

Crypto Mining

MIVOLT[®]
IMMERSION COOLING LIQUIDS



Dielectric fluids
for safer, cooler, greener
high performance crypto mining.

THE COMPETITION IS HEATING UP

As more powerful miners are introduced, operators are facing increased difficulty levels and a steep rise in heat loads.

ASIC miner power has increased 40 times in the last 7 years - from 80 Watts in 2013 to more than 3,200 Watts in 2020. This keeps rising every year and as power increases - so does heat.

Miners need to become more powerful if they are to ensure that the number of hashes per second successfully produce a valid block and a profitable return. As a result, ASIC miner hash rates have gone up 500 times from 0.2 TH/sec in 2013 to more than 100 TH/s in 2020. However, even these high hash rates are not enough to guarantee success, and so miners must 'overclock' their machines to remain profitable in this ever-competitive mining race.

Increasing both power and hash rate are expensive in terms of CAPEX. The more heat produced - the more difficult it becomes to cool, contributing to OPEX. Cooling can be problematic in itself despite extra costs, as overclocking in air conditioned systems is impossible at most locations. Even if it is possible - air conditioning can seriously damage the ASICs and affect miner longevity and reliability. With machines running 24/7, thermal management is essential if equipment is to remain effective, reliable and long-lasting. These longevity and performance issues must be resolved if operators are to remain competitive and profitable.

Therefore, in order to compete effectively, three key areas need to be addressed:

1. Speed - miners need to work faster and harder to increase hash rates
2. Thermal management - powerful miners must be able to operate under extreme conditions
3. Savings - CAPEX and OPEX must be lowered to maintain profitability

KEEP COOL WITH THE MIVOLT RANGE

Increase your hash rate by up to 60% with MIVOLT immersion cooling liquids.

The MIVOLT range of dielectric liquids are single-phase. This means that they don't require complex systems to facilitate efficient heat transfer. However, the benefits of MIVOLT don't end there.



Safer

Firstly, the K Class fluid within the range mitigates against fire risks. The dielectric properties of the whole range provide safe, electrical insulation whilst the oxidation stability, moisture resilience and natural robustness of the formulations fully protect IT equipment.



Cooler

Secondly, the low viscosity of the range, together with an extremely low pour point, ensure that equipment is chilled efficiently and effectively - enabling 'hash rate per miner' to be increased (overclocking) within specified chip temperature limits. This not only enhances computing performance, which maximises miner longevity and reliability - it also reduces CAPEX and OPEX.



Greener

Finally, MIVOLT liquids are readily biodegradable with a Global Warming Potential (GWP) of <1. This means that not only does the range cool mining equipment effectively, it does so with minimal environmental impact.



DIELECTRIC FLUIDS

The **MIVOLT** range will*:

- ↑ Hash rate by 60%
- ↓ CAPEX by up to 60%
- ↓ Cooling costs by up to 90%
- ↓ IT Power consumption by 5-10%
- ↓ Operational costs by 50%
- ↑ Miner longevity by up to 60%
- 👍 Enable waste heat recovery

* These figures vary depending on the ASIC miner model, the location of the mining farm and other external factors.

MIVOLT benefits:

- + Low viscosity
- + Readily biodegradable
- + High flash point
- + Oxygen stable
- + High moisture tolerance

MIVOLT PRODUCT SELECTOR

MIVOLT DF7 and DFK dielectric fluid properties.

The data presented in these tables are typical values.

MIVOLT[®] DF7

- + Low viscosity
- + Readily Biodegradable
- + Extremely low pour point -75°C
- + Non-volatile
- + Halogen free
- + Non-toxic

Thermal Properties	Units	Method	MIVOLT DF7
Density at 20°C	kg/m ³	ISO 3675	916
Specific Heat at 20°C	J/kg-K	ASTM E1269	1907
Kinematic Viscosity at 20°C	mm ² /s	ISO 3104	16.4
Thermal Conductivity at 20°C	W/m-K	ASTM D7896	0.129
Coefficient of Expansion at 20°C	1/K	ASTM D1903	0.00080
Cold Behaviour			
Kinematic Viscosity at -10°C	mm ² /s	ISO 3104	87.4
Kinematic Viscosity at -30°C	mm ² /s	ISO 3104	534
Pour Point	°C	ISO 3016	-75
Fire Safety			
Flash Point	°C	ISO 2719	194
Fire Point	°C	ISO 2592	218
Auto-Ignition Temperature	°C	ASTM E659	385
Environmental Impact			
Biodegradability		OECD 301	Readily Biodegradable
Global Warming Potential	GWP		<1
Ozone Depleting Potential	ODP		0
Chemical Properties			
Neutralisation Value	mg KOH/g	IEC 62021-2	<0.03
Net Calorific Value	MJ/kg	ASTM D 240-02	33.5
Dielectric Properties			
AC Breakdown Voltage	kV	IEC 60156	>75
Volume Resistivity at 20°C	GΩ.m	IEC 60247	>90



Readily biodegradable dielectric fluids for the direct immersion cooling of IT equipment.

MIVOLT[®] DFK

- + High fire point (>300°C)
- + Readily biodegradable
- + Low pour point
- + Non-volatile
- + Halogen free
- + Non-toxic

Thermal Properties	Units	Method	MIVOLT DFK
Density at 20°C	kg/m ³	ISO 3675	968
Specific Heat at 20°C	J/kg-K	ASTM E1269	1902
Kinematic Viscosity at 20°C	mm ² /s	ISO 3104	75
Thermal Conductivity at 20°C	W/m-K	ASTM D7896	0.147
Coefficient of Expansion at 20°C	1/K	ASTM D1903	0.00075
Cold Behaviour			
Kinematic Viscosity at -10°C	mm ² /s	ISO 3104	572
Kinematic Viscosity at -30°C	mm ² /s	ISO 3104	4362
Pour Point	°C	ISO 3016	<-50
Fire Safety			
Flash Point	°C	ISO 2719	>250
Fire Point	°C	ISO 2592	>300
Auto-Ignition Temperature	°C	ASTM E659	>400
Environmental Impact			
Biodegradability		OECD 301	Readily Biodegradable
Global Warming Potential	GWP		<1
Ozone Depleting Potential	ODP		0
Chemical Properties			
Neutralisation Value	mg KOH/g	IEC 62021-2	<0.03
Net Calorific Value	MJ/kg	ASTM D 240-02	30.8
Dielectric Properties			
AC Breakdown Voltage	kV	IEC 60156	>75
Volume Resistivity at 20°C	GΩ.m	IEC 60247	>90

MIVOLT[®]



LIQUID
IMMERSION
COOLING

SWITCH ON,
COOL OFF
WITH MIVOLT

A HERITAGE IN MATERIALS SCIENCE

MIVOLT is liquid
engineered by
M&I Materials Ltd.

M&I Materials is an independent, privately owned British company committed to developing specialised materials for challenging applications, and whose roots can be traced back to 1901.

Having started out manufacturing 'Micanite' products for electrical insulation, the company has reinvested in its capabilities throughout its history, having engineered its first dielectric fluid range over 40 years ago.

With the MIVOLT range of immersion cooling fluids, M&I Materials continues to grow its portfolio, building on a reputation for innovative products and superior technical knowledge.



TRUSTED BY LEADING ORGANISATIONS

Material innovations
for demanding
applications.

Globally, M&I Materials supplies to a wide range of sectors, from power and aerospace, to nuclear medicine and high-performance motorsports.

From its Trafford Park headquarters in the UK, M&I Materials exports its specialist products to 60+ countries around the globe.

This is made possible by the company's growing network of production facilities and commercial premises across the Americas, Africa, Europe and Asia Pacific.

LOCATIONS

Offices

- UK
- USA
- India
- China
- South Africa

Manufacturing Locations

- UK
- USA
- India
- South Africa



MIVOLT®

IMMERSION COOLING LIQUIDS

a product of  **M&I MATERIALS**

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 **APIEZON®**

 **METROSIL®**

[MIDEL®]

MIVOLT®

WOLFMET®

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