

Attachment X

Ester Oils

Confidential

By-ester oils we mean synthetic esters produced on the same basis as Isobutyl oil, phenol and cresol. At present the following esters are being manufactured.

1. Ester oil 504, prepared from methyl-adipic acid and Leuna alcohol. (Fraction 160-200°C),
2. Ester oil 515, prepared from methyl-adipic acid and Leuna alcohol (Fraction 180-250°C),
3. Ester oil 455, prepared from adipic acid and Leuna alcohol (Fraction 140-180°C),
4. Ester oil 426, prepared from Leuna carboxylic acid (Fraction 200-250°C) and trimethylol ethane
5. Ester oil IT 4, prepared from Leuna carboxylic acid (Fraction 160-180°C) and trimethylol ethane
6. Mollith L 85, prepared from Leuna carboxylic acid (Fraction 140-180°C) and trimethylol ethane
7. Ester oil 623, prepared from methyl-adipic acid and 1/2 dimethylol propane + 1/2 Isobutyl oil (Fraction 180-250°C).

Preparation of Ester Oils:

Acid and alcohol are intimately mixed in an agitator at ordinary temperature with the simultaneous addition of zinc oxide, or toluene sulfonic acid as catalyst. Zinc oxide is used for trimethylol ethane esters, toluene sulfonic acid for the adipic acid esters and methyl adipic acid esters.

The mixture is then externally heated with gas and brought to a temperature of 180-220 C. The water liberated during the reaction is distilled off azeotropically by means of a middle oil fraction (180-220°C) which is recycled. The reaction lasts about 6 to 8 hours and is completed when water is no longer formed.

The crude esters are washed with dilute caustic soda and then with water until

neutral, freed from middle oil and lower boiling impurities by distillation until a flash point of 210°C has been obtained, and then decolorized with bleaching clay.

For manufacturing 100 kg ester oil there is required:

1. Ester oil 504, 56 kg methyl-adipic acid
 160 kg alcohol (fraction 160-200°C).
2. Ester oil 515, 50 kg methyl-adipic acid
 164 kg Leuna alcohol (fraction 180-250°C).
3. Ester oil 544, 48 kg adipic acid
 158 kg Leuna alcohol (fraction 140-180°C).
4. Ester oil 426, 90.4 kg Leuna carboxylic acid (fraction 200-250°C).
 6.5 kg Soap fatty acids
 24.5 kg trimethylethane.
5. Ester oil IT 4, 96.1 kg Leuna carboxylic acid (fraction 140-180°C).
 30.8 kg trimethylol ethane
6. Mollith L 85, 97.0 kg Leuna carboxylic acid (fraction 160-180°C).
 29,7 kg trimethylol ethane
7. Ester oil 623, 57 kg methyl-adipic acid
 133 kg Isobutyl oil
 9 kg dimethylol propane

Uses and properties of ester oils:

1. Ester oil 504 is used for manufacturing cold-resistant journal oils, ("Y-Journal oil red") for the Railroads, being blended in equal parts with AlCl₃ treated R-oils from SS oil manufacture. The low cold-test journal oil should be satisfactory for lubricating freight cars at -40°C.

Properties:

$E_{50^{\circ}}$	> 3.4
$E_{40^{\circ}}$	< 3300
Solid. point	< -60°C
Flash point	> + 140°C

Ester oil 504 is also used for preparing cold-resistant ink.

2. Ester oil 515 and Ester oil 426 in the ratio 3:2 are used for manufacturing low cold-test aviation engine and automobile oils. The low cold-test aviation oil is obtained by adding

25% of the Ester blend to
75% SS 903 polymerizate.

This oil makes it possible to start aircraft at -30°C.

Properties:

$E_{99^{\circ}}$	> 2.0
$E_{30^{\circ}}$	about 3000
Solid. point	< -50°C
Flash point	> 220°C

A low cold test automobile oil is obtained by mixing

50% SS 903 polymerizate with
50% Ester blend

This oil makes it possible to start automobiles at -35° to -40°C .

Properties:

$E_{99^{\circ}}$	> 1.6
$E_{30^{\circ}}$	about 2000
Solid. point	< -50°C
Flash point	> 200°C

3. Ester oil 455 is used for preparing Armament Oil, Blue ("Waffenöl blau") which is cold-resistant at -60°C and is used for machine guns. This Armament Oil, Blue is a blend of

46% Ester oil 455
47% High boiling constituents from the overhead of SS 900 manufacture
2% SS 906 oil
5% Amyl Xanthogentetrasulfide.

Properties:

$E_{20^{\circ}}$	> 2.0
$E_{50^{\circ}}$	< 350
Solid. point	< -70°C
Flash point	> $+120^{\circ}\text{C}$

4. Ester oil IT 4 is used as switch insulating oil for liquid-cooled switches. It is less combustible than mineral oil, very cold-resistant and deposits no carbon in operation so that its dielectric strength is high.

Properties;

$E_{20^{\circ}}$	4-7
$E_{30^{\circ}}$	< 800
Solid. point	< -50°C
Flash point	> 200°C

5. Mollith L 85 is used as non-jelling plasticizer for nitrocellulose.

Properties:

$E_{20^{\circ}}$	5-6
Solid. point	< -60°C
Flash point	> 200°C

6. Ester oil 623 is a substitute for rape oil for lubricating highly specialized cutting and drilling machines.

Properties:

	F ₂₀₀	8-13
Solid. point		< -50°C
Flash point		> 200°C

Plants, partially under construction, or planned:

	<u>Leuna:</u>	<u>Schkopau:</u>	<u>Auschwitz:</u>
Ester oil 504	1000 Jato	-	2400 Jato
" " 515	1500 "	2400 Jato	-
" " 455	230 "	-	-
" " 426	1000 "	-	1600 Jato
" " IT 4	200 "	-	-
Mollith L.85	1000 "	-	-
Ester oil 623	500 "	-	-
