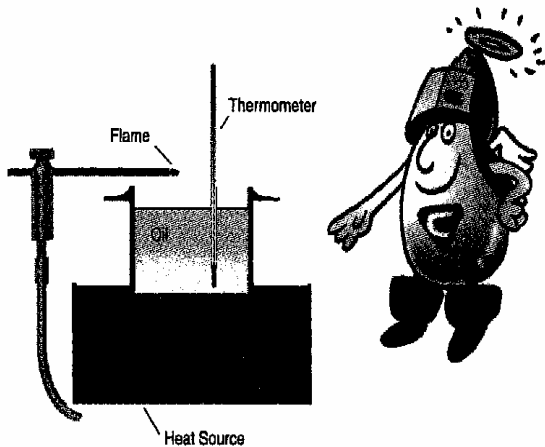


“Everything you always wanted to know
about EDM fluid...
but were too afraid to ask.”

FLASH POINT: ASTM D92-52 (CLEVELAND OPEN CUP)

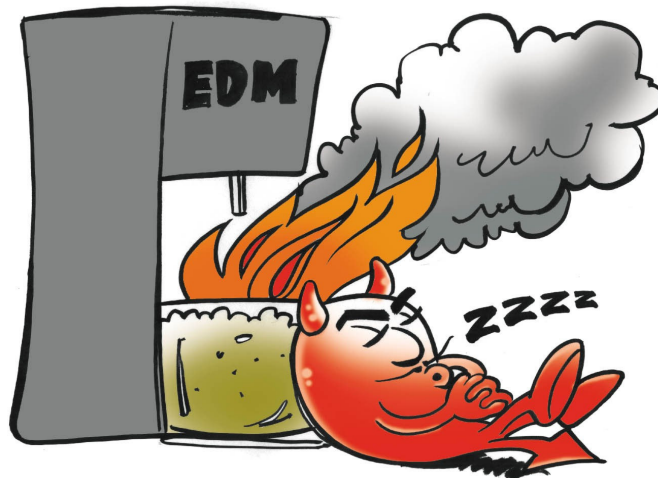
When a liquid petroleum product is exposed to air, some of it evaporates, causing a certain vapor/air concentration. As the temperature of the liquid product is raised more and more evaporates and the vapor/air ratio increases. Eventually, a temperature is reached at which the vapor air ratio is high enough to support momentary combustion, if a source of ignition is present. This temperature is the **Flash Point** of the product.



AUTO-IGNITION TEMPERATURE: ASTM 659-78

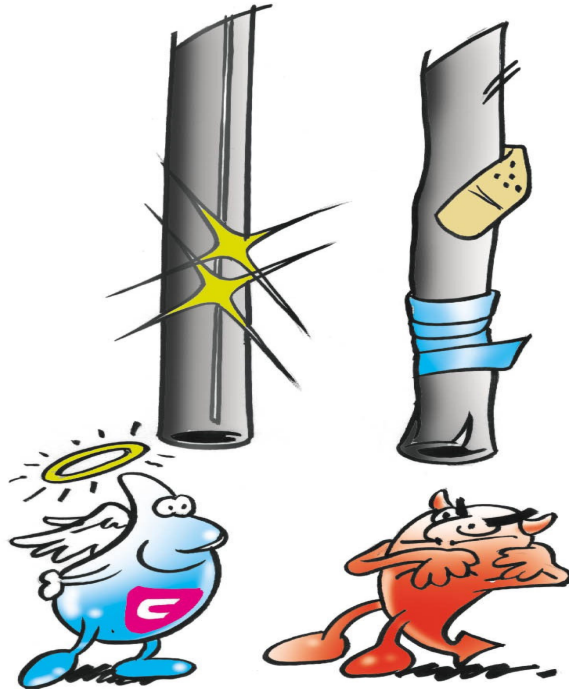
PRODUCT	FLASH PT. °F	AUTO IGNITION PT. °F
EDM Fluid (Oil)	259	410
Synthetic EDM	266	428
Mineral Seal Oil	260	455
Unleaded Gas	-40	752
Diesel Fuel	100	482
K-1 Kerosene	100	485
Propane	-108	878
Octane Booster	40	1000

If no ignition source is present, as the temperature increases above the product's flash point, a temperature is reached at which the product will ignite spontaneously, without any external source of ignition. This temperature is called the auto-ignition temperature of the fluid.



ANILINE POINT: ASTM D611-82

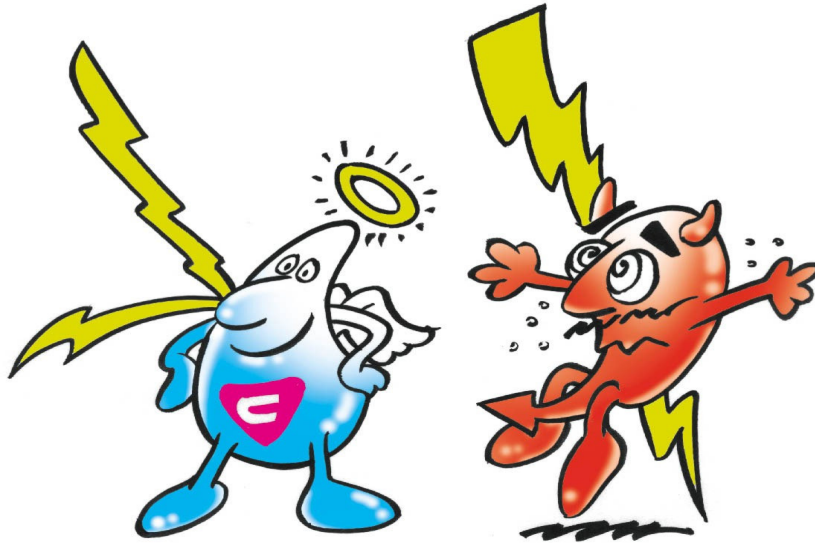
The degree of solvent power of a petroleum product varies with different types of hydrocarbons. The solvent powers for many other fluids are related to the solvent power for aniline, which is measured by the lowest temperature at which aniline and another fluid are miscible. Usually, paraffinic hydrocarbons have the least solvency for aniline and most other materials and consequently have the highest aniline points. Aromatics have the greatest solvency and the lowest aniline points (usually well below room temperature), while naphthenic materials are intermediate between the paraffins and the aromatics. If the aniline point is too low, it can cause excessive softening and “mushiness” of rubber components.



CONDUCTIVITY/DIELECTRIC CONSTANT: ASTM D877

Dielectric Strength/Breakdown Voltage – Minimum voltage required to produce an electric arc through oil. This value is the measure of the insulating (arc-preventive) properties of an EDM Fluid. A low dielectric-strength value

may indicate contamination from dirt and especially water which is usually introduced into a system by compressed air.



DISTILLATION:

If a petroleum product is gradually heated, greater portions of the lower-boiling constituents are in the first vapor formed and the successively higher-boiling constituents are vaporized as the temperature is raised. Thus, for any petroleum product, boiling takes place over a range of temperatures.

The narrower the distillation range, the fewer varieties of chemicals and hydrocarbons present, thus a purer fluid. A narrow range also means a more uniform rate of evaporation for the whole fluid instead of driving off all the low ends and leaving the high ends or a more viscous fluid behind.



“BEWARE OF THE FUMES YOU ARE EXPOSED TO”

EVAPORATION RATE: ASTM D3539-76

Petroleum solvents are volatile materials. The time required for this evaporation is called evaporation rate and can be an important factor in some applications including EDM. Typically, evaporation rate is never constant for a mixture of compounds, but varies throughout the whole process. Evaporation rate is important in EDM. It should be as slow as possible to the point of being almost nil.



“AVOID FLUIDS WITH HIGH EVAPORATION RATES”

GRAVITY/DENSITY: ASTM D287

Density is the weight of a given product per unit volume i.e. pounds per gallon. Density is important to the EDM operator because the higher the density of a given fluid or the more it weighs per gallon, the longer any electrode material or metal particulate will stay in suspension.

COMPARATIVE WEIGHTS PER GALLON

PRODUCT	DENSITY (LBS./GAL.)
EDM Fluid (Oil)	6.42
Synthetic EDM Fluid	6.49
Mineral Seal Oil	6.89
10W-30 Motor Oil	7.30
Water	8.34
Tapping Fluid	11.05

SULFUR CONTENT:

The more highly refined EDM fluids require extremely low sulfur levels.

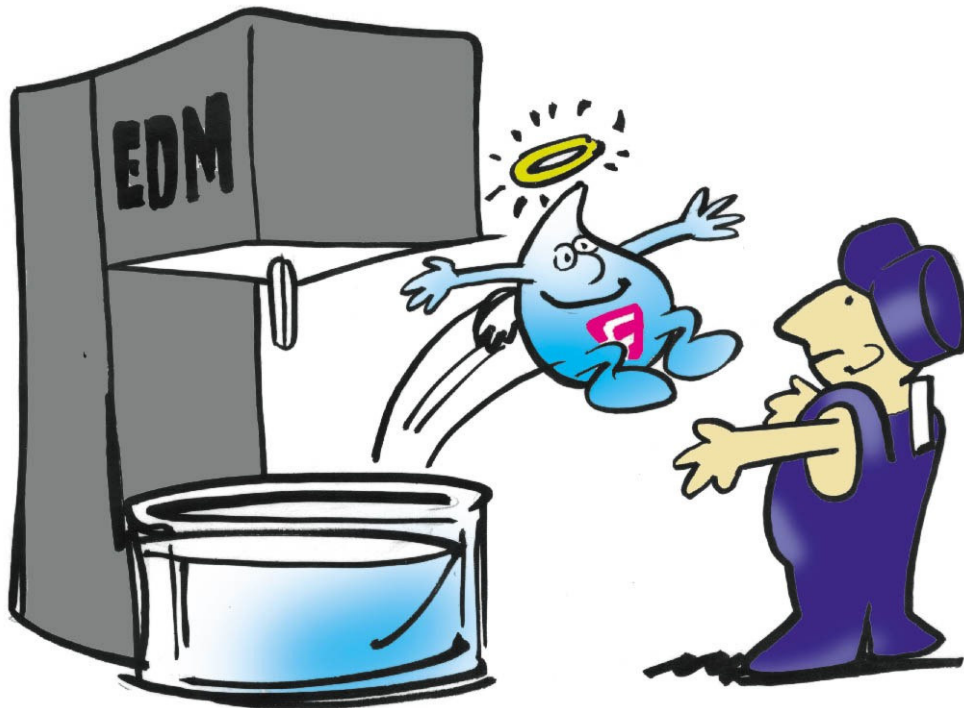


These products must be non-reactive, non-corrosive and free of the odors caused by sulfur. EDM fluids should not be considered for use with sulfur above 3ppm.

VISCOSITY: ASTM D445-82

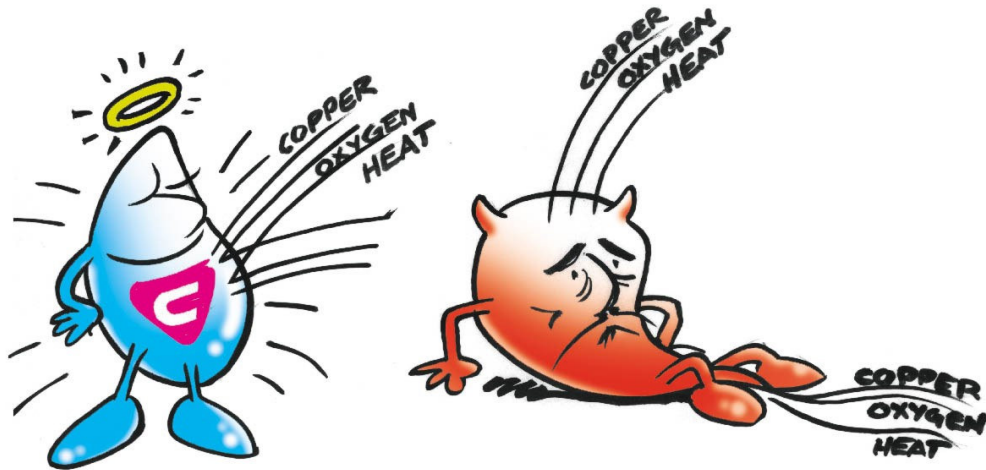
Viscosity is a measure of a liquid's resistance to flow. Viscosity arises from internal friction between which occurs when one layer of molecules of a solvent moves past an adjoining layer in that liquid.

Viscosity is a factor in the pumping and flushing characteristics. The lower the viscosity the easier to pump and the better the flushing characteristics.



OXIDATION STABILITY: ASTM D2272

Oxidation is a form of deterioration to which all oils in service are exposed. It is a chemical reaction that occurs between portion of the oil and whatever oxygen may be present. The oxidation of oils is accelerated by high temperature catalysts (such as copper). The rate of oxidation increases with time and temperature. Oxidation tends to raise the viscosity of an oil. It is characteristic of paraffinic oils to have greater oxidation resistance than naphthenic oils, though naphthenic oils are less likely to leave hard deposits. Oxidation stability is an important factor in the prediction of an oil's performance. The higher the operating temperature, the greater the need of oxidation stability, especially if water, catalytic metals or dirt are present.



Oxidation stability should be a very important consideration when selecting an EDM fluid.

ACID NUMBER: ASTM D-974

This test indicates an EDM Fluid's life expectancy. A specific quantity of KOH (potassium hydroxide) is required to counter-balance the acid characteristics. How high an acid number can be tolerated depends on the oil and service conditions. An acid number in excess of 1.5 shows a fluid an the ends of it's life expectancy.

COLOR:

Buy an EDM Fluid listed as 30+ Saybolt, which means water white. Any fluid that is not water white out of the barrel is virtually guaranteed to contain dangerous contaminants. A fluid with low oxidation stability will discolor very quickly.

AROMATICS:

Any product with an aromatic content greater than 0.05% should be considered too dangerous. **AROMATICS ARE CARCINOGENIC.** Please note examples below:

TOLUENE: CAS: 108-88-3
27th highest-volume chemical produced in the U.S. (1985).

USES: Gasoline
Adhesives
Aeroplane Glue
Saccharin
Perfumes

BENZENE: CAS: 71-43-2
16th highest-volume chemical produced in the U.S. (1985).

USES: Detergents
Solvents
Chemical Intermediary
Mfg. Maleic Anhydride(permanent press resins for textiles and pesticides)

DESIRABLE CHARACTERISTICS OF MODERN EDM FLUID

- High Oxidation Stability
- Low Viscosity
- Low Odor
- Narrow Distillation Range
- Low Specific Gravity

WHAT YOU SHOULD LOOK FOR ON A SAFETY DATA OR SPECIFICATION SHEET THAT WOULD BE A WARNING SIGN OF A POTENTIALLY DANGEROUS PRODUCT

HAZARDOUS INGREDIENTS:

If the fluid has a low LD50 or LC50 rating it should be suspect immediately. LD50 means lethal dose and anything under 5gm per kg should be considered dangerous. LC50 means lethal concentration capable of killing 50% of laboratory rat population.

FLASH POINT OR AUTO IGNITION TEMPERATURE:

Anything below 200°F is a serious concern.

ROUTE OF ENTRY:

If there is a potential health risk with a product, what is the manner or the way in which it can be a cause of a problem, i.e. is it through breathing of fumes or absorption through skin surfaces?

HAZARDOUS BY-PRODUCTS FROM COMBUSTION:

Anything listed other than fumes, smoke and carbon monoxide should be watched, i.e. products with high amounts of sulfur can give off oxides of sulfur. In the presence of moisture from your lungs, these fumes will create various sulfur containing acids.

TOXICOLOGICAL PROPERTIES:

The most important part to look for is the route of entry. This tells you that if the product causes problems you will at least know how to prevent entry. Next you want to consider the effects of chronic (long term exposure) and acute effects. Last but not least, the chronic effects could be carcinogenicity, reproductive effects, teratogenicity and mutagenicity.

SERICE INFORMATION FOR EDM FLUIDS

PERSONAL HYGIENE:

Consistent exposure to EDM fluids may result in skin irritation and skin defatting, resulting in dermatitis. If these skin problems are to be avoided, the operators must adopt proper standards of personal hygiene. Operators should keep the handling of work pieces and electrodes to a minimum and abstain from placing their hands in the EDM Fluid whenever possible. The use of skin care products such as Dermablok S/R is suggested.

Operators are advised to avoid washing their hands with harsh chemicals and mechanical scouring products. These agents can cause a reddening of the skin and create irritation.

Oil soaked clothing and rags that come in contact with the operator's skin will cause further irritation. A clean apron is recommended to protect the operator

from splashing. Wiping hands should be avoided whenever possible to reduce the chance of particulate causing abrasions on the skin surface. These abrasions are natural breeding grounds for dermatitis and other skin irritants.

SEAL & HOSE COMPATIBILITY:

The proper choice of hose and gasket material for your EDM machine can eliminate the problems of a potential spill due to premature failure. The following materials have been shown to provide the longest lifespan when used with most EDM fluids:

- 1) Teflon- tetra fluoro polyethylene
- 2) Neoprene – polychloroprene
- 3) Buna-n nbr – acrylonitrile and butadiene
- 4) Viton – vinylidene fluoride hexafluoro-propylene
- 5) MCP – modified cross-linked polyethylene

Your local mill supply house, when given the above information, will be able to provide you with the proper materials.

SPECIFICATIONS

	ASTM Test Method	Fluid A	Fluid B
Viscosity			
SUS @ 100°F	D-445	32.1	34.5
cSt @ 40°C	D-445	1.84	2.5
Flash Point			
C.O.C. °F	D-92	256	266
Density lbs./U.S. gal.	D-1298	6.42	6.41
Distillation Range	D-86	482-518	N/A
Dielectric strength, KV/2.5mm	D-877	50	>55
Color, Saybolt	D-156	30+	30+
Sulfur Content, ppm	D-3120	<5	<2
Aromatic Content, %volume		Nil	Nil
Auto Ignition Temp. °F	D-659-78	392	428
Aniline Point, °F	D-611-8	198	213
Evaporation Rate	D-3539	<. 01	<. 001
Oxidation Stability, minutes	D-2272	660	>700

ASTM is the American Society of Testing Materials and is the recognized body for establishing proper test methodology and procedures.

The above test results are typical results observed and may vary from time to time or can be modified by Commonwealth Oil Corporation. The company shall not be liable for any damages arising out of the use of this data sheet howsoever caused if the product in question is not employed in normal or reasonably foreseeable use or circumstances. The company shall not be liable for any indirect or consequential damages arising out of the use of this data sheet, howsoever caused.

Commonwealth Oil Corporation has deliberately chosen to maximize the safety of machine operators! All components of our EDM Fluids meet or exceed the standards of the Food and Drug Administration (FDA) for incidental contact with food.

COMPARISON OF OPPOSITE QUALITY EDM FLUIDS

	ASTM Test Method	MINERAL SEAL OIL		FLUID A	
		New	1 Year Old	New	1 Year Old
Viscosity					
SUS @ 100°F	D-445	40.2	44.3	32.1	32.4
cSt @ 40°C	D-445	4.31	5.59	1.92	1.99
Viscosity					
SUS @ 75°F	D-445	47.5	54.7	37.6	37.7
cSt @ 24°C	D-445	6.59	8.79	3.51	3.55
A.P.I. Gravity	D-287	40.3	37	52	50.7
Specific Gravity	D-287	0.8236	0.8396	0.771	0,7766
Flash Point					
°F	D-92	258	266	252	250
°C	D-92	125.5	130	122.2	121
Color		Clear, Faint Yellow	Cloudy Brown	Clear, Water White	Clear, Med. Brown
Odor		Faint Odor	Pungent	Nil	Mild