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AERONAUTICAL STANDARD AS 177A

OPERATING INSTRUCTIONS FOR AIRCRAFT ENGINES (PREPARATION OF)

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1. PURPOSE: The operating instructions covered by this specification are published for the purpose of providing a background of engine operating information with which a pilot and his crew should be familiar when operating an aircraft powered by a particular engine model. Operating instructions also contain engine operational procedures which serve as a guide for: (1) the preparation of the flight manual by the aircraft manufacturer, (2) operating an engine prior to the publication of the aircraft flight manual, and (3) instructional purposes.

2. SCOPE: This specification covers the requirements for format and outline of contents of operating instructions in published form or in manuscript form suitable for publication.

3. GENERAL REQUIREMENTS:

3.1. Operating Instructions: Only those similar engine models and/or series whose operating procedures are identical shall be included in a basic operating instruction. Where a multiplicity of series exist for a given engine model, one or several similar engine series of the particular model may be further described, as necessary, by the publication of applicable supplements to the basic operating instructions.

3.1.1 Supplements and Revisions: Supplements, when used in addition to the basic operating instructions, shall present the engine operating limits, curves and other data which pertain to one specific engine series or to several whose operation is similar. The supplements shall also include specific procedures and information for a given engine series which may differ from those presented in the basic operating instructions. Revisions to the supplements shall be effected either by the publication of later editions or through the use of revised pages. A statement shall be included in the front of the supplement describing the means whereby any subsequent revisions thereto may be readily identified.

3.2 Symbols: The use of symbols and abbreviations is to be avoided wherever practicable.

3.3 Units of Measurement: For length, weight, temperature, pressure, etc., which are used throughout the instructions shall conform to SAE standard practice and/or (when known) the units in which the aircraft instruments will be calibrated (i.e., °C, psi, etc.).

3.4 Material and Process Specifications: Reference to material and process specifications shall be made by SAE, MIL or ASTM specification number, if any, unless the customer or the engine manufacturer desires that his own specification number be used. In case there is no specification number of any type applicable to certain materials, it shall be permissible to refer to that material by its trade name. The materials referred to are primarily fuels and lubricants. When known, the fuel and/or oil grade should also be included and a statement made, when applicable, whether it is for winter or summer use.

3.5 Binding: Printed operating instructions shall be furnished in suitable form for inclusion in standard 8.5 x 11 inch looseleaf binders.

3.6 Phraseology: Technical phraseology requiring specialized knowledge shall be avoided except in cases where no other phraseology will clearly convey the intended meaning. Instructions covering standard operations and description of engine parts and instruments need not be entered into in any greater detail than is necessary for personnel having a general training in the operation of aircraft engines to understand.

4. DETAIL REQUIREMENTS:

4.1 Format:

4.1.1 Size: Operating instructions shall be published on one or both sides of 8.5 x 11 inch pages, with margins to accommodate the type of binder or cover to be used. The text limits shall be 7 x 9 inches, exclusive of headings. The text may be set in either one or two columns. When set in one column it is recommended that the 5-inch column be used. Fold-over pages are undesirable except in the case of operating or performance curves which cannot be fitted to an 8.5 x 11 page. Whenever possible, operating and performance curves and data tables should be laid out for vertical reading.

4.1.2 Type Size: The type appearing in the published operating instruction shall not be smaller than eight point.

4.1.3 Major Divisions of Instruction: The operating instruction shall be divided into introductory parts and five major sections, as may be required, each part and section to be started on a right-hand page:

Title Page

Table of Contents (optional)

Introduction, Foreword or Preface

Section 1 - Description

Section 2 - Ground Operation

Section 3 - Flight Operation

Section 4 - Emergencies

Section 5 - Engine Check Chart and Operating or Performance Curves

4.2 Paragraphs: Where applicable, the sections shall be subdivided into major paragraphs. Each major paragraph may be divided into subparagraphs if necessary. As a general rule, not more than one primary paragraph subdivision is recommended.

4.2.1 Paragraph Identification: Major paragraphs and subparagraphs should be identified for ready reference. This should be accomplished with a system of numerals and lower-case letters or by use of headings with appropriately different type faces or sizes. When numerals and letters are used, the paragraphs should also be identified by a heading, introductory phrase or step designation following the paragraph or subparagraph number or letter.

4.2.2 Procedures: Engine operating procedures should be listed and numbered in steps in their chronological sequence under the appropriate paragraph heading. Each step should be clearly designated on a separate line rather than included with other steps in a general paragraph or discussion.

4.2.3 Notes, Cautions, and Warnings: Whenever slight deviations from the regular procedure, added information, or special considerations are necessary, a note, caution, or warning may be included under the appropriate paragraph, subparagraph, or step in the procedure. The word "Note", "Caution", or "Warning" should be printed either over or at the beginning of the added information in an appropriate variation in type face. The information should be printed in block form and indented. The following should govern instructions of this nature:

Note: A "Note" should be printed in ordinary type face. The information included in a note should be slight deviations in normal procedure required under special conditions, needed information on how certain equipment works or operates or the reasons why a certain step in the procedure is accomplished, to clarify or highlight the particular procedure or step.

Caution: A "Caution" should be printed in italics. Cautions are used to call special attention to or add additional information regarding operational step, procedure or engine characteristic which, if not observed, might result in mechanical damage to the engine, aircraft, or equipment.

Warning: A "Warning" should be printed in bold face type. Warnings are used to call attention or explain a step in procedure which, if not observed, might result in serious accident or injury to personnel or otherwise affect safety of flight.

4.3 Page Numbering: The first page of Section 1 shall be numbered "1" (Arabic numerals), and the numbers carried straight through to the last page of the instruction. For pages preceding Section 1, lower-case Roman numerals shall be used. In order to prevent the necessity of resetting type, added pages, if required in last minute alterations of an instruction in the process of reproduction, may be numbered 1A, 1B, 2A, 2B, etc.

4.4 Section Headings: Section identification shall appear in the running head of the first page of each section.

4.5 Engine Serial Numbers: Reference to engines shall be made by model designation if possible. Where the model number does not furnish sufficient identification further identification by serial number or physical characteristics is permissible. It is recommended that in order to make Sections 1 through 4 of the operating instruction interchangeable among several engine models or series, specific reference to engine models or series be restricted to the introductory pages and Section 5.

4.6 Nomenclature: Throughout the text of the instruction the principal noun in the nomenclature of a particular part shall be the same as that specified in the Spare Parts Catalog. The descriptive nomenclature of the principal noun may vary, however, according to the particular use and location to which reference is made. As much as possible, the nomenclature used in the instruction should be consistent throughout the instruction and should conform to the accepted SAE standards and accepted common usage.

4.7 Engine Equipment: Instructions for the items of engine equipment such as carburetors, magnetos, turbojet engine fuel controls, etc., which are required for normal engine operation shall be included in the operating instruction in as great detail as necessary for satisfactory operation of the engine. The instruction may also include general instructions for items of aircraft equipment which may have a definite effect on engine operation such as cowl flaps, carburetor heaters, turbine engine pneumatic or combustion starters, etc.

4.8 Illustrations: Except for an operational schematic diagram or sketch, illustrations shall be included in the operating instruction only whenever an illustration will specifically serve to clarify or simplify any information presented in the text.

4.8.1 The hands of an operator may be included in an illustration where necessary to illustrate an operation. The inclusion of more of an operator's body than his hands is permitted only as necessary to properly illustrate the procedure.

4.8.2 Each illustration specifically referenced in the text shall show directly beneath it the figure number (Arabic numerals) and the name or title of that particular illustration. The figure numbers shall be applied to the illustrations in the order in which the illustrations are shown in the instruction.

4.8.3 Illustrations shall be inserted as closely as possible to the applicable text.

4.8.4 Reference to the illustrations shall be made by figure number throughout the text immediately following descriptive text material.

4.9 Title Page: The title page shall be to the manufacturer's standard, except where it is necessary to abide by a customer's standard. The title page shall include the following information, if available:

1. Title of publication
2. Name of manufacturer and address
3. Engine designation
4. Date of issue and, when applicable, the latest revision or rewrite date. The operating instruction may be revised and reissued when necessary.

4.10 Table of Contents: The table of contents shall immediately follow the title page and shall contain a list of each of the operating instruction section titles with a break-down into their major paragraph titles and primary subparagraph titles, showing the page numbers on which the detailed data is found. A table of contents may be omitted whenever the length or complexity of the operating instruction does not warrant such a table.

4.11 Introduction: The introduction, foreword, or preface shall be a concise statement of the purpose of the operating instruction and how the instruction should be used. It shall include such introductory matter as deemed pertinent and which may aid in the proper use of the operating instruction. Reference shall be made to other available publications covering the same engine or which will provide a background of essential operating information for engines of the same type covered by the operating instruction. The specific engine models and/or series covered by the operating instructions shall be stated.

4.12 Description: This shall be numbered "Section 1" and will contain a brief description of the engine and/or its instrumentation, ratings, and other information of which special knowledge is necessary in order to operate the engine. Special engine characteristics may be pointed out and, when necessary, attention called to specific features of the engine which are different from other engines of its type or model. Whenever it will be helpful, a schematic diagram or sketch of the engine and its instrumentation may also be included in this section. If non-standard or unusual terms are used elsewhere in the text, they should be defined in Section 1. A table of engine characteristics may be included in this section, if desired.

4.13 Ground Operation: This shall be numbered "Section 2" and will contain all of the procedures, steps, notes, cautions, warnings, and other information necessary for ground operation of the engine. The following are suggested as typical subjects:

1. Procedure preliminary to starting
2. Starting, including more than one method when applicable
3. Warm-up
4. Ground tests, including any necessary equipment tests.
5. Taxiing
6. Engine shutdown

4.14 Flight Operation: This shall be numbered "Section 3" and will include all procedures, steps, notes, cautions, warnings, and other information necessary for operating the engine in flight. The following are suggested as typical subjects:

1. Computations to determine take-off power or thrust, when applicable.
2. Pre-take-off engine check.
3. Take-off, including the use of coolant injection or afterburner, when applicable.
4. Climb
5. Cruising recommendations, maximum cruise, etc.
6. Glide
7. Approach
8. Landing, including the use of reverse power or thrust.
9. Other required information or procedures which may be required for flight operation such as an intentional in-flight engine shutdown, anti-icing precautions, etc. The use of flight operation curves may be included in this section if desired.

4.15 Emergencies: This shall be numbered "Section 4" and will include all required emergency procedures, including pertinent notes, cautions, and warnings. The following are suggested as typical subjects:

1. Ground engine fire
2. In-flight engine fire
3. Engine failure
4. Engine flame-out (turbojet and turboprop engines)
5. Oil system malfunction
6. Afterburner cutoff failure (turbojet engines)
7. Air start or in-flight re-light
8. Other emergencies which might arise with a particular engine type, model or series

4.16 Engine Check Chart and Operating or Performance Curves: This section shall be numbered "Section 5" and shall contain a chart or table called the engine check chart, or an equivalent title. As required, specific information applicable to a particular series of an engine model shall be covered in the supplementary sheets to the pertinent basic operating instructions. The chart or table shall recapitulate all essential engine operating data and operating limits for each engine rating and cruise condition for ready reference. The same page on which the chart is shown may also include the engine specifications, fuel and oil used, etc. Section 5 shall additionally include the essential engine operating or performance curves, either for direct use by the engine operator or which are necessary to the aircraft manufacturer for preparation of the final curves or tables which will appear in the aircraft flight handbook. Any corrections or revisions which must be made to the curves by the aircraft manufacturer for a particular engine installation such as air inlet duct loss, accessory drive loss, etc., should be either included in this section or a reference made, indicating what corrections are necessary and where the procedures for making them may be found. The method of reading the curves should either be clearly shown by an example drawn on the curves, by a discussion either in this section or another part of the operating instructions (to which reference should be made) or by a reference made, preferably on the curves or on the same page as the curves, to some other publication in which the method of using the curves is described.

4.16.1 The engine power or thrust ratings to be included in the engine check chart and/or the Operation and performance curves are as follows:

Military Engines: Those ratings defined by the latest military model specification.

Commercial Engines: Those ratings defined by the latest CAA regulations, part 13.

It is recommended that the engine check chart and the curves also include the engine manufacturer's recommended settings and/or limits for additional power or thrust conditions such as 70, 80, or 90% of, for instance, normal rated power or thrust.