

Minimum Quantity Lubrication System



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Connotation

Converging of Global Resources

Professional as Industry Leader

CONPROFE

Company Overview

With its roots back to 2003, Conprofe is a Provider of Efficient, Green and Intelligent Manufacturing Solutions and Key Units. It has been holding on to the idea of "Converging of Global Resources, Professional as Industry Leader" in the past two decades. Revolving around "Efficient, Green and Intelligent Manufacturing", the company has achieved a giant leap from parts, units to machines and developed a product portfolio with three major industries - Precision Tools, Key Units and CNC Machine Tools, which covers eight categories of products, including Super-hard Tools, Tapping Tools, Precision Tool Holders, Ultrasonic Technologies, Green Technologies, Precision Units, Ultrasonic-Green CNC Machine Tools and Automation. Its customers have spread across diverse sectors, such as semiconductors, aviation & aerospace, medical field, automotive, consumable electronics, education and general precision manufacturing, etc.

Conprofe perseveres in laying a solid foundation in the domestic market while keeping its eyes open to the world. Headquartered in Guangzhou Science City, the company has established sales and service centers in seven domestic regions and forged a network of R&D, sales and service based in Hong Kong, Taiwan, the United States, South Korea, India and Vietnam, etc. With its products being exported to over 70 countries and regions across six continents, Conprofe's integrated distribution of R&D, production, sales and service around the globe has gradually come into being.

Conprofe persists in innovation-driven developing strategy and owns two National High-tech Enterprises under the Group. The company's Frontier Technology Research Institute (FTRI) and Guangdong Province Engineering Technology Center (GPETC) has developed over 850 core technology patents. Its primary product technologies have reached an internationally advanced level, as assessed and acknowledged by experts led by members of the Chinese Academy of Engineering (CAE). Furthermore, Conprofe has successively been granted the Guangdong Scientific and Technological Progress Award (First Prize 2020, Second Prize 2021), Guangdong Patent Award (Silver), China Patent Award (Excellence) and has been honored as Enterprise with Significant Contribution to Guangdong's Supplies for COVID-19 Prevention and Control, Guangzhou Pioneering Private Enterprise, etc.



Manufacturing and Testing Equipment



Minimum Quantity Lubrication (MQL) Cooling System



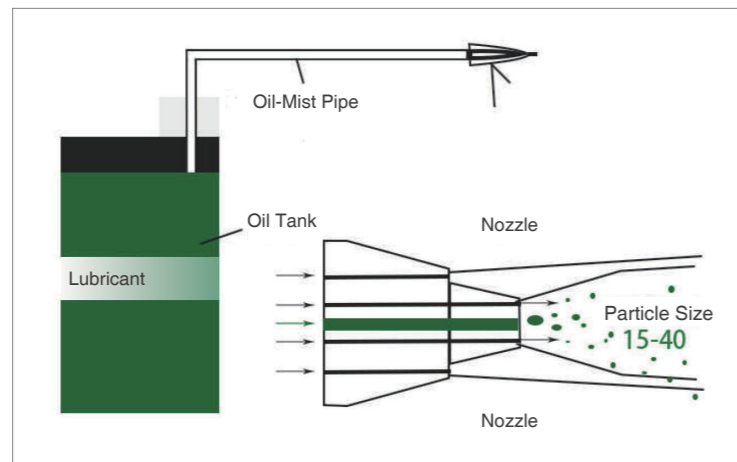
Innovative Minimum Quantity Lubrication System

MQL Cooling System R&D

- Drawing on over a decade of experience in metals machining and R&D of cutting tools, Conprofe has developed Minimum Quantity Lubrication (MQL) System that enables highly efficient machining operations. We have also designed a range of specialized nozzles with different structures and dedicated MQL lubricants tailored to specific applications to provide our customers with effective, efficient, and eco-friendly MQL-based machining solutions, thus promoting clean production, cost reduction and machining efficiency.

Working Principle of MQL Cutting Technology

- MQL Cutting Technology, also known as dry or semi-dry cutting, is one of the cutting machining methods which mixes compressed gas (air, nitrogen, CO₂ etc.) and a minimal amount of atomized lubricant, forms a micron-level lubricant and blasts it to the machining area, providing effective lubrication.



Benefits of MQL Cooling System

MQL offers numerous benefits that directly address issues associated with use of traditional cutting fluid.

- **Longer Tool life**
Extending tool life by virtue of higher cooling and lubricating efficiency and less friction
- **Higher Machining Efficiency**
Better lubricating performance that enables higher cutting speed and feed rate, hence improving machining efficiency
- **Higher Machining Precision**
Conditions of contact between the workpiece and the tool improved, allowing better planeness and roughness
- **Lower Cost**
Significant cost reduction achieved by eliminating need for large quantities of cutting fluid and related waste processing
- **Better Working Environment**
Clean and neat working environment and fresh air without pungent fumes
- **Eco-Friendly Performance**
No fluid waste and no need of waste processing and discharge
- **Energy-Saving Effect**
Energy saving from dispensing with high-power pump and fluid circulation & filtration system
- **Good for Health**
Clean and dry working environment without any toxicant or contamination



Traditional Machining



MQL-Based Machining



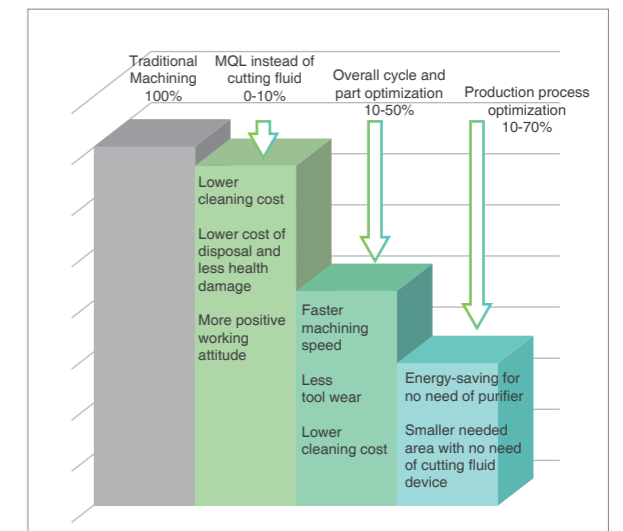
Machining with Add-On Nozzles



Through-Spindle MQL-based Machining



Centralized Atomized MQL-Based Machining



Cost-Saving Capability

MQL Cooling System

Airlube Series



Airlube MEM101

Features

User-friendly with compact structure, especially suitable for small turning centers, drilling centers, milling centers and sawing centers



Airlube MEM102

Features

With function of alarming and capable of reaching -5~-5°C with Vortex Refrigeration Technology, achieving better cooling and lubricating performance



Airlube MEM201

Features

Adapted with Oil-Water Atomization Technology and equipped with dedicated Oil-Water Nozzle, forming a thin-layer of oil film mixed with water droplets to enable mixed atomization

State-of-the-Art Oil-Water Ratio Regulating System to enable precise digitalized fine tuning of the amount of water and oil

State-of-the-Art Precision Electric Pump with up to 1ml/h of tuning accuracy

State-of-the-Art dedicated nozzles to enable precise lubrication

Capable of automatic controlling of oil-water-gas delivery with simultaneous machine tool system

Applicable to gear hobbing, shaping, milling and other MQL machining

Airlube Pro Series



Airlube Pro MIM101

Features

User-friendly with compact structure, especially applicable to tools with spindle-through holes and machining scenarios that require constant oil mist for cooling and lubrication.



Airlube Pro MIS101

Features

Capable of gas and oil-mist flow tuning, and linkable to the machine system for controlling start and stop, and enabling semi-automatic tuning of oil output.



Airlube Pro MIA101

Features

Self-adaptive in terms of oil amount based on the corresponding tool and technical parameters, especially applicable to modern CNC machining centers that are equipped with multiple types of tools and requires separate oil output control.

Airlube Series

Working Principle

- Dedicated nozzles generate an optimal mist for the cutting zone. Lubricant is efficiently atomized, creating micron-sized suspended particles that travel with compressed gas to the cutting zone. This forms a protective oil film between the cutting tool and workpiece, ensuring smooth and efficient cutting while minimizing wear and friction.
- Customizable nozzles and premium micro-lubricants deliver tailored micro-lubrication and cooling solutions for any application. Our innovative technology ensures optimal performance of MQL System.
- There are three series of MQL Cooling System including Airlube MEM101, MEM102, and MEM201. Each option is meticulously designed to meet the unique demands of various application scenarios.



<<< Airlube Series >>>

MEM101 MQL Cooling System

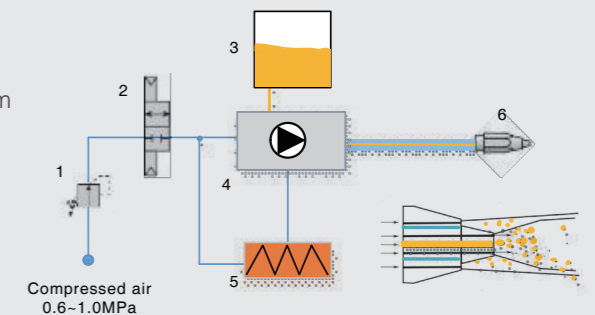
Airlube Series >>>

- Airlube MEM101 features precision micro oil pump to enable oil pumping and output of MQL, with action frequency regulator of precision oil pump and oil quantity regulator for oil quantity tuning.
- With dedicated MQL nozzles that boasts multiple IPR engineering, the amount of oil-gas mixture blasted to the cutting area is appropriately tuned. By virtue of it, There is no a great amount of atomized oil mist in the air.
- Easy to install, with almost no need to readapt the original machine or fussy engineering



Working Units

1. Pressure Control Valve
2. Two-Position Two-Way Valve
3. Oil Tank
4. Micro Oil-Pump System
5. Frequency Regulator
6. Atomization Nozzle



MEM102 MQL Cooling System

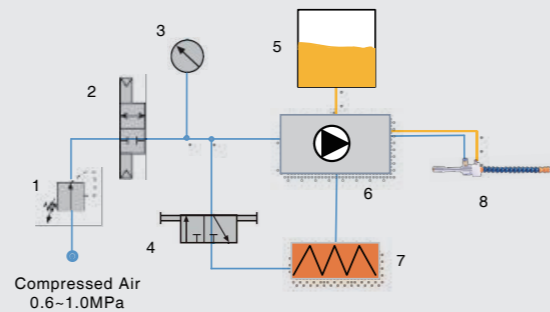
Airlube Series >>>

- Airlube MEM102 System features functions of Liquid Level Alarm, Air Pressure Alarm, Power Prompt and Startup Prompt, etc., improving automation capability.
- With special system hardware and optical dedicated vortex refrigeration nozzle, to achieve $-5\sim-5^{\circ}\text{C}$ on the nozzle outlet for better cooling and lubrication.
- Ensure stable machining process by enabling machine tool signal regulating system to control start and stop and accelerate system response speed



Working Units

- | | |
|-------------------------------|--------------------------|
| 1. Pressure Control Valve | 5. Oil Tank |
| 2. Two-Position Two-Way Valve | 6. Micro Oil Pump System |
| 3. Pressure Gauge | 7. Frequency Controller |
| 4. Manual Valve | 8. Frequency Controller |



MEM201 MQL Cooling System

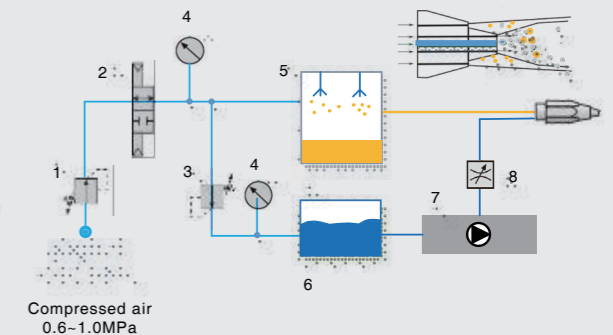
Airlube Series >>>

- Airlube MEM201, an efficiency-boosted oil-water MQL equipment, applies new oil-water atomization technology and specially-engineered oil-water nozzle, allowing formation of Oil on Water (OoW) particle on the nozzle outlet, while oil, water and gas are delivered separately to the cutting area, mixed and atomized, achieving highly-efficient cooling and lubrication on the cutting area.
- With new oil-water ratio regulating system for digitalization of oil and water quantity
- With precision electric pump for output control of micro-quantity oil and water at the regulating accuracy of up to 1ml/h
- Applicable to gear hobbing and shaping, milling, turning and sawing



Working Units

- | | |
|-------------------------------|-------------------------|
| 1. Pressure Control Valve | 5. Oil-Mist System |
| 2. Two-Position Two-Way Valve | 6. Water Tank |
| 3. Pressure Control Valve | 7. Electric Pump System |
| 4. Pressure Gauge | 8. Throttle Valve |



Technical Data

	Airlube MEM101		Airlube MEM102		Airlube MEM201
	Piston Pump	Electronic Pump	Piston Pump	Electronic Pump	—
Oil Pump Type	Piston Pump	Electronic Pump	Piston Pump	Electronic Pump	—
Water Pump Type	—	—	—	—	Electronic Pump
Dimension (mm)	270x135x355	220x320x400	320x235x425	220x320x400	492x533x695
Oil Tank Volume (L)	1.8	1.8	2.0	2.0	4
Water Tank Volume (L)	—	—	—	—	10.0
Power Supply (Standard)	24V DC	24V DC	24V DC	24V DC	AC220V
Inlet Pressure (MPa)	0.6~1.0	0.6~1.0	0.6~1.0	0.6~1.0	0.5~0.8
Fluid Level Indicator (for visual inspection)	●	●	●	●	●
Fluid Level Monitor	—	●	○	●	●
Pressure Monitor	—	●	○	●	●
Outlet Amount	1-5	1-5	1-3	1-3	1-3
Air Consumption (L/min)	50~300*	50~300*	50~1000*	50~1000*	50~300*
Oil Consumption (ml/h)	10~100*	5~150*	10~100*	5~150*	5~150*
Water Consumption (L/h)	—	—	—	—	0.3~0.5
Weight with Empty Oil Tank (kg)	5	15	15	18	60

(Following the preceding table)

	Airlube MEM101		Airlube MEM102		Airlube MEM201
	Mechanical (Manual Rotary Knob)	Electronic (Touch Screen)	Mechanical (Manual Rotary Knob)	Electronic (Touch Screen)	Mechanical (Manual Rotary Knob)
Oil Quantity Tuning	Mechanical (Manual Rotary Knob)	Electronic (Touch Screen)	Mechanical (Manual Rotary Knob)	Electronic (Touch Screen)	Mechanical (Manual Rotary Knob)
Parameter Display	—	Digital Display	—	Digital Display	Digital Display
Water Quantity Tuning	—	—	—	—	Electronic
Auto Fluid Replenishment	—	—	—	Supported	Supported
Start & Stop Control of Nozzle	Manual or On-line	Manual or On-line	Manual or On-line	Manual or On-line	Manual or On-line
Cooling Capability	Moderate (air cooling at ambient temperature)		Good (air cooling at around -5~5°C)		Good (cooling by water droplet evaporation)

Note: Refer to the specific machining process
 - Nil ● Standard ○ Optional

Application Recommendation

	Airlube MEM101	Airlube MEM102	Airlube MEM201
Sawing Machine	✓	○	○
Turning Center	✓	●	●
Milling Center	○	✓	●
Drilling Center	○	x	x
Hobbing Machine	x	○	✓
Machining Center	x	●	●
Gantry Milling Center	x	○	●

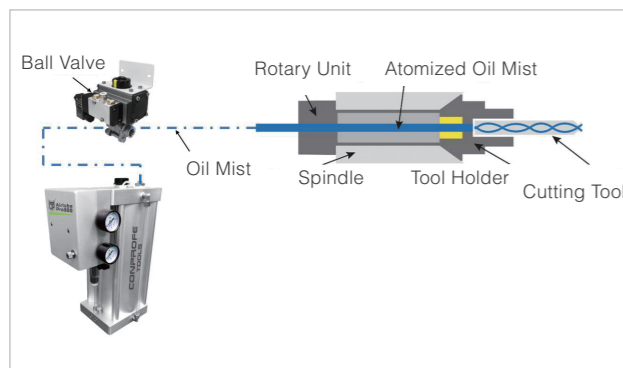
Note: ✓ Excellent ● Good ○ Optional x Not recommended

Airlube Pro Series

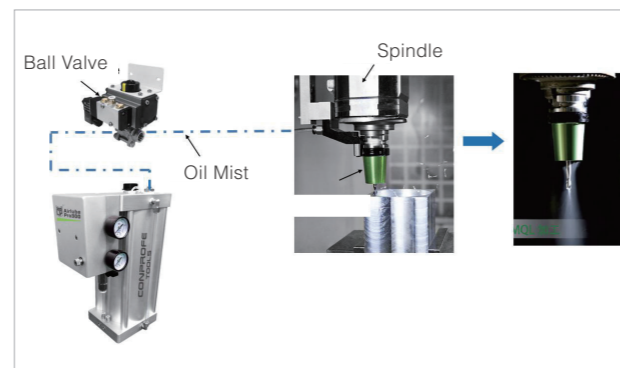
Working Principle

- Spindle-Through MQL Cooling Technology facilitates seamless lubrication between the tool and the workpiece by leveraging highly dispersed micron aerosol transported by compressed air. The magic begins in the atomizing box of the micro-lubrication system, where the aerosol is generated. It is then introduced into the cutting tool through the rotating spindle of the machine tool, either exiting through the internal cooling channels of the tool or via add-on nozzles. Precise control is maintained by specially designed atomizing nozzles and regulating devices, depending on the specific cutting requirements.
- Specially designed atomizing nozzles and regulating devices can control the atomization of lubricants through compressed air, producing fine oil mist particles with a diameter of about 0.5-3 μ m. These fine oil mist particles easily penetrate into the cutting area, improve the friction state of the cutting tool, and reduce the generation of cutting heat.
- Spindle-Through MQL Cooling System is available in two types, MIM101 and MIS101, to provide customers with the best solution for different applications.

Connected with Coolant-Through Spindle



Connected with Add-On Nozzle



MIM101 MQL Cooling System

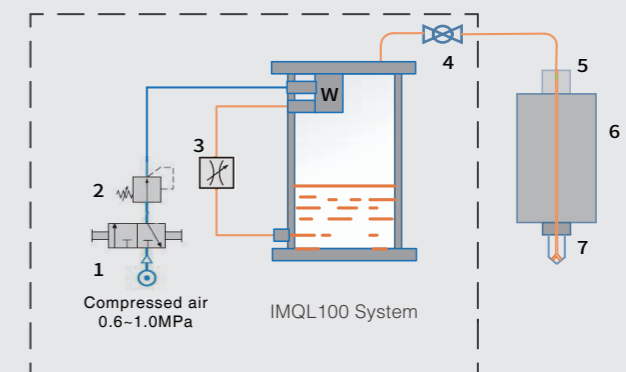
Airlube Pro Series >>>

- MIM101 is a simple and easy to operate Spindle-Through MQL Cooling System, especially suitable for cutting processes requiring constant gas lubrication.
- The MIM101 requires to manually press the button to start the atomizing device and achieve constant output of the atomizer.
- MIM101 oil mist output is controlled by a ball valve, which is set near the spindle or the add-on nozzle, allowing a quick response and reliable cutting.



Working Units

1. Manual Valve
2. Pressure Control Valve
3. Oil Quantity Regulator
4. Ball Valve
5. Rotary Joint
6. Spindle
7. Coolant-Through Tool



MIS101 MQL Cooling System

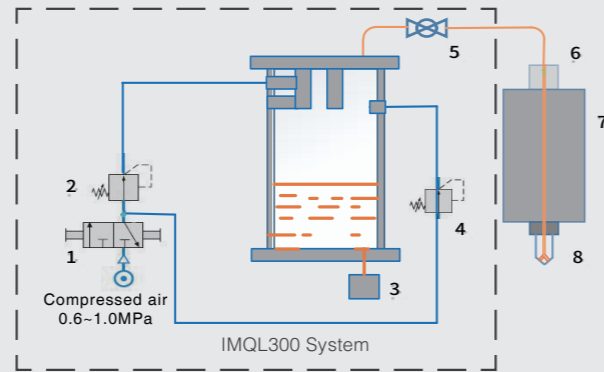
Airlube Pro Series >>>

- The MIS101 is a semi-automatic controlled Spindle-Through MQL Cooling System, suitable for machining where varying atomization levels are required for lubrication.
- MIS101 atomizing box is equipped with a number of special atomizing devices and gas regulating valves, and through the combination of solenoid valve control, to achieve 5 kinds of flow regulation.
- The MIS101 oil mist output is controlled by a ball valve, which is set near the spindle or add-on nozzle, allowing quick response and reliable cutting.
- The MIS101 can control the start & stop of each solenoid valve by obtaining the machine signal, achieving semi-automatic tuning of the atomization output and generating different amount of oil mist to meet the different needs of each tool and cutting process.



Working Units

1. Manual Valve
2. Pressure Control Valve
3. Auto Oil Replenishment Unit
4. Pressure Control Valve
5. Ball Valve
6. Rotary Joint
7. Spindle
8. Coolant-Through Tool



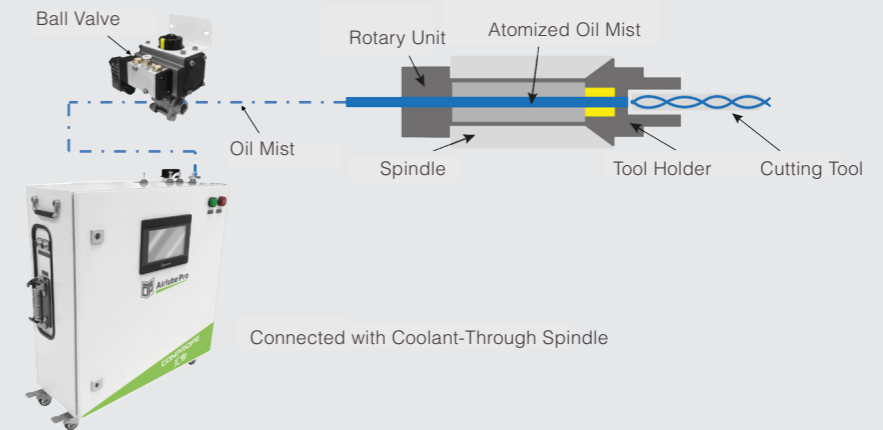
MIA101 MQL Cooling System

Airlube Pro Series >>>

- MIA101 is an intelligent Spindle-Through MQL Cooling System that automatically controls the output of oil mist, suitable for cutting processes that require changing the amount of gas for lubrication, such as drilling, turning or milling.
- MIA101 is equipped with 3 atomizing nozzles and ratio regulating valves, which can achieve 27 flow changes through different adjustment combinations.
- MIA101 can be activated by machine tool control, and the pressure difference can be automatically set by the ratio regulating valve to achieve automatic adjustment of the atomization output.
- With optional booster system to realize intelligent pressure boosting control of the MQL unit and solve the problem of insufficient oil mist output of small diameter cutting tools; Applicable range of spindle-through hole diameter: $\geq 0.5\text{mm}$.



Working Units



Technical Data

	Airlube Pro MIM101	Airlube Pro MIS101	Airlube Pro MIA101
Dimension (mm)	240x210x390	267x200x380	635x245x674
Oil Tank Volume (L)	2.8	2.8	2.8
Power Supply (Standard)	24V DC	24V DC	AC 220V / DC24V (Optional)
Inlet Pressure (MPa)	0.6~1.0	0.6~1.0	0.6~1.0
Fluid Level Indicator (for visual inspection)	●	●	●
Fluid Level Monitor	○	●	●
Pressure Monitor	○	○	●
Outlet Amount	1-3	1-3	1-3
Gas Consumption (L/min)	50~800*	50~800*	50~800*
Oil Consumption (ml/h)	1~120*	1~120*	1~120*
Weight with Empty Oil Tank(kg)	8	10	42
Oil Quantity Tuning	Manual	Manual	Automatic
Oil Quantity Change	Constant	5 kinds	Automatic
Auto Oil Replenishment Unit	Not supported	Not supported	Supported
Start & Stop Control of Oil Mist	Ball Valve	Ball Valve	Ball Valve
Applicable Hole Diameter	≥0.8 mm	≥0.8 mm	≥0.5 mm

Note: Refer to the specific machining process
 ● Standard ○ Optional

Application Recommendation

	Airlube Pro MIM101	Airlube Pro MIS101	Airlube Pro MIA101
Turning Machine	●	●	●
Milling Machine	●	✓	✓
Drilling Machine	●	●	●
Machining Center	○	✓	✓
Gantry Milling Machine	○	✓	✓

Note: ✓ Excellent ● Good ○ Optional

Accessories Set

Conprofe is proud to offer a comprehensive range of atomizing nozzles and common nozzles, designed to deliver exceptional blasting accuracy, uniform jet distribution, and minimal oil mist generation. Our blasting nozzles are characterized by their efficient "blasting mode", ensuring optimal performance in various applications. Our diverse portfolio of nozzles caters to numerous industries and needs, providing tailored solutions to suit individual requirements. Our team of skilled technicians boasts extensive experience in MQL design, enabling us to offer personalized solutions that meet the unique demands of each customer.



Accessories Set with MQL Cooling System

NA31/NA32 Ring-Type Jet Nozzle

Accessories Set >>>



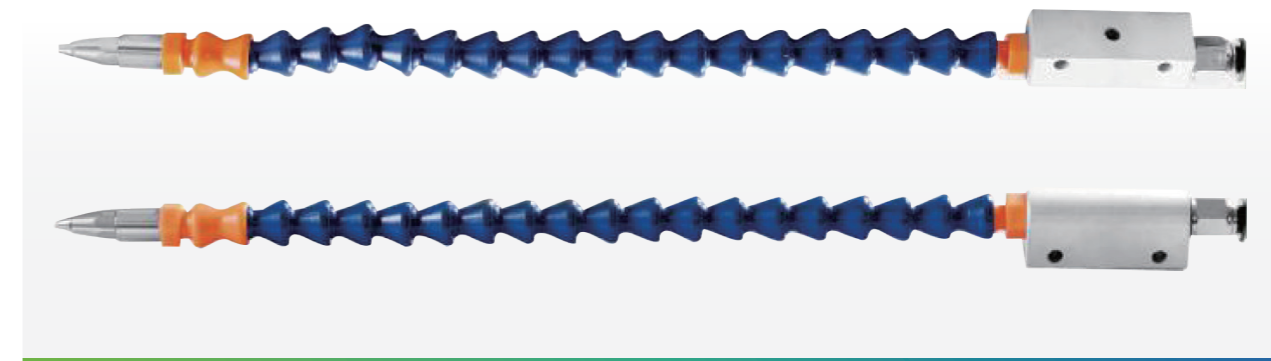
- With unique ferrule design to ensure that uniform the oil jet applies stably and accurately onto the cutting edge
- The atomizer oil mist outlet is close to the cutting edge, and the strong oil mist airflow can quickly remove the chips generated during the cutting process.
- The powerful oil mist outlet is designed with multiple angles or fixed injection angles to adapt to different chip tools for optimal lubrication.
- The ferrule design can be customized according to each tool holder, and can be installed in the automatic tool changing device together with the matching tool holder to realize automatic and fast tool changing.



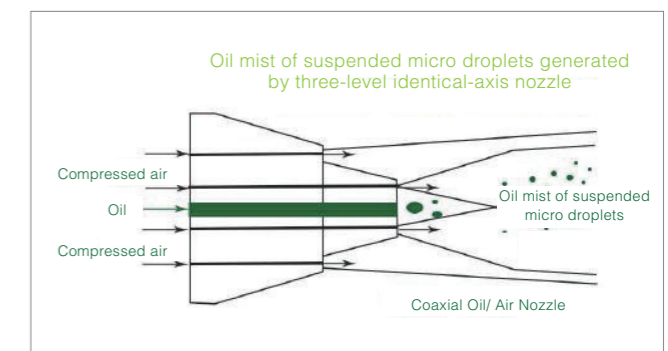
Tool Change System of Ring-Type Nozzle

NC21/NC22 Round Jet Nozzle

Accessories Set >>>



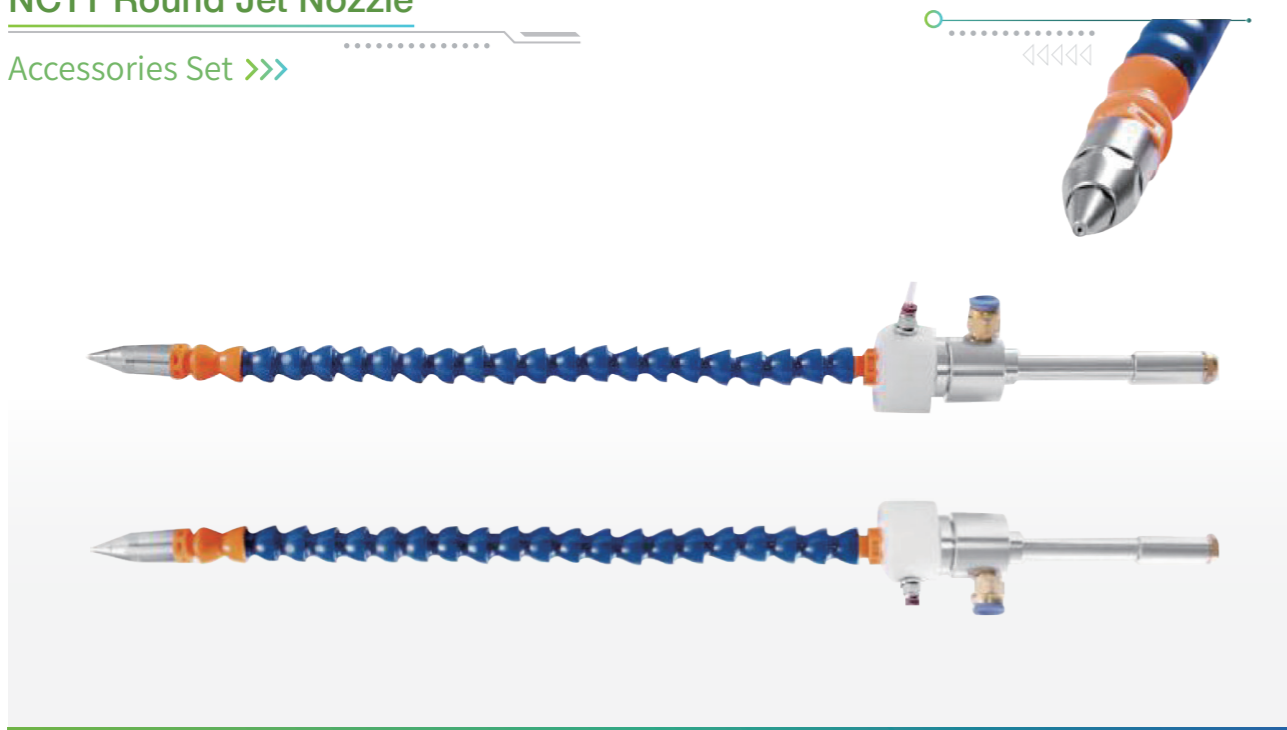
- Applicable to tool cooling and lubrication in turning, milling, drilling, tapping and other machining processes
- The nozzle structure adopts three layers of coaxial bushings. Quantitative lubrication is carried out from the inner capillary of the nozzle, and compressed air is transported from the outside to ensure that the oil mist can be centrally sprayed, so that the lubricant can be accurately delivered to the cutting area.



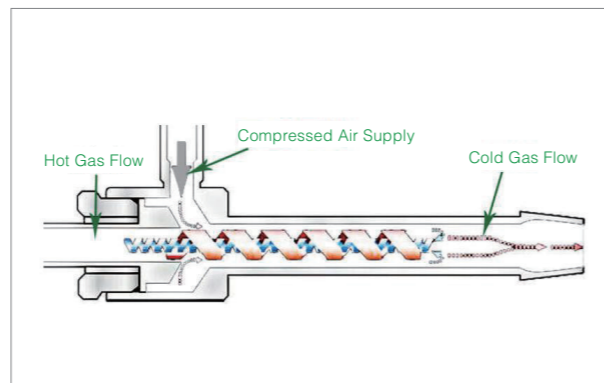
Working Principle

NC11 Round Jet Nozzle

Accessories Set >>>



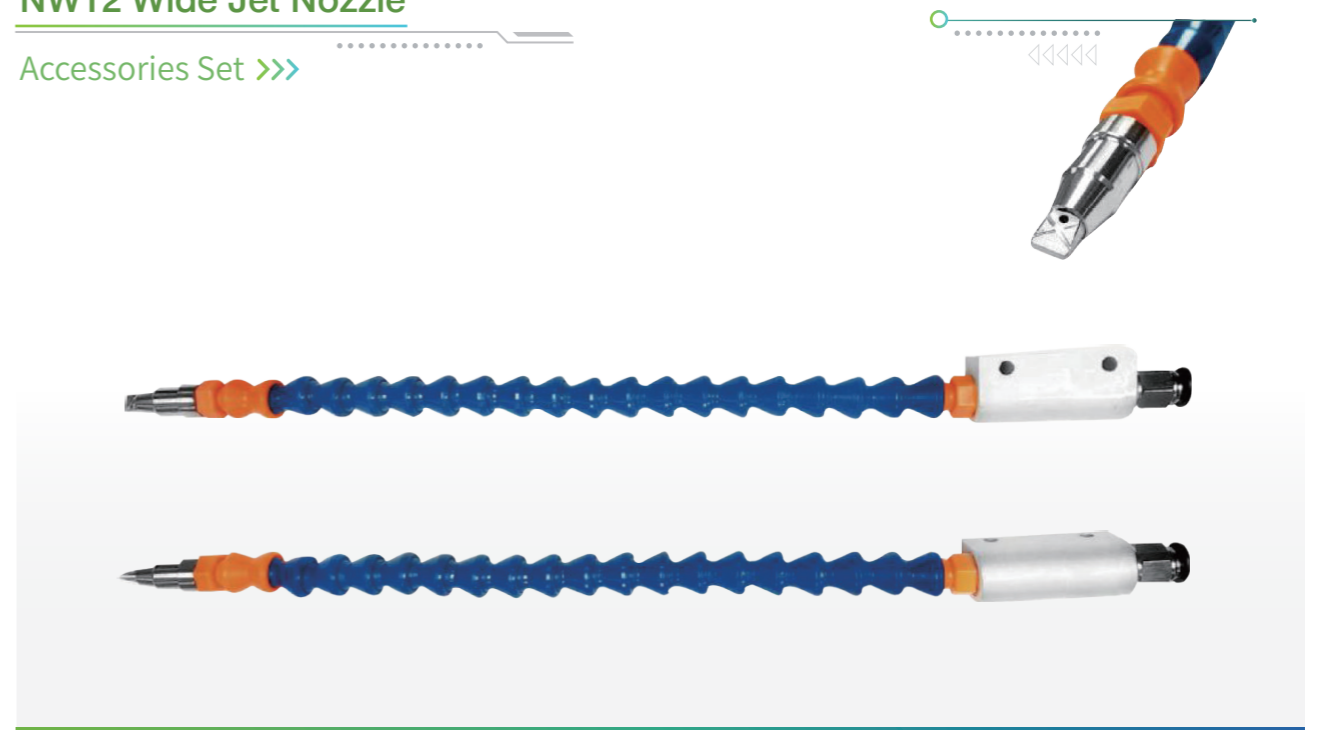
- Applicable to cooling and lubrication of turning, milling, drilling, tapping and other machining processes
- The nozzle is combined with vortex refrigeration technology, and the compressed air at normal temperature is connected to the cold end of the vortex pipe of the nozzle, which can instantly generate a temperature difference of -30 to obtain low temperature oil mist without using any refrigerant.



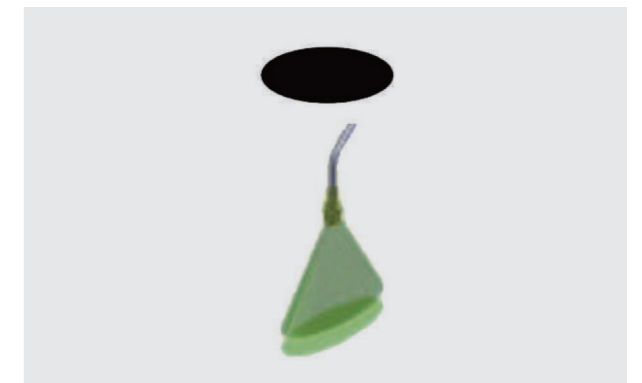
Working Principle

NW12 Wide Jet Nozzle

Accessories Set >>>



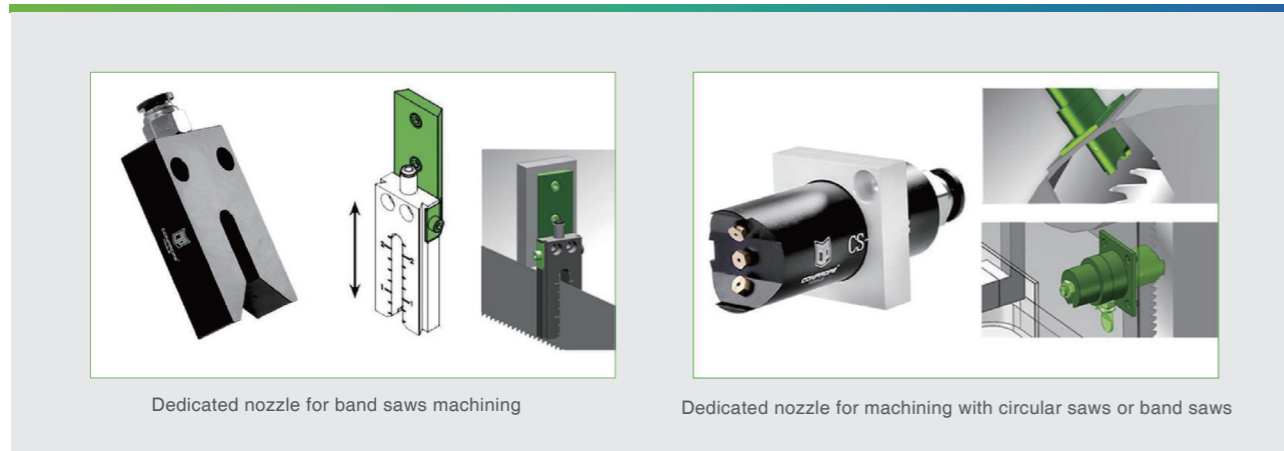
- Applicable to tool cooling and lubrication of stamping, forging and pressing, drawing and other machining processes
- The nozzle front structure uses a wide jet design to ensure that the oil mist is sprayed in a fan shape, so that the lubricant can completely cover the tool machining area and achieve accurate cooling lubrication.



Working Principle

NM31 Multi-Orifice Jet Nozzle

Accessories Set >>>



- Saw blade nozzles are suitable for cooling and lubrication of all kinds of saw blades, such as vertical band saws, horizontal band saws, circular saws.
- Among them, the band saw blade nozzle design can be used for vertical band saw or horizontal band saw cutting, and the circular nozzle design can be used for various circular saws and band saws cutting.

Convertible Coolant-Through Tool Holder

Accessories Set >>>



- Unique oil channel design for coolant-through conversion to realize coolant-through machining on machine tools without such structure.
- The unique oil mist sealing structure design solves the problem of overheating of tool holder, and the maximum speed of the tool holder can reach 10,000rpm.
- When installed on the machine tool, the automatic tool change positioning block can be used to realize automatic tool change of the tool holder.

Dedicated Lubricant for MQL Cooling System

- The micro-lubrication cooling system uses high-quality micro-lubricants for cooling lubrication, rather than traditional water-based cutting fluid or oil-based cutting fluid. Special lubricants AirlubeF20C and F30 are developed for micro-lubrication cutting technology.
- Airlube F series micro lubricant, with high lubricity natural vegetable oil and synthetic ester based oil as the main components, contains extreme pressure additives, free of free chlorine and its derivatives, safe and non-toxic.
- It forms a uniform and stable lubricating film between the cutting tool/workpiece, reduces friction and prevents heat accumulation, especially suitable for metal cutting in the state of minimal lubrication.

Model	To-be-machined Material				Workload Intensity		Water Solubility	External MQL	Coolant-Through MQL
	Aluminum/Copper	Cast Iron	Low and Medium Carbon Alloy Steel	High Carbon Alloy Steel/Nicochrome	Heavy Workload	Light Workload			
MC-12V	●	○	○	○	○	●	×	○	●
MC-45N	●	○	○	○	○	●	×	●	●
MC-59N	○	●	●	○	●	●	×	●	●
MC-69N	○	●	●	●	●	●	×	●	●

Note: ● Highly-Applicable ○ Applicable × Not Applicable

Airlube Lubricant

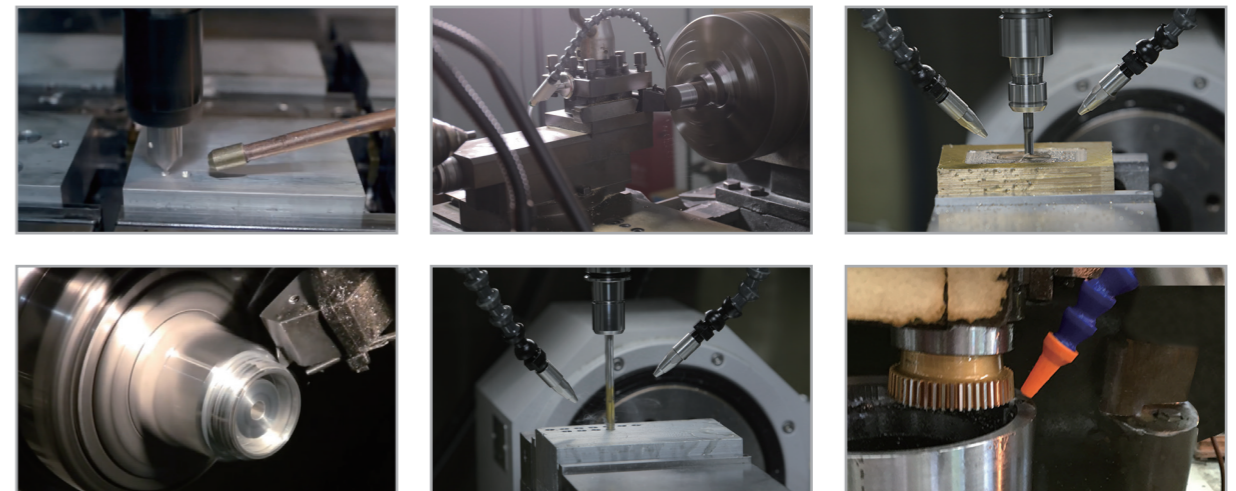


Traditional Cutting Fluid



Applications

As a cooling lubrication method for metal working, MQL Cooling Systems can be used in almost every metal machining, especially in metal cutting and metal forming, such as: turning, milling, drilling, reaming, broaching, grinding, sawing, tapping, threading, folding, bending, stamping, pressing, welding, riveting, pressing, mold forming and so on. In addition, MQL Cooling System is used in chain lubrication, high-speed bearing lubrication, printing, construction and other industries.



Available Solutions

- » For Aluminum Alloy
- » For Stainless Steel
- » For Copper
- » For Cast Iron
- » For Precious Metal
- » For CoCrMo Alloy
- » For Ceramics
- » For Glass

Application Fields

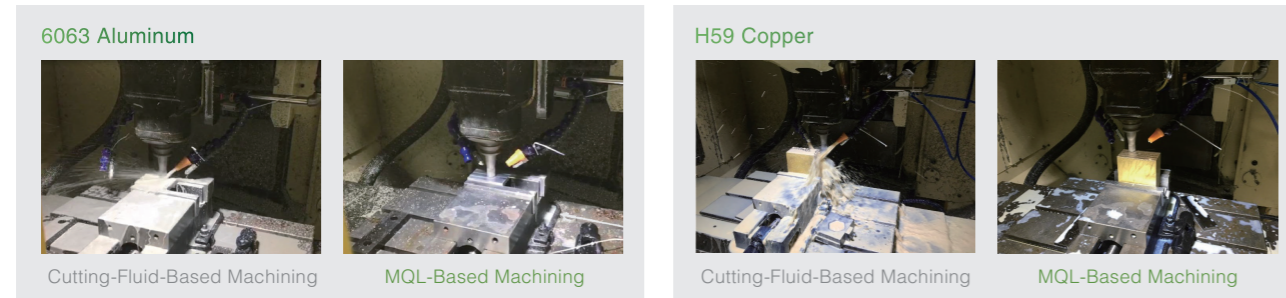
The lubrication system provides excellent performance for different applications on various machine tools.

Surface Roughness Comparison

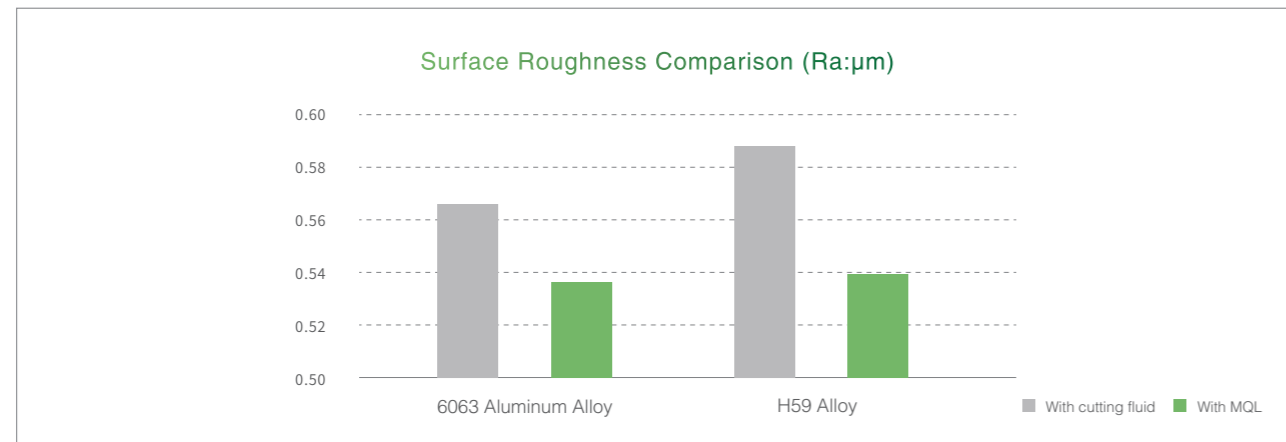
The workpiece roughness machined with MQL is significantly better than that machined with traditional cutting fluid.

- » Workpiece Material: 6063 Aluminum Alloy / H59 Copper Alloy
- » Tool Material: Carbide
- » Tool Diameter: D=20mm
- » Cutting Speed: $V_c=94.2\text{m/min}$
- » Feed Rate: $F=1,000\text{mm/min}$
- » Cutting Depth: $a_p=0.2\text{mm}$

Machining Site >>>



Machining Performance >>>



Outcome >>>

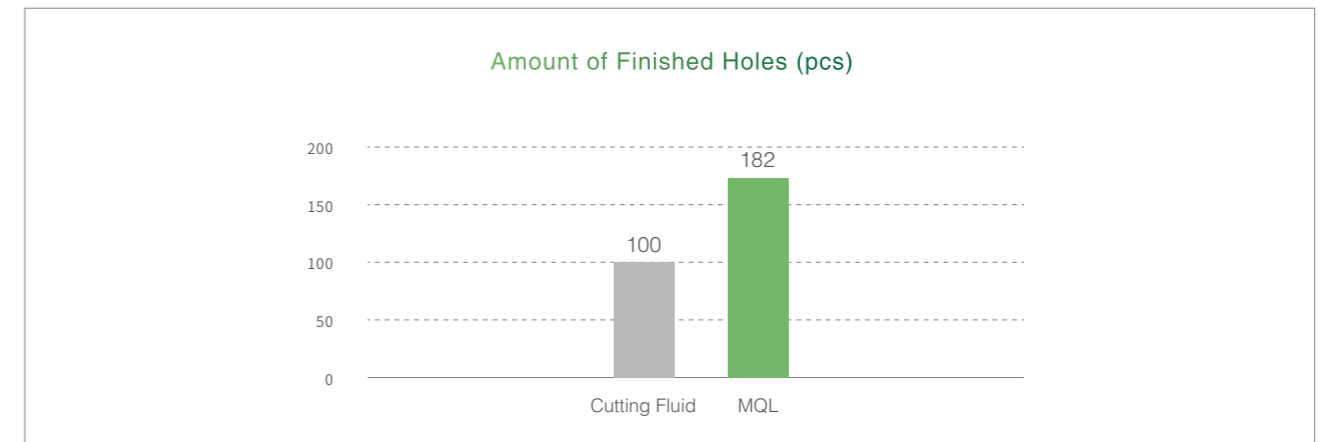
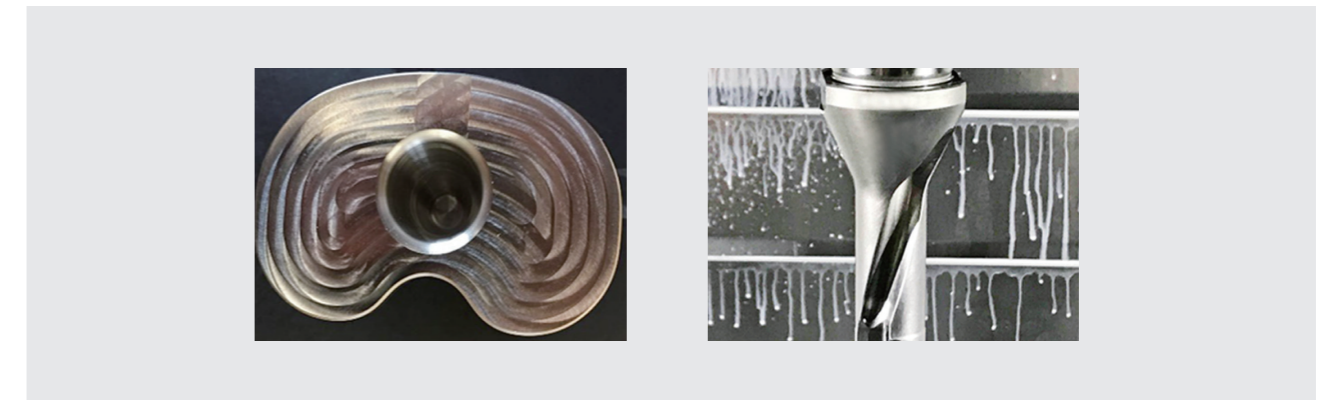
Significant improvement on surface quality of the workpiece.

Comparison of Tool Life

The tool life of drilling with MQL is significantly better than that of conventional cutting fluids.

CoCrMo Drilling

- » Workpiece Material: CoCrMo
- » Tool Material: PCD
- » Tool Diameter: D=20mm
- » Cutting Speed: $V_c=25.12\text{m/min}$
- » Feed Rate: $F=30\text{mm/min}$
- » Drilling Depth: $L=20\text{mm}$



Outcome >>>

80% improvement on tool life of drills.

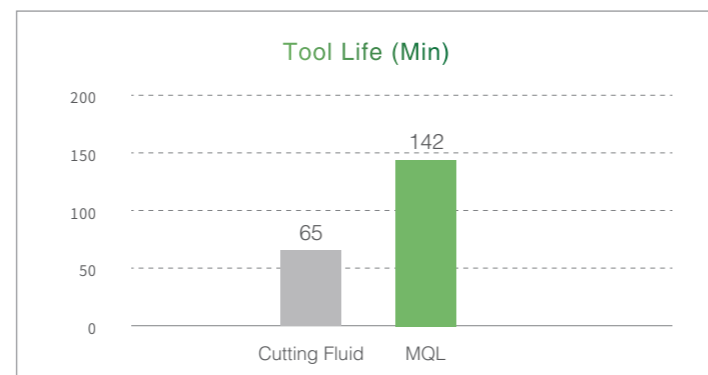
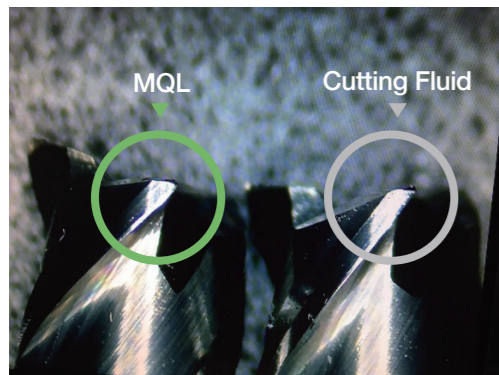
Comparison of Tool Life

The tool life of MQL milling is twice or more than that of traditional cutting fluids.

H59 Copper Alloy Drilling

- » Workpiece Material: H59 Copper Alloy
- » Tool Material: Carbide
- » Tool Diameter: D=6mm
- » Cutting Speed: $V_c=23.55\text{m/min}$
- » Feed Rate: $F=1,600\text{mm/min}$
- » Cutting Depth: $a_p=0.2\text{mm}$

- When the tool wear amount of machining using cutting fluid reaches $VB=0.2\text{mm}$, the tool milling time is 65min, and the tool milling time using MQL is 142min, which means the tool life using MQL is 2.18 times longer than that with the cutting fluid.



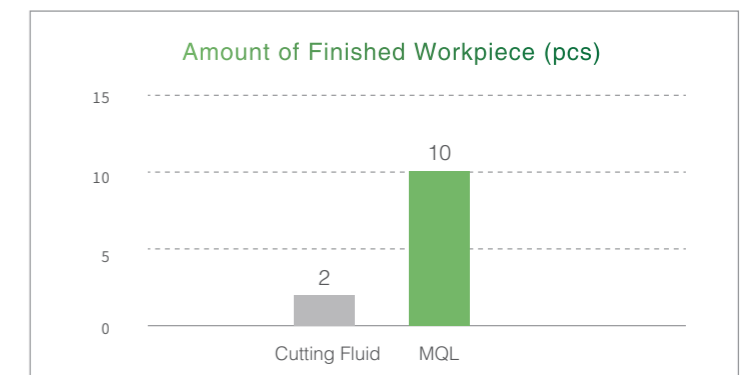
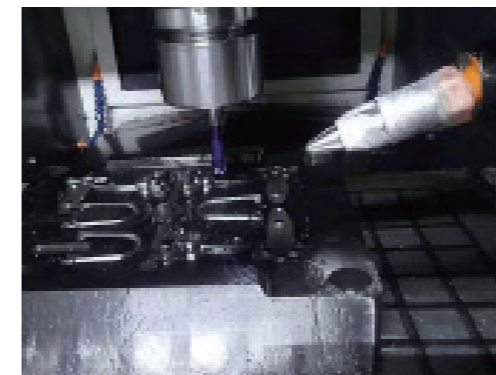
Outcome >>>

Service life of mills increased by 2 times.

H13 Mold Steel Milling

- » Workpiece Material: H13 Mold Steel (HRC56±2)
- » Tool Material: Carbide End Mill D6, TiSiN
- » Feed Rate: $F=4,000\text{mm/min}$
- » Cutting Speed: $V_c=188.4\text{m/min}$
- » Cutting Depth: $a_p=0.05\text{mm}$

- Under the same conditions, finished workpiece number is 2pcs with the traditional cutting fluid while finished workpiece number can reach 10pcs with MQL Solution.



Outcome >>>

Service life of tools increased by 5 times compared to traditional machining.