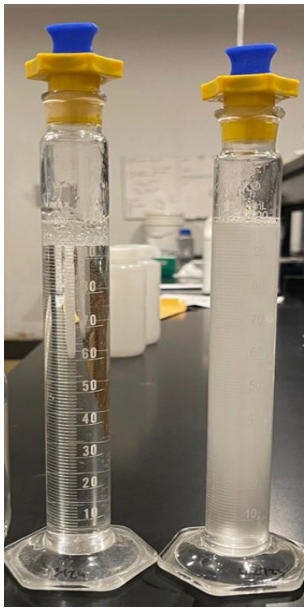

Figure 1

Left: Finworks 100C after shaking the tube of water and lubricant, shows to immediately separate to the surface.

Right: Competitors product after shaking the tube of water and lubricant, shows to emulsify into the water.

Implementation and Benefits

1. **Separation of Residual Oil**:
    - In the leak testing process, the residual oil from the coil surfaces entered the water tank. Finworks 100C separated from the water and floated to the surface, allowing for easy removal using a skimmer or filter.
2. **Maintained Visibility**:
    - With Finworks 100C, the water in the tank remained clear, significantly improving visibility for leak testing.
3. **Reduced Maintenance and Downtime**:
    - The competitor's product required frequent tank cleanouts and refills. In contrast, Finworks 100C reduced the frequency of these maintenance activities, minimizing downtime and associated costs which can be extremely high due to cost of disposal of the diluted water containing chemicals and metals.

Transition Process

The client was advised that immediate improvement in tank visibility would not be observed until a complete switch to Finworks 100C was made, eliminating any contamination from the competitor's oil. The lab testing provided confidence in the new process before full-scale production implementation, facilitating an easier decision for the client to transition to Finworks 100C.

Results (Shown in Figure 2)

- **Before Implementation**: The leak testing tank required routine cleanouts and refills due to visibility issues caused by the emulsification of the competitor's lubricant.
- **After Implementation**: With Finworks 100C, the tank maintained clear water, reducing the need for frequent maintenance and enabling uninterrupted leak testing.

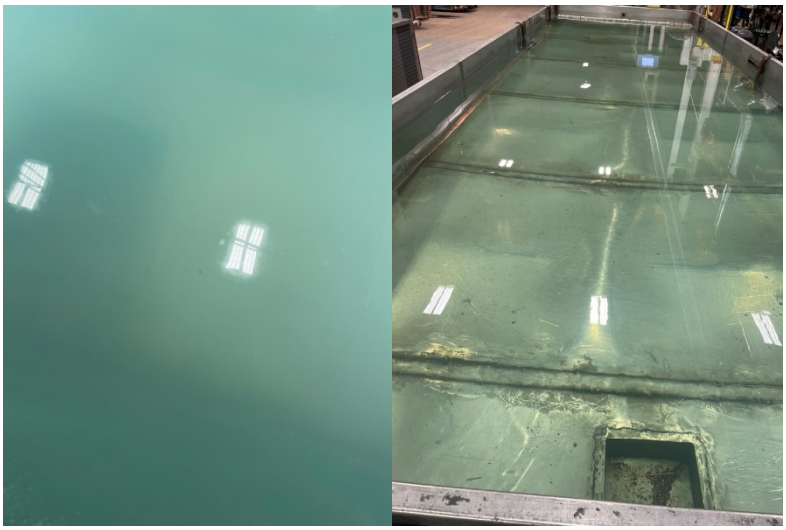

Figure 2

Left: Leak test tank after a short period of use with competitors' product

Right: Leak test tank after months of usage with Metalloid's Finworks 100C

Conclusion

Metalloid's introduction of Finworks 100C addressed the OEM's visibility issues in their leak testing tank, leading to clearer water, reduced maintenance, and lower operational costs. This case study demonstrates the effectiveness of Finworks 100C in providing a superior solution for fin stamping lubrication and highlights Metalloid's commitment to solving client-specific challenges through innovative products and thorough analysis.

The success of this transition has reinforced the client's decision to continue using Metalloid products and explore further process improvements with Metalloid's expertise.

7 Metalloid Case Study #2

Background

A Michigan-based manufacturing company with multiple locations recently undertook an evaluation of its metalworking fluids with the help of Metalloid's Territory Manager, Jared Albus. The CNC Manufacturing Engineer, with over 48 years of machining experience, was tasked with testing a new coolant, Metalloid Addvance 6035EP, as a potential replacement for their long-standing coolant, Blaser Swiss Cut.

Initial Setup

The engineer, who had been using Blaser Swiss Cut for over 20 years and believed it to be the best on the market, meticulously cleaned the machines and installed the Metalloid Addvance 6035EP coolant, setting it to an 8 percent concentration. The coolant was then tested over a period of two months across various materials.

Performance Evaluation

1. **Machining Efficiency**:
    - **Metalloid Addvance 6035EP**: Performed well in all materials at concentrations between 6-10 percent.
    - **Blaser Swiss Cut**: Required a 15 percent concentration to achieve similar performance levels.
2. **Coolant and Machine Cleanliness**:
    - The new coolant allowed way lube and hydraulic oils to float on top, making it easy to skim off and maintain clean machines.
    - The Blaser coolant did not facilitate this separation as effectively.
3. **Coolant Usage**:
    - **Metalloid Addvance 6035EP**: Demonstrated excellent stability, with minimal dehydration over the two-month period. Only occasional water additions were necessary.
    - **Blaser Swiss Cut**: Required daily refills at 6 percent concentration to maintain proper coolant levels.
4. **Employee Safety**:
    - **Metalloid Addvance 6035EP**: Identified as a bio-green product with no harsh chemicals. It produced no misting and was safe to touch, significantly improving the shop environment.
    - **Blaser Swiss Cut**: Contained harsher chemicals, as indicated by a Material Safety Data Sheet (MSDS) comparison.
5. **Cost Efficiency**:
    - **Metalloid Addvance 6035EP**: Approximately 50 percent cheaper than Blaser Swiss Cut, providing significant cost savings.

6. **Customer Service**:
    - The coolant supplier offered exceptional customer service, with regular bi-weekly visits from a representative who checked coolant conditions and took samples to ensure optimal performance.

Additional Products Tested

Based on the success of Metalloid Addvance 6035EP, the company began using other Metalloid products, including:

- **Metcor 57**: They described as a superior alternative to WD-40.
- **Metkleen 2140**: They described it as a preferred alternative over Simple Green for its effectiveness.

Health Benefits

The company also introduced Metalloid's hand soap. An employee with sensitive skin and dermatitis experienced significant improvement after using the hand cleaner, demonstrating its gentle yet effective properties.

Conclusion

The comprehensive testing and subsequent transition to Metalloid Addvance 6035EP coolant and other products have resulted in enhanced performance, cost savings, improved safety, and superior customer service for the company. The positive outcomes have solidified the company's decision to permanently switch to Metalloid products.

The company highly recommends Metalloid for its remarkable performance improvements across various metrics.

8 Conclusion

Metalworking fluids are indispensable in metalworking for maintaining efficiency. The ability of MWFs to meet the standards of the manufacturers can play a major role in cost management, surface finish, tolerance and quality, and health and safety. Selecting and managing metalworking fluids ensures that your parts meet the highest standards of precision and quality.

As a proven MWF manufacturer with over 70 years of industry experience, Metalloid is always ready to demonstrate the value of our products and how we can reduce overall costs for our customers. Reach out to us today to discover how we can enhance your manufacturing processes with the help of our industry experts to find you the proper fluid selection for your manufacturing needs.

9 References

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