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SUBJECT

Basic Grades of Liquid Fuels Used in  
the USSR for Internal Combustion  
Engines

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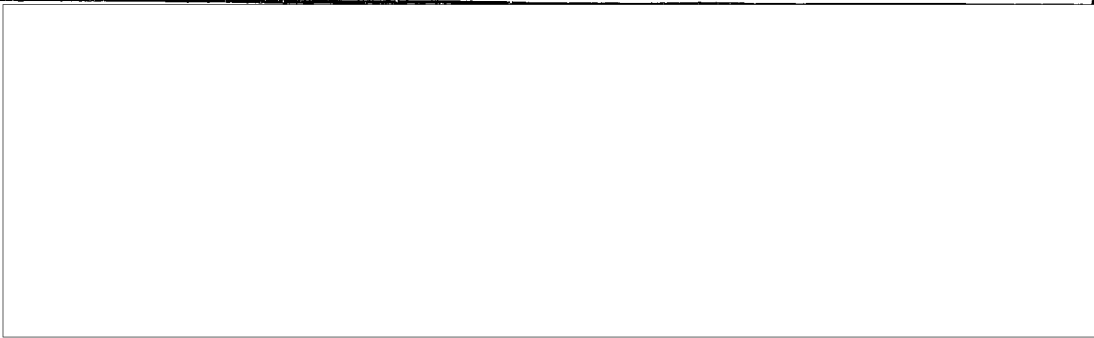
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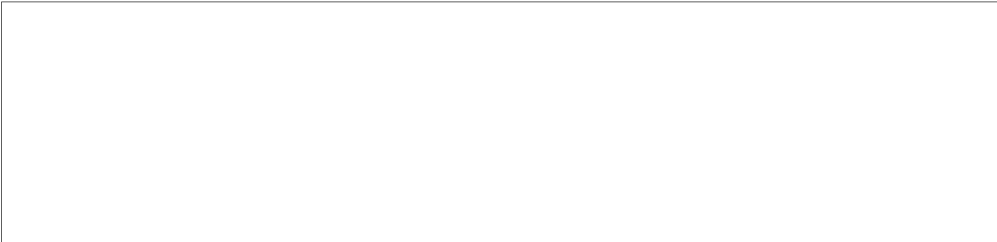
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1. The basic fuels for gasoline-kerosene and Diesel engines are set out in this re-  
port. The physical properties and uses of the fuels are listed where known.

2.



3. The basic fuels for gasoline-kerosene engines are gasoline, ligroin, kerosene,  
benzene, alcohol and miscellaneous mixtures.

(a) Gasoline

At the present time in the USSR motor vehicle gasolines (heavy gasoline of  
grade II and cracked gasoline) and aviation gasoline are in use. As a rule,  
gasolines are obtained by distillation from the lightest fractions with an  
initial boiling point of 50° C. and a final boiling point of 225° C.

Gasoline in the pure state is not used in the USSR because of the appearance  
at high compression ratios of the phenomenon of "knock". Knocking occurs  
when combustion of a part of the air fuel mixture proceeds at a speed ex-  
ceeding 2,000 to 3,000 meters per second, whereas the speed of normal com-  
bustion is 20 to 30 meters per second. In the USSR the anti-knock quality  
of fuel is customarily classified by the octane rating (O.ch. - oktanovoe  
chislo).

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The determination of the octane rating is effected in a special engine, which has a variable compression ratio. For this purpose the engine is at first started on the fuel being tested. Then gradually the compression ratio is increased until knocking occurs. Thereafter, without changing the compression ratio, the operation of the engine is switched over to a fuel composed of hydrocarbons of isooctane and heptane, which is accepted as a standard. Isooctane hardly ever knocks and its octane rating is accepted as 100, while heptane knocks easily and its octane rating is accepted as equal to zero. By adding heptane to isooctane a mixture is formed which gives rise to knocking of the same intensity as the fuel being tested. The number representing the percentage of isooctane in the standard mixture of isooctane and heptane is the octane rating of the fuel being tested. For instance, if a certain fuel being tested knocks at the same compression ratio as a mixture of 60% isooctane and 40% heptane, the octane rating of the fuel will be 60. In the USSR they use as an anti-knock compound, an ethyl fluid consisting of tetraethyl lead (TES), to which are added compounds which will aid in reducing the deposit of lead oxides (ethyl bromide and bromo-ethane) on the parts of the engines. Such gasoline is called ethylated gas. Usually 1/3 cubic centimeter of fluid is added per liter of fuel. The color of ethylated gasoline is usually blue or violet.

B-60 gasoline has an octane rating of 55-60 and is used for engines with a compression ratio of four to five. B-74 gasoline has an octane rating of 74 and is used for engines with a compression ratio of six to seven. B-100 gasoline has an octane rating of 100 and is used for engines with a high compression ratio.

Usually the specific gravity of heavy gasoline grade II is 0.745 and the calorific value is 10,200 kilogram calories per kilogram.

The specific gravity of cracked gasoline is 0.755 and the calorific value is 10,200 kilogram calories per kilogram.

## (b) Ligroin

Ligroin is to some degree heavy gasoline made up of heavy fractions which boil away at temperatures of 150° C to 230° C. It is used chiefly as tractor fuel. The average chemical content is C=85%, H=15%.

Specific gravity	0.755 - 0.790
Calorific value	10,000 kg cal/kg
Octane rating	54

## (c) Kerosene

Kerosene is obtained by distillation of gasoline-ligroin fractions. It is made up of petroleum distillates which boil away at temperatures of 200° to 315° C. The average chemical content is C=86% and H=14%. Two kinds of kerosene, tractor and illuminating, are used in the USSR. Tractor kerosene has a yellowish color while illuminating kerosene is clear with a light bluish tint.

Specific gravity	0.825 - 0.826
Calorific value	10,200 kg cal/kg
Octane rating	46

## (d) Benzene and alcohol are seldom used as fuel in the USSR.

## 4. There are several different grades of Diesel fuels in use in the Soviet Union.

## (a) Ge-oil - 9

Specific gravity	0.876
Flash point	70° C
Engler viscosity at 50° C	1.4
Solidification point	-30° C

This fuel is used for high speed Diesel engines.

## (b) Solar oil

Specific gravity	0.871 - 0.881
Flash point	130° C
Engler viscosity	1.3 - 1.75
Solidification point	-20° C

This fuel is used for high speed Diesel engines.

## (c) Light motor fuel (Diesel M-1)

Specific gravity	0.851 - 0.896
Flash point	45° C
Engler viscosity	1.1 - 1.2
Solidification point	-5° C

This fuel is used for Diesel engines which require light fuels.

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## (d) Medium motor fuel (Diesel M-2)

- (1) Winter grade M-2
- |                      |          |
|----------------------|----------|
| Specific gravity     | 0.875    |
| Flash point          | 65° C    |
| Engler viscosity     | 1.2 - 2. |
| Solidification point | -23° C   |
- This fuel is used for Diesels at an outdoor temperature of -17° C. At lower temperatures tractor kerosene is added in amounts ranging from 15% to 30% of the final mixture.
- (2) Summer grade M-2
- |                      |          |
|----------------------|----------|
| Specific gravity     | 0.875    |
| Flash point 65°      | 65° C    |
| Engler viscosity     | 1.2 - 3. |
| Solidification point | -10° C   |
- This fuel is used for Diesel engines when the temperature of the air is not lower than 5° C.

## (e) Heavy motor fuel

- (1) Diesel M-3A
- |                      |               |
|----------------------|---------------|
| Specific gravity     | 0.895 - 0.926 |
| Flash point          | 65° C         |
| Solidification point | -5° C         |
- This fuel is used for low speed Diesels.
- (2) Diesel M-3B
- |                      |               |
|----------------------|---------------|
| Specific gravity     | 0.895 - 0.926 |
| Flash point          | 90° C         |
| Solidification point | 5° C          |
- This fuel is used for low speed Diesels.
- (3) Diesel M-3G
- This fuel is used for stationary Diesel installations.

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