

Dielectric Fluid Guide

Definitions

Explanations

Recommendations



DEFINITIONS & EXPLANATIONS

AROMATIC CONTENT

Aromatics are unsaturated hydrocarbon compounds. They are identified by ringed structures such as benzene. In dielectric fluids, a low aromatic content is desirable as aromatics are likely to contribute to skin irritation that may lead to dermatitis. Aromatics can also have some effect on the rubbers and elastomers used in hoses and seals.

COLOR

Most EDM oils are clear but some manufacturers add a small amount of dye to give their product a distinct color. The addition of dye does not affect performance as the amount of dye is usually only 5-15 drops in a 55 gallon drum. Over time, depending on the filtration system being used, some colored fluids may lose their dye because it is filtered out. Some oils may oxidize over a period of time, which will cause the oil to turn a pale yellow color. Fluids should be tested for suitability for further use when oxidation occurs.

DIELECTRIC STRENGTH

This is the measure of the insulating capacity of an EDM fluid. Virtually all EDM fluids have a high dielectric strength. Once the EDM process has begun, the dielectric strength is difficult to measure because of the solids and particles introduced. Dielectric strength is unique because while a high value is required, too high of a dielectric value will force a smaller gap and may lead to higher electrode wear and lower machining speeds.

EVAPORATION RATE

Virtually all good EDM fluids have a very low evaporation rate.

FLASH AND FIRE POINT

The flash point of oil is the lowest temperature at which the vapor will ignite if a small flame or spark is present. The oil will not ignite by itself, there must be a flame or spark present. In addition, oil at its flash point will not burn continuously as it will only 'flash' or burn for a moment. The fire point is the temperature at which the vapor concentration of a fluid is sufficient to sustain a fire.

Generally, the higher the flash point the safer the fluid. EDM fluids should have a flash point above 180°. Usually the higher the flash point, the higher the viscosity. Depending on your application, such as fine finishing, you may want a lower viscosity fluid which will sacrifice flash point. Fine finishing with low amps will require a low viscosity fluid because your gap will be narrow. Higher amp projects, such as roughing, will require a high flash point and the viscosity is not of a major concern.

ODOR

The presence of an odor in an EDM generally does not affect performance. However, an odor may sometimes indicate a high level of sulfur or a high aromatic content. Most EDM operations prefer low odor fluids in the work place. Quality EDM fluids are odorless or have a negligible odor.



OXIDATION

Oxidation is the reaction between oxygen and oil. All EDM oil is subject to oxidation. As the EDM process continues, oxidation only gets worse as heat, water, and other contaminants are introduced. However, higher quality petroleum EDM fluids resist oxidation and good synthetic EDM fluids do so even more. Choose an EDM fluid that resists oxidation and keep in mind that the best way to manage oxidation is to keep your system clean and temperatures relatively low.

POUR POINT & CLOUD POINT

The pour point of oil is the lowest temperature at which the oil will flow. Prior to reaching the pour point, many fluids will become cloudy, representing the cloud point. The cloud point is the temperature at which paraffin wax or other compounds present in the oil begin to crystallize. Fluids that cloud or freeze do not suffer any performance effects once they return to normal temperatures.

SULFUR CONTENT

Sulfur is a common natural product in petroleum products. Highly refined EDM fluids have low sulfur levels, and the lower the better. High sulfur fluids will have an odor and could be hazardous when burned. EDM fluids should have a sulfur content lower than 5 ppm.

SYNTHETIC FLUID

"Synthetic fluid" is a fluid made by combining chemicals with a base stock to produce a fluid with specific properties. The base fluid may be supplemented with additives to improve fluid properties. Many synthetic fluids are derived wholly or primarily from petrochemicals; other raw materials are derived from coal and oil shale or even from animals or vegetable oils. Synthetic fluids generally have higher viscosity, better oxidation stability, and higher flash point.

TESTING PROCEDURE

When comparing different brands of EDM fluids, be sure you are comparing the same testing procedure. For example, Flash Point is usually tested one of two ways; "COC" or "PMCC". "COC" is ASTM test D-92 and "PMCC" is ASTM test D-93. (ASTM stands for American Society for Testing and Materials) Testing of the same fluid using different methods will give different results. One test may give a Flash Point of 215 degrees while the other may give 205 degrees. This can make comparing two brands of fluid difficult. Other references include "ppm", which means parts per million. How much is a "part per million"? In terms of length, 1 part per million would be 1 inch per 16 miles or in terms of time it would be 1 minute per 2 years. Of course, testing methods only tell a portion of the story. Do not base your decision purely on numbers - different applications and situations in the "real world" will cause fluids to perform with varying results. For example, other factors such as electrode and work piece materials, discharge current, pulse duration, gap control, and circulation rate effect the results.

VISCOSITY

Viscosity is a measure of a fluids resistance to flow. A low viscosity fluid will flow faster and offer better pumping and flushing characteristics. Viscosity increases as the fluid temperature decreases. Generally, a lower viscosity is better and for general EDMing viscosity of EDM fluid should not exceed 38 SUS@100F. Occasionally, an application comes up where a higher viscosity fluid is preferred. The viscosity of a fluid is related to its flash point. See "flash point" for more information.



TIPS AND RECOMMENDATIONS

USE APPROPRIATE FLUID

Use the appropriate fluid - in sinker EDM machines use dielectric fluid. Sounds simple enough, but many shops use a cheap mineral oil in an effort to save money. Fluids not designed for use in an EDM system may be dangerous to the operator, the workplace, and could damage your EDM equipment. Mineral oil does not have the fluid properties to be effectively used in EDM. The savings of a couple hundred dollars isn't worth the risk. Remember, use fluid specifically designed for EDM.

For low amp fine finishing work, choose a fluid with a low viscosity. The low viscosity allows the fluid to get into the cut of material and help flush out particles. Generally, because these fluids have a low viscosity they also have lower flash point - not for rough cutting with high amperage. For roughing work, choose a fluid with a high flash point.

If you are like most shops and the machine is used for every application, choose a good overall performer. Dielectric fluids EDM 3001 Lite, Clear-3, EDM 3033 provide good overall performance in most EDM situations from fine finishing to roughing.

PETROLEUM OR SYNTHETIC

Generally a synthetic fluid is better; longer life, better performance, and excellent operator acceptance. However, synthetic fluids cost more and depending on what applications you are using your EDM for, sometimes it makes sense to choose petroleum over synthetic. BUT, be careful when selecting a synthetic. Some low cost synthetics are not fit to be called synthetics. A low grade "synthetic" or "synthetic blend" is not any better than a good petroleum fluid...and it may be worst!

Keep in mind that highly refined petroleum EDM fluids such as EDM 3033 perform almost as good as many synthetic EDM fluids on the market. However, a petroleum fluid life span is usually less than a synthetic. In addition, semi-synthetic Clear-3 provides some of the benefits of synthetic and is economical for most shops. Generally, if your budget allows choose a quality synthetic fluid such as EDM 3001 Lite. It will last up to 6 times longer than petroleum fluids and will pay for itself in the long run.

FILTERING

A simple way of extending the performance of EDM fluid is to replace filters often and to replace them with quality filters. Some filter sizes are available in "cheap" alternatives from an automotive, truck, or industrial supplier but the quality is low. Remember, your EDM machine is only as strong as it's weakest link - using a cheap filter affects the performance and shortens the life of the fluid.

COMBINING FLUIDS

When dielectric fluids are combined, a mixture of a wider distillation range is generally the result. Distillation implies that lower boiling components of a mixture are among the earliest to vaporize with heat. The resulting material is often higher in viscosity than the initial mixture. Possible affects of mixing dielectric fluids of different distillation ranges are slower removal rates, rougher surface finish, and higher fluid evaporation rates. Generally mixing fluids is not recommended.

REPLACING FLUID

If you are replacing your EDM fluid, there are a few things you can do to maximize the performance of the new fluid. Always try and remove as much as possible of the old oil. Clean out your system including any sludge or waste at the bottom of the work tank, base, and reservoir. Drain hoses and pump housing. Remove old filters and clean out the filter canister and replace with a new filter. If you are using an external filtration system or centralized system, take appropriate actions to clean out any hoses, tanks, and reservoirs it may have. These suggestions are especially important if you are replacing a petroleum fluid with a synthetic fluid. Some minor contamination will not affect performance, but heavy contamination will.

RECYCLE FLUIDS

It is important that you dispose of fluids properly. There are many organizations that will recycle used dielectric fluid.

EDM ZAP



AVOID CONTAMINATION

Care should be taken to prevent water from contaminating the dielectric fluid. Water in dielectric fluid lowers its dielectric strength and in some cases can cause excessive arcing making it necessary to replace the fluid. In addition, if drums are being stored outside place them on their sides to prevent any water from leaking into drum.

Hydraulic fluid should also be prevented from contaminating the dielectric fluid. In addition to possible filter system damage, it could also cause harm to your machine. Dielectric that has significant hydraulic fluid contamination should be replaced immediately.

HEALTH AND SAFETY

If you have been around EDM machines for a while, you know some EDM oil can smell and irritate the skin. Today, quality EDM fluid is available which can minimize odor and the effects on the skin. High quality petroleum products such as EDM 3033 have virtually no odor and usually do not irritate the skin. Synthetics and most semi-synthetics such as EDM 3001 Lite and Clear-3 also have virtually no odor and do not irritate skin. Of course, there are some individuals that are so sensitive to chemicals that they may react to even the purest of fluids. Many individuals skin is not irritated by the dielectric fluid, but by contaminates and particles introduced during the EDM process. Wiping hands with oily rags or towels which may contain small EDM'd particles could cause many very small cuts which can lead to skin irritation.

It is strongly recommended, as with all chemicals, that you limit exposure. Similar to house-hold products, it is suggested that you wear gloves and have adequate ventilation. Do not put hands in the dielectric fluid when it is not necessary. Use of a barrier lotion will aid in the protection of skin.





EDM 3001 LITE

SYNTHETIC DIELECTRIC FLUID

EDM 3001 Lite is an advanced premium synthetic dielectric fluid for machines of all power ratings and sizes. It is a multipurpose, high performance, long lasting dielectric fluid with special emphasis on safety. The extremely low aromatic content, low sulfur content, and high flash point increases safety and operator acceptance. EDM 3001 Lite resists oxidation, retains viscosity and does not irritate the skin. The consistent viscosity allows improved finishes, rapid flushing and excellent filterability.

Specifications:

Viscosity SUS@100°F	35
Viscosity SUS@77°F	38
Flash Point, COC °F	245
Dielectric Strength	high
Evaporation Rate	nil
Odor	nil
Color	clear



Clear-3

semi-synthetic dielectric fluid

Clear-3 is a semi-synthetic dielectric fluid featuring a low viscosity for good flushing and a high flash point for safety. Suitable for electrical discharge machines of all sizes and power ratings, Clear-3 offers flexibility while meeting operator requirements for performance. It's clear, highly transparent appearance makes for excellent work visibility. Worldwide operator acceptance because Clear-3 is virtually odorless and since it is so highly refined, almost eliminates skin irritation. Additives help Clear-3 resist oxidation and extend fluid life.

Specifications:

Viscosity SUS@100°F	33.8
Viscosity SUS@77°F	36.2
Flash Point, COC °F	235
Dielectric Strength	high
Evaporation Rate	nil
Odor	nil
Color	clear



EDM 3033

Premium Dielectric Fluid

EDM 3033 dielectric is a premium, highly refined petroleum fluid suitable for roughing and finishing operations. The high performance fluid features a high flash point for safety and a low viscosity for effective flushing. EDM 3033 has a clean and clear appearance with extremely low odor giving it excellent operator acceptance. In addition, EDM 3033 has a high dielectric strength and long service life.

Specifications:

Viscosity SUS@100°F	32.6
Viscosity SUS@77°F	34.8
Flash Point, COC °F	225
Dielectric Strength	high
Evaporation Rate	nil
Odor	nil
Color	clear

Distributed By:

EDM ZAP
 1108 Front Street - Lisle, Illinois 60532
 Toll Free: 1-800-759-2839
 630-852-1699
www.edmoils.com

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