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FLAMMABLE LIQUID FUELS FOR CLASS B
FIRE TESTS FOR PORTABLE FIRE
EXTINGUISHERS

by

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July 1971

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FOR PORTABLE FIRE EXTINGUISHERS

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KEY WORDS: Fuel, liquid; Extinguishing; Extinguisher
(hand operated); Tests

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Introduction

An international standards co-ordinating committee, the Comité Européen de Normalisation has set up a Tripartite Sub-Committee ("CENTRI 2") to study the problems associated with European standards for portable fire extinguishers. The committee have already agreed details of the fire tests which includes the use of Aviation Gasoline of 100/130 octane rating as the official test fuel for the Class B fires.

This note outlines the considerations taken into account by the Sub-Committee when the use of this particular fuel was recommended.

Standards and Specifications for fuels

The main requirements for the flammable liquid fuel are that it should, if possible, be similar to those fuels already in use, be internationally available to a known specification, and be acceptable to the Testing Authorities concerned. The different fuels specified in the three national extinguisher standards and the relevant standards for those fuels are listed in Table 1.

Gasoline type fuels have been studied and the use of paraffin and light fuel oil for the testing of certain water extinguishers has not, at this stage, been considered. The main requirements of the different standards and specifications for British motor gasoline (BS 4040), German motor gasoline (DIN 51600), French "essence F", and aviation gasoline (Ministry of Aviation DEng RD 2485 are summarised in Table 2 and Figs 1 and 2.

The most important properties of the liquid fuel are its distillation characteristics, and the Reid vapour pressure (R.V.P.). Specific gravity and calorific value do not vary greatly from gasoline to gasoline. The distillation characteristics and R.V.P. do vary significantly from manufacturer to manufacturer, from country to country, from area to area within a country (depending on climatic conditions) and from season to season. Cold climatic conditions demand a more volatile motor vehicle fuel than warm conditions.

Neither of the standard specifications for motor gasoline nor the standard for aviation gasoline stipulate limits for the Initial Boiling Point. The characteristic of the distillation curve at low temperature is gauged by the R.V.P. which is specified in DIN 51600 and DEng RD 2485 but not in BS.4040. Table 2 gives typical values for Britain and the range of values which could

be expected in European areas. Only DEng RD 2485 (aviation gasoline) sets a limit for the Final Boiling Point.

The distillation characteristics are normally specified by setting a lower limit to the volatility of the fuel at three points along the curve. This is done either by setting a maximum temperature for the distillation of a given percentage of fuel, or by setting a minimum percentage of fuel to be evaporated at a given temperature. In addition, at one temperature, DEng RD 2485 (aviation gasoline) also sets a maximum limit to volatility.

It can be seen that motor gasolines are not so tightly specified as aviation gasoline and there can be significant differences between motor gasolines depending on the source, geographical location and climate. Aviation gasoline is specified within close limits especially R.V.P. and Final Boiling Point. This fuel is internationally available to specifications similar to that quoted (DEng RD 2485).

The "essence F" used by the French Testing Authority is not a normal gasoline like those used by the German and British Testing Authorities but is a special boiling range liquid for which there appears to be no internationally accepted standard.

It was suggested therefore that the motor gasolines and "essence F" at present used for Class B fire tests should be replaced by an aviation gasoline.

There are a number of grades of aviation gasoline available, the most common being 100/130 octane and 115/145 octane. The most common lower grade is 80/87 octane which is covered by an American military specification (MIL-G-5572 D) which is identical to D.Eng.RD 2485 apart from the octane number rating.

Although there is little difference between the three grades mentioned, it was suggested that 100/130 octane aviation gasoline be chosen as the standard fuel for Class B fires for testing hand fire extinguishers as it is more readily available than 80/87 octane and is likely to contain less tetraethyl lead than 115/145 octane.

(1) O'DOHERTY, M.J. Fire Research Note 682 (1967) "International standards for Fire Extinguisher construction and performance".

TABLE 1
LIST OF FUELS USED IN FIRE TESTS
AND THE RELEVANT STANDARDS

Extinguisher Type	Country	National Standard for the Fire Test	Fuel for Fire Test	National Standard for the Fuel
Water	France	NF.S. 61-911 Soda Acid NF.S. 61-912 Gas Operated (Optional tests)	Essence-F Paraffin Light Fuel oil	- - -
Foam	France	NF.S. 61-910 (1965)	Essence-F	-
Carbon Dioxide	France Germany	NF.S. 61-914 DIN.14406 : Sheet 1 (1964) and Sheet 2 (1967)	Essence-F Motor Gasoline	- DIN. 51600 (1966)
Vaporizing Liquids	France Germany Britain	NF.S. 61-913 (1966) DIN.14406 : Sheet 1 (1964) and Sheet 2 (1967) BS.1721 (revised draft 1966)	Essence-F Motor Gasoline Motor Gasoline	- DIN. 51600 (1966) BS. 4040 Part 1 (1967)
Dry Powders	France Germany Britain	NF.S. 61-915 (1966) DIN.14406 : Sheet 1 (1964) and Sheet 2 (1967) BS.3465 (1962)	Essence-F Motor Gasoline Motor Gasoline	- DIN. 51600 (1966) BS. 4040 Part 1 (1967)

TABLE 2

Comparison of standards and specifications for Motor Gasoline in Britain and Germany,
Aviation gasoline, and French "essence F"

Flammable Liquid Property	British Motor Gasoline BS 4040	German Motor Gasoline DIN 51600	Range of Values to be expected for Motor Gasolines in Europe ¹	Aviation Gasoline D.Eng. RD. 2485	French "Essence F"
Specific Gravity	Not specified, but typically 0.72 - 0.77	Minimum 0.72	0.7 - 0.78	Not specified, but typically 0.725	0.739
Net Calorific Value (cal/g)	Not specified, but typically 10,400 - 10,500	Not specified	10,300 - 10,550	Minimum 10,400	Not specified
Vapour Pressure (REID) (R.V.P.) kg/cm ² (lb/in ²)	Not specified, but typically 0.49(7.0) - 0.91 (13.0)	Minimum 0.7 (10.0) Maximum 0.9 (12.9)	0.35 (5.0) to 0.98 (14.0)	Minimum 0.386 (5.5) Maximum 0.49 (7.0)	Not specified
Initial Boiling Point °C	Not specified	Not specified	25 - 45	Not specified	100
Final Boiling Point °C	Not specified	Not specified	140 - 220	Maximum 170	158.5
Distillation Characteristics	10% distilled at max. temp. 70°C 50% distilled at max. temp. 125°C 90% distilled at max. temp. 180°C	Minimum of 10% distilled at 70°C. Minimum of 40% distilled at 100°C Minimum of 95% distilled at 200°C	-	Between 10% & 40% distilled at 75°C Minimum of 50% distilled at 105°C Minimum of 90% distilled at 135°C	Not specified

¹Data supplied by Shell Petroleum Company.

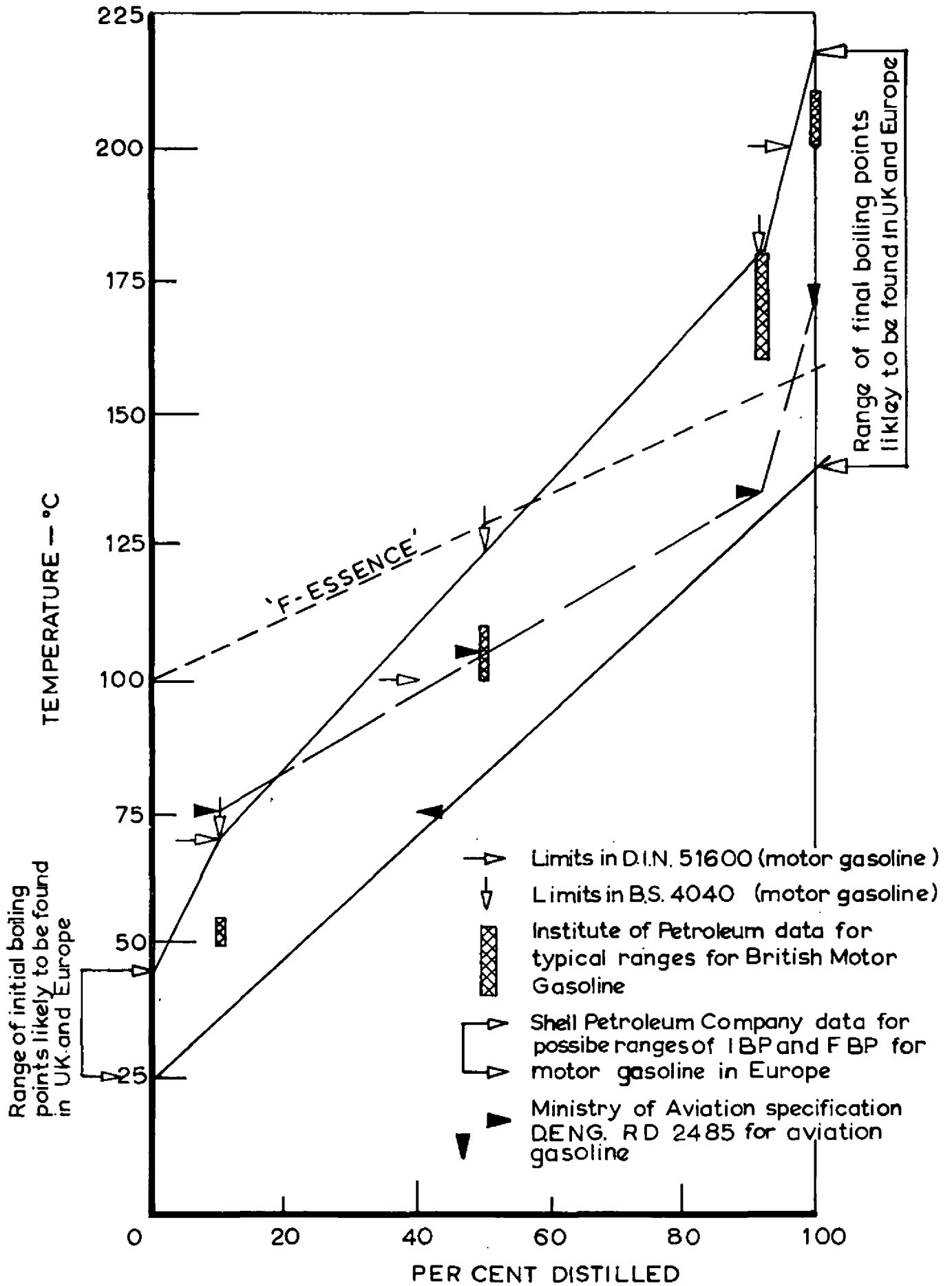


FIG.1. COMPARISON OF MOTOR AND AVIATION GASOLINES, AND 'F-ESSENCE'

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Motor gasoline as available in Great Britain and Europe

French flammable liquid 'F-Essence'

Aviation gasoline D.ENG.RD.2485

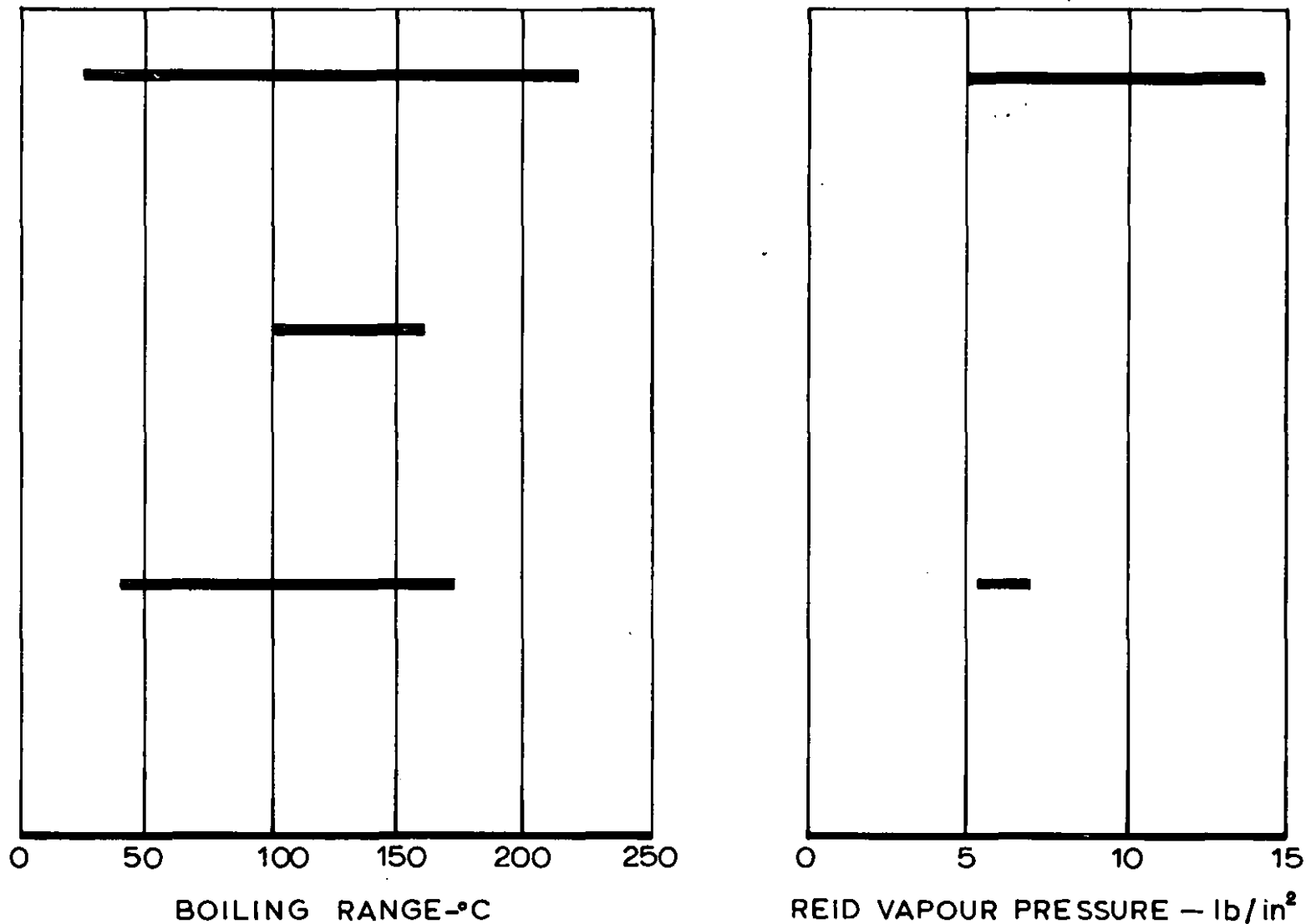


FIG. 2. COMPARISON OF BOILING RANGES AND VOLATILITIES OF MOTOR GASOLINE, AVIATION GASOLINE AND 'F-ESSENCE'

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