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ATD Report P-65-31 17 May 1965

Surveys of Soviet-Bloc Scientific and Technical Literature

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MOTOR, JET, AND ROCKET FUELS

Review Article

(Report No. 1 in this series)

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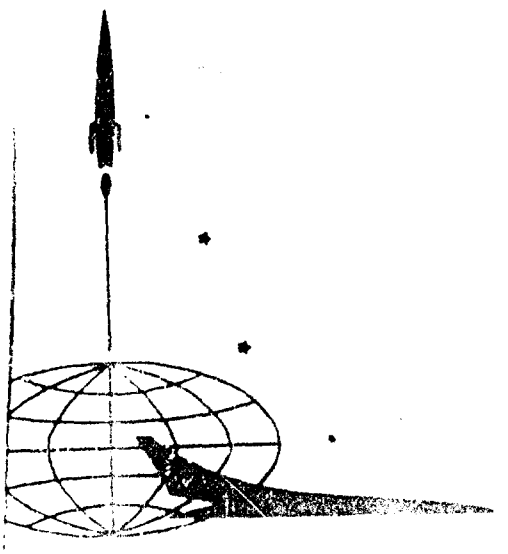

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FOREWORD

This report, prepared in response to ATD Work Assignment No. 77, is a comparison of the 1957 and the 1962 editions of a book on motor fuels. The editions were originally published as follows:

A) Papok, K. K., and Ye. G. Semenido, eds. Motornyye topliva, masla i zhidkosti. [tom 1] Motornyye topliva (Motor fuels, lubricants, and fluids. [v. 1] Motor fuels). 3d ed., rev., Moskva, Gostoptekhizdat, 1957. 512 p.

B) Papok, K. K., and Ye. G. Semenido, eds. Motornyye, reaktivnyye i raketnyye topliva (Motor, jet, and rocket fuels). 4th ed., rev., Moskva, Gostoptekhizdat, 1962. 741 p.

The purpose of this comparison is to show the nature of coverage of the enlarged 1962 edition. No further editions of this book are known at the present time.

Full translations of some of the source materials used in this report may be available from other agencies or commercially. Interested readers may obtain translation data for individual sources by indicating source numbers from the bibliography list on the form attached at the end of this report and returning it to the Aerospace Technology Division.

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Appendix I: Phase I of 1962 Edition

MOTOR, JET, AND ROCKET FUELS

Publication Data

A. Papok, K. K., and Ye. G. Semenido, eds. Motor fuels, lubricants, and fluids. v. 1. Motor fuels. Third revised and enlarged edition. Moscow, Gostoptekhizdat, 1957. 512 p. This volume was sent to typesetting on 18 Sept 1956 and was ready for printing 11 Feb 1957. The latest references include sources from the first half of 1956.

B. Papok, K. K., and Ye. G. Semenido, eds. Motor, jet, and rocket fuels. Fourth revised and enlarged edition. Moscow, Gostoptekhizdat, 1962. 741 p. This book was sent to typesetting 22 July 1961 and was ready for printing 14 Dec 1961. The latest references are from the first half of 1961.

The statistical differences between these two editions can be seen in the following: (B) has 229 pages, 35 tables, and 117 graphs more than (A).

Comparison of Contents

In order to simplify the text, the 1957 edition will be marked (A), and the 1962 edition will be marked (B). Both books, (A) and (B), contain references to Soviet research in the text in addition to the prevailing Western references.

The following table is introduced here to give the reader a preliminary comparison of the chapters in (A) and (B):

CHAPTERS IN (A)		
Chapter I—V	[See Phase I]	No change
Chapter VI	Combustion of motor fuels	VI expanded by 3 sections
Chapter VII	Composition of motor fuels	XIII and in XVII
Chapter VIII	Antiknock agents	XV with 4 new sections
Chapter IX	Water injection	omitted
Chapter X	Low-temperature behavior of fuels	XI with addition of section on evaporation
Chapter XI	Automobile fuels	XVII
Chapter XII	Diesel fuels	XVIII
Chapter XIII	Fuels for aviation piston engines	XVI
Chapter XIV	Jet fuels	XX—XXIII
Chapter XV	Rocket fuels	XXIV—XXVII
Chapter XVI	Storage of motor fuels	single sections in XV and XXII
Chapter XVII	Boiler fuels	XIX
Chapter XVIII	Handling; toxicity	XXIX (one section) and XXX

Comparison of individual chapter of edition (B) with edition (A):

Chapters I to V are essentially the same in scope in both editions, with (B) containing more recent data, e. g., (A) shows VTI-GOST 5080-49 and (B) shows VTI-GOST 5080-55 for the determination of the heat of combustion.

Chapter VI is expanded by the addition of the following section: 1) The effect of liquid-state oxidation on preignition reactions in engines; 2) Fuel combustion in

air-breathing engines; and 3) Fuel combustion in liquid-propellant rocket engines.

Chapters VII to X represent new headings (see Phase I). In chapter VIII, the carbon-deposit formation of the T-4 fuel is given as 13 mg/5 min (Zarubin and Slavinskiy).

Chapter XI repeats Ch. X from (A) with the addition of one section on evaporation of fuels at low temperatures.

Chapters XII to XIV are new headings (see Phase I). The section of "Corrosivity of sulfur fuels" in Ch. XII includes data for the sulfur content in T-4 fuel and on the corrosion of VB-24 bronze in T-4.

Chapter XV is an expansion of Ch. VIII in (A) and covers organic and inorganic antiknock agents: aniline, xylidine, TEL, tetraethyltin, diethylselenium, diethyltellurium, nickel tetracarbonyl, iron pentacarbonyl, Soviet "ethyl fluids" R-9, 1-TS, and P-2, MD-CMT (AK-33x), TLA, and the Soviet additive "ekstralin."

Chapter XVI is a shorter version of Ch. XIII in (A) containing a general description of US and Soviet aviation gasolines. The Soviet fuels are: GOST-5760-51; BA; GOST 1012-54:B-100/130, B-95/130, B-91/115, B-70. A separate section discusses the stability of gasolines in storage.

Chapter XVII is an updated version of Ch. XI in (A).

Chapter XVIII is an updated version of Ch. XII in (A).

Chapter XIX covers the subject matter presented in Ch. XVII in (A) in an updated and expanded text (including 1960 sources).

Chapter XX is a shorter and updated version of Ch. XIV in (A) with references including 1959 sources. Fuels discussed in this chapter are: T-1 (GOST 4138-49; TS-1 (GOST 7149-54); T-2 (GOST 8410-57); T-5 (GOST 9145-59); US fuels and NATO fuels. Chapter XIV (A) gives some of the characteristics of T-1, TS-1, and T-2, but without GOST requirements. Instead, Table 114 shows technical norms for wide-fraction general types of fuels (gasoline type, ligroine type, kerosine type, etc.). These data are based on one Soviet source (Nikolayev, 1947) and five Western sources. Data for the ligroine type, kerosine type, and straight-run wide fraction (Table 114 in (A) corresponds to data for TS-1, T-1, and T-2 (Table 143 in (B)), respectively. Table 143 in (B) gives GOST requirements for T-1, TS-1, T-2, and the new T-5.

Chapter XXI consists of two sections taken from Ch. XIV (A) plus a new section on oxidation in storage of ABJE fuels (T-1, TS-1, T-2).

Chapter XXII is principally a new chapter which contains some of the text on fuel stability from Ch. XIV (A). Sources for this chapter include materials from 1960. Soviet fuels mentioned in this chapter are fuel types: T-1, TS-1, T-2, T-4, and T-5. The text shows that T-4 consists of straight-run gasoline and kerosine fractions plus thermal cracking products. The filtration performance of T-4 is shown in Table 172 (Sablina, Gureyev, 1959) in comparison with T-1, TS-1, T-2, T-5, and cracking kerosene.

Chapter XXIII constitutes a new chapter (16 pages) which is an expansion of the last section (3 pages) in Ch. XIV (A): "Future Trends in ABJE Fuels." The 1957 text discusses, in general terms, the need for improved fuels to be used in supersonic aircraft (Mach 1.5—2.5). Thermal stability of fuels is considered an important factor (this problem is treated in the 1963 edition as a separate chapter; Ch. XXII). Chapter XXIII, in addition to high-energy fuels (Al, B, Mg — hydrocarbon fuels), includes the standard Soviet fuels, T-1, TS-1, T-2, and T-5, indicates that the latter has the highest energy index. The authors conclude that organometallic fuels appear to be the best fuels for use in the immediate future. The chapter is based on two Soviet sources (Zrelov, 1959; and Chertkov, et. al., 1954) and 25 Western sources.

Chapter XXIV is an introduction to liquid propellants. It gives a historical review of the LP development and, together with Ch. XXV to XXVII, gives expanded coverage of the subject dealt with in Ch. XV (A).

Chapter XXV is based mostly on Western sources (nine Soviet references out of a total of 52 including 1960 materials); for instance, the table of properties of elemental fuels (H, Li, Be, B, C, Mg, Al, Si) is taken from Hipman, Burgess, and Leonard; the table for hydrogen fuels is from Aero Digest, etc.

Chapter XXVI is based mostly on Western literature (11 Soviet out of 56 references) and reviews known oxidizers with most of the specifics quoted from Western sources.

Chapter XXVII covers general aspects of monopropellants using five Soviet references out of 17. The following compounds are mentioned: nitro compounds, H_2O_2, N_2H_4, C_2H_4O.

Chapter XXVIII is a new chapter on the filtering of aviation fuels based on Western sources with one section entitled, "Method for Visual Evaluation of Fuel Purity Used in the Soviet Union" (nine lines in the text). This rough method is based on simple visual observation of the presence or absence of macroimpurities.

Chapter XXIX is a new chapter on the flammability of fuels from the point of view of eliminating fire hazards. Air-fuel mixtures are discussed for such fuels as: A-66, A-74, B-70, B-19/115, B-95/130, T-2, TS-1, T-1, and kerosine.

Chapter XXX is essentially a repetition of Ch. XVIII in (A), updated to 1959.

COMMENT: This writer finds the 1962 edition more descriptive, too general, and less readable than the 1957 edition. The purpose of the book probably accounts for this since it is intended for engineers and technicians in fuel handling, engine operation, and petroleum refining. The usual omission of specific Soviet data in the more important fields is evident throughout the book.

APPENDIX I

Papok, K. K., Doctor of Technical Sciences, Professor, and Ye. G. Semenido, Doctor of Technical Sciences, Professor, eds.

Motornyye, reaktivnyye i raketnyye topliva (Motor, Jet, and Rocket Fuels) 4th ed., rev. and enl., Moscow, Gostoptekhizdat, 1962. 741 p. Errata slip inserted. 7000 copies printed.

Exec. Eds.: Ye. S. Levina and B. F. Titskaya; Tech. Ed.: I. G. Fedotova.

PURPOSE: This book is intended for engineers and technicians in fuel handling, engine operation, and petroleum refining.

COVERAGE: This is the fourth edition, revised and enlarged, of the original book published in 1957. The editors believe that the large amount of new material included justifies considering it as an entirely new

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book. It deals with the physical, chemical, and service properties of propellants and fuels for aircraft piston engines, turbojets, ramjets, rockets, automobiles, diesels, stationary turbines, and boilers. In addition to combustion problems, discussions of corrosion, carbon deposits, and residue formation are included. No personalities are mentioned.* References follow each chapter.**

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*Authors of individual chapters are listed on page 4. Additional Soviet personalities are mentioned in the text in connection with Soviet research quoted. [Writer's note]

**Most of the references cover sources up to 1960. One or two are from 1961. [Writer's note]

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