



Innovation in
**Metalworking
Fluids**

High Performance Hybrid Semi-Synthetic Coolants

Where High Lubricity, Exceptional Surface Finishes,
Precision Tolerances and Improved Cycle Times are Required



E-LEARNING GUIDE



Today's Premium Hybrid Semi-Synthetic Cutting Fluids

for light to severe duty machining

Solving the Stigmas of the Past with new Hybrid Semi-Synthetic Coolants

Millions of gallons of metalworking fluids are sold and used in the U.S. every year. These fluids range from containing 100% oil to 95-100% water depending on the application. Oil offers lubrication while water offers cooling and more often than not, a combination of the two will provide the ideal performance balance for a range of metals and machining processes. Straight oils, those containing 100% mineral oil plus oil-soluble performance additives, work extremely well on gummy metals being cut or formed in slow processes where lubrication is the most desired performance property. Synthetic fluids, those containing 100% water plus water-soluble performance additives, work well on stainless steels being cut in high pressure applications where cooling is the most desired performance properties.

Although both of these types of fluids are commonly found in the industry for specific applications, modern metalworking fluids have transformed to combine the two product types together creating what is known as a semi-synthetic fluid. Semi-synthetic fluids usage has steadily grown in the past 20 years because of their versatility. However, in recent years, metalworking formulators have begun to develop an even newer class of metalworking fluids, a hybrid semi-synthetic.





Traditional semi-synthetic fluids work well because they contain some mineral oil, anywhere from 5-50%, as well as the water soluble components from a synthetic fluid allowing them to machine a wider range of metals with the same product. This is beneficial to job shops that machine a wide variety of parts and metals as they can use the same fluid across the shop vs. stocking and using multiple types. And although moving to semi-synthetic fluids certainly helped alleviate some problems, one big thing is, they still utilize mineral oil.

Mineral oil has some health, safety, and

environmental issues that come along with using it in coolants.

Straight oils create a mist during the machining process which not only leads to a mess but can have some health impacts on workers who are exposed and breathe them in. But as tighter restrictions on fuel economy drive the industry trend to light weight cars, more and more aluminum is being utilized and machined. Synthetics offer a mineral oil-free option, but as mentioned before, they do not work well on soft, gummy metals. What is the best option, then, moving forward? The most recent metalworking fluid developed is a hybrid semi-synthetic. These fluids utilize breakthrough technology that will 'act' like a mineral oil for machining performance, but do not come with the same health, safety or environmental issues as a mineral oil. The oil-like component tends to be environmentally friendly, renewable, more oxidatively stable, and can machine even better at lower percentages than mineral oil itself.





Synthetics in the Past Had a Bad Reputation

- 1) They offered a decrease in lubrication properties and poor results in machining aluminum as efficiently as in steel.
- 2) Relied on higher amounts of alkalinity which can cause contact allergic dermatitis when workers were exposed to the fluid.
- 3) They formed hard crystalline residues from the lubricity additives and alkalinity components required for performance.
- 4) They caused paint on machine tools to peel as well as made wipers wear prematurely. This was caused by the high alkalinity/pH that synthetic fluids tend to have.
- 5) Because traditional synthetic coolants did not contain oil, they did not provide lubrication, and rather had detrimental effects on the non-cutting pieces of a machine tool, such as the O-rings or other seals that come into contact with the fluid.
- 6) The higher pH synthetic coolants could also play a part in staining aluminum. Traditional synthetic fluids were formulated with higher pH amines that attacked aluminum leaving parts with a black coating.



Copper tube scrap parts due to an inconsistent finish. Copper is a more gummy metal and synthetics do not provide the same finish consistency when machining as hybrid semi-synthetics do.

Today's Premium Hybrid Semi-Synthetic Cutting Fluids

Hybrid semi-synthetic fluids are the most modern formulations available to the metalworking industry. They do not contain mineral oil, but instead use various polymers and newer technology to replicate or even improve the natural lubricity of mineral oil without the downfalls we've already discussed.





These premium hybrid semi-synthetics run cleaner than other cutting fluids because they reject tramp oil. With the unique use of this breakthrough technology, hybrid semi-synthetic fluids can be used to replace their mineral oil containing counterparts in virtually any metalworking operation and are equally effective on most metals.

Benefits:

- High lubricity for cutting and tapping aluminum as efficiently as steel
- Exceptional surface finish
- Elimination of staining sensitive metals
- Eliminating difficult residues
- Maintaining clean machines by leaving a light oil-like film to lubricate machine surfaces

Premium hybrid semi-synthetics are the ideal solution for:

- Through-the-tool coolant delivery
- Difficult-to-machine alloys (excellent for medical and aerospace)
- Applications where precision tolerance and high finishes are required
- Improved cycle times
- Extending the service life of tooling
- Job shops that work with a variety of metals

JTM Products, Inc. manufactures specialty formulated hybrid semi-synthetics that can fulfill a variety of applications ranging in machining severity:

- Ⓜ **SYNMAX™ 2505 ULTIMATE COOLANT FOR [LIGHT TO MODERATE MACHINING](#):**
where coolant losses are high, and metal and operation demands are moderate.

Unique economically priced hybrid semi-synthetic coolants that meet or exceed the performance of even the best commercially available mineral oil containing semi-synthetic fluids. These offer the best choice where high coolant losses and metal and operation demands are light to moderate.





- Ⓜ **SynMAX™ 2515 ULTIMATE COOLANT FOR [HEAVY DUTY MACHINING](#):** *where machining operations are more demanding and the shop requires similar performance across a variety of metals.*

For maximizing output in heavy machining operations, this coolant is a workhorse for any job shop that wants to limit the number of lubricants in their shop while providing similar performance across operations and metals.

- Ⓜ **SYNMAX™ 2525 ULTIMATE COOLANT FOR [SEVERE DUTY MACHINING](#):** *where tool-life and surface finish of the parts are the number one priority in even the most severe of operations.*

This extraordinary coolant is a premium hybrid semi-synthetic cutting fluid formulated to provide the ultimate performance on the most difficult, demanding operations and metals.

SynMAX 2525

Provides the ultimate in machining performance on your most difficult, demanding operations and metals. When maximized feeds and speeds are required, SynMAX 2525 is your best choice.

SynMAX 2515

The workhorse of the family. SynMAX 2515 has the best all metal machining capability. It is therefore perfect for job shops where any metal could come in the door. Great for heavy operations and metals.

SynMAX 2505

Best where coolant losses are high and metals and operations demands are moderate. Economically priced SynMAX 2505 packs a lot of machining capability.

*All SynMAX products meet **Boeing BAC 5008 Revision U** for steel, aluminum and titanium and are REACH compliant*





Case Studies

Below are extensive field trials of JTM Products Inc.'s SynMAX™ Hybrid Semi-Synthetic line of coolants. Each trial is unique and demonstrates the successful use of SynMAX 2515 Ultimate Coolant in a variety of different applications and on multiple metal types. These trials demonstrate the ability of the SynMAX series to offer end-users a solution to the growing demand on products that require improved tool-life, part finishes, and longer fluid-life.

SynMAX Hybrid Semi-Synthetic Coolants Provide:

1. Improved efficiency: providing better cooling and lubrication.
2. Ability to be used in multi-metal shops and machines with the same efficiency.
3. Elimination of oil — full hybrid semi-synthetic providing improved performance over an excellent high-oil semi-synthetic with a decade long proven track record.

In the ever-evolving world of metalworking fluids, end-users are confronted with a vast array of products to choose from. Each product boasts benefits over their current fluid. But how does an end-user really know if these benefits will be realized? As the adage goes; *seeing is believing.*

These trials demonstrate that SynMAX Ultimate Coolants provide improved cooling and lubrication. This is realized by improved tool-life and part finish as reported by the operators in each shop.

In these trials, SynMAX 2515 Ultimate Coolant replaced a well-established, excellent high-oil semi-synthetic fluid with a decade long proven track record. The results of these trials prove that a full hybrid semi-synthetic, containing 0% mineral oil, can be used to replace a high oil containing product without sacrificing lubrication; and actually, improving it.

Customer A: Bearing Manufacturer

- Machines
 - Cutting = Haas ST-35 Lathe
 - Grinding = Cincinnati Centerless Grinder
 - Wheel in-use = 20" x 12" x 6" A/O SS AK60
 - Operation is a punch cut at 0.020 Depth of Cut





- Material
 - Part = 52100 Bearing material at 60-62
 - Tool = Iscar 432 Grade 6025 with 0.32 rad inserts

SynMAX 2515 Ultimate Coolant was introduced to Customer A. Prior to trialing SynMAX Ultimate Coolant, they had been using a well-established, high oil semi-synthetic product, providing excellent performance. The decision to trial the new product came from the desire to improve part throughput and improve tool-life. Table 1 outlines the improvements that were seen after charging the machine with the SynMAX Ultimate Coolant.

Table 1: Customer A Performance Improvements

	Competition	SynMAX™ 2515	Percent Increase
Surface Feet per Minute (SFM)	300	500	40%
Depth of Cut (DOC)	0.45 – 0.50	0.60 – 0.65	25%
Inches per Revolution (IPR)	0.010	0.015	33%

In addition to the reported results, the operator of the Haas ST-35 Lathe commented on the improved finishes provided by SynMAX 2515 Ultimate Coolant, as well as decrease in carry off. From his observations, he has seen an increase in tool-life of approximately 20%. The operator of the Cincinnati Centerless Grinder observed that SynMAX 2515 was keeping the machine very clean with decreased carry-off.

Customer B: Oil Field and Aerospace

- Machine: Okuma Lathe
- Material
 - AISI 6061 Aluminum
 - Mitsubishi Carbide 0.157” Drill with through-the-tool coolant delivery at 1,000 psi
 - Depth of Cut is 3”

Customer B was experiencing tool breakage after just 30 parts, utilizing a traditional synthetic. Table 3 outlines the improvements that were seen after charging with SynMAX 2515 Ultimate Coolant.





Table 2: Customer B Performance Improvements

	Competition	SynMAX™ 2515	Percent Increase
Parts / Tool Machined before Breakage	30	400 +	92.5%

Once Customer B converted to SynMAX 2515 Ultimate Coolant, they were able to finish out a run of 18 parts and a second run of 400 parts without tool breakage. These extraordinary results demonstrate the ability of SynMAX 2515 Ultimate Coolant to utilize breakthrough technology, providing performance that is far superior to current market offerings. In addition, the customer reported minimal foam even with high pressure through-the-tool coolant delivery system.

SynMAX 2515 continues to provide outstanding performance for this customer.

Customer C: General Machining

Customer C is another example of a job shop in which a multitude of different metals are machined, operations run, and tools used. A substantial amount of their work is short run milling and turning on materials including brass, copper, several polymers, multiple alloys of steel, and aluminum. Again, it should be noted, this type of trial will push the limits of any metalworking product due to the number of variables the fluid needs to be compatible with. In addition to these challenges, it is important to note that Customer C does not track their tooling usage or follow a machine and coolant maintenance program.



Customer C replaced their current fluid, a high oil semi-synthetic, with SynMAX 2515

Ultimate Coolant. Operator feedback provided better finishes and a general feeling of improved tool-life. After running for eight months, the shop requested to convert back to their original high oil semi-synthetic fluid. Due to the lack of a maintenance program, operators were allowing chips to remain untouched on the machine for four to five days.





A high oil semi-synthetic will provide lubrication to help keep these chips from sticking to the machine; something true synthetics fall short on. However, just two short months later, this customer contacted JTM Products Inc. and requested to continue the field trial of the SynMAX 2515. The improved part finishes and tool-life were realized after comparing the previous months to the two utilizing the high oil semi-synthetic. Customer C has since implemented a maintenance program to ensure chips are not left on machine surfaces while continuing to use the SynMAX Ultimate Coolant product.

In addition to the general machining mentioned previously, Customer C charged a screw machine with SynMAX 2515 Ultimate Coolant. In general, this screw machine was historically problematic, requiring many adjustments for each parts order received. After charging the SynMAX Ultimate Coolant, operator feedback provided that the machine was no longer problematic and required significantly less adjustments per parts order.

SynMAX 2515 is now the preferred coolant for this customer.

Conclusion

The key needs of machine shops in today's market are improved tool-life, part finishes, and fluid longevity. Each customer experience discussed here provided feedback that JTM Products' SynMAX Ultimate Coolant did in fact improve both tool-life and part finishes. In addition to those improvements, some of these field trials have been running for almost a year without a sump turnover; even with a lack of fluid maintenance program. Improving on these properties provided each of these customers with lower overall cost per part to manufacture; spending on tools decreased, fluid waste decreased, and the amount of scrap parts decreased.

JTM Products Inc.'s SynMAX Ultimate Coolant series truly offers the market a breakthrough technology with field data to back it up.

THE SYNMAX PRODUCT LINE MEETS BOEING BAC 5008 REVISION U FOR STEEL, ALUMINUM AND TITANIUM AND ARE REACH COMPLIANT.





About the Author

JTM Products has been manufacturing quality industrial lubricants for more than one hundred years. Founded in 1890 as the Phoenix Oil Company, it produced the axle greases, belt dressings, and lubricants that helped the Industrial Revolution run smoothly. The company was on the leading edge in the early 1900s, when it introduced the first water-soluble cutting oil for machine tools. In the 1920s, Murphy Oil Soap was born. Now a household word, Murphy Oil Soap has remained a favorite cleaning product with homemakers, industrial, and commercial maintenance people ever since. As a pioneer in the field of industrial chemicals, JTM's mission has been to provide products which meet the changing needs of customers. All of the formulations have played key roles in emerging technologies.

In the mid-2000s, JTM Products introduced **KOOLRite™** Long Life Fluids and in 2018 **SynMAX™** Ultimate Coolants; both product lines offering unique and innovative solutions to metal working industry challenges. We have a dedicated team focused on the metal working industry. Within the team we have a Certified Metalworking Specialist, a Certified Lubrication Specialist, and years of expertise with our chemists, sales and technical service staff. In addition to the KOOLRite and SynMAX Coolants, JTM offers a broad portfolio of metal working fluids including Swiss Cutting, Sawing and Grinding Fluids, Forming Lubricants, Rust Preventatives, Cleaners and many others.

Our goal remains the same as it was over 100 years ago...to provide quality, innovative products that meet the current and future demands of our customers and the industrial markets that we service.

