SAE INTERNATIONAL

AEROSPACE RECOMMENDED PRACTICE

ARP1797 REV. A

Issued 1983-09
Revised 1999-04
Reaffirmed 2014-12

Superseding ARP1797

Aircraft and Aircraft Engine Fuel Pump Low Lubricity Fluid Endurance Test

RATIONALE

ARP1797A has been reaffirmed to comply with the SAE five-year review policy.

INTRODUCTION

In recent years more hydrotreating and hydrocracking equipment is being used in the production of aircraft turbine fuels. Hydrogen refining techniques remove the crude oil's sulfur and polar constituents. Some high quality hydro-refined fuel products have very poor lubricating properties. These low lubricity fuels have caused friction and wear problems in aircraft components. A standard test method is required to provide a basis for evaluating the capability of aircraft and aircraft engine fuel pumps utilizing these low lubricity fuels. The procedure recommended herein is based on experience gathered by a number of facilities conducting component tests to investigate low lubricity fuels. In addition, this procedure is intended for the investigation of potential wear problems in fluid machinery due to low lubricity fluids and not wear or material removal problems associated witih fluid viscosity, cavitation, machine geometry and aircraft operational modes that impact bearings, bearing dams, and gear surfaces. Also, this procedure is not intended as a qualification test procedure.

1. SCOPE:

This procedure is intended to apply to fuel pumps.

This procedure will be defined in terms of recommended test fluid, test setup, test conditions, and test method.

This procedure may be used for other fuel system components, by testing in conjunction with the pump, which normally supplies the component inlet flow, or a substitute test pump of similar capacity.

This procedure may be used, with variations in test conditions and test fluid for performing pump evaluation tests. Tests at progressively increasing pump speeds and pressures will provide design limitation data. Alternate test periods on a test pump and another pump, of a design for which actual service durability is known, will provide useful comparison data.

TO PLACE A DOCUMENT ORDER: **Tel: 877-606-7323 (inside USA and Canada)**
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/ARP1797A

1.1 Purpose:

This recommended practice defines procedures for testing aircraft and aircraft engine fuel pumps to ensure their operability with respect to low lubricity fuels. This is achieved by verification testing on a standard low lubricity test fluid. This procedure is intended to produce a uniform reproducible test condition for fuel pump endurance testing using low lubricity fluid, to provide a common reference for endurance capability. Pump endurance capability is to be established in terms of internal parts wear and change in pump performance. Pass/fail criterion are normally established by the purchasing authority. This document is not a pump qualification test procedure.

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 5001 Standard Test Method for Measurement of Lubricity of Aviation Tubine Fuels by the Ball-on-Cylinder Fuel Lubricity Evaluator (BOCLE)

ASTM D 4306 Standard Practice for Aviation Fuel Sample Containers for Tests Affected by Trace Contamination

2.2 Reference Documents:

NAPTC PE-112 Lubricity Properties of High Temperature Jet Fuel by L. Grabel, August 1977

ASTM D 5001-90-"95" Test Method for Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator (BOCLE)

2.3 U.S. Government Specifications:

Available from DODSSP, Subscription Services Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.

MIL-PRF-7024E Calibrating Fluids, Aircraft Fuel System Components

3. GENERAL REQUIREMENTS:

3.1 Duration of Test:

100 h

3.2 Test Fluid:

The value and validity of low lubricity tests, as defined by this document, are dependent on consistently maintained and accurate lubricity measurement of the test fluid. The following fluid and wear scar limits are recommended:

Test Fluid: MIL-PRF-7024 Type II
Wear Scar: Between 0.85 mm and 0.96 mm. The wear scar shall be measured by the test method defined in ASTM D 5001.

3.3 Test Setup:

In accordance with Figure 1 and Appendix A.

3.4 Test Conditions:

1. Pump speed, engine flow, and discharge pressure shall be maintained at the conditions required for engine maximum normal steady-state loading condition for the duration of the test.
2. Ambient temperature and pressure: Normal Facility
3. Fluid pressure in supply tank (P1): As required to maintain P2
4. Fluid pressure at pump inlet (P2): Within normal pump operation therefore between the pump's specified minimum and maximum inlet pressure.
5. Fluid temperature in supply tank (T1): ±3 °C (5 °F) of T2
6. Fluid temperature at pump inlet (T2): 38 to 41 °C (100 to 106 °F) or that determined by the gear stage inlet temperature of the performance specification for the conditions specified in 1.
7. Accuracy of flow, temperature, speed, pressure and instrumentation shall be within ±1% of actual value.

3.5 Precautions:

This document may involve hazardous materials, operations, and equipment. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of whoever uses this procedure to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

4. DETAIL REQUIREMENTS:

4.1 The test setup will be made in accordance with Figure 1.

4.1.1 Supply tank minimum volume shall be equivalent to maximum test flow for 1 min or 0.3 m^3 (75 gal) whichever is smaller.

4.1.2 Fluid contacting surfaces, except for fluid test article interfaces and filter media, shall not contain materials that will be reactive with the test fluid. Therefore, materials such as rubber, pipe joint compounds, packing lubricants, copper, etc. are not permitted.

4.1.3 The test setup shall be constructed such that all surfaces in contact with the fluid can be cleaned.

4.1.4 Adequate vents must be provided to allow removal of all trapped air.

4.1.5 The test setup must be adequately grounded to dissipate static charges generated during filling and testing.

4.1.6 Fixtures and fittings must be provided in order to simulate fluid installation interfaces. If a test or setup unit is used for setting up the test rig, the actual fixtures and fittings of the test setup must be used.

4.1.7 Flow setting and measurement piping arrangement is optional in order to allow simulation of operational arrangement (see Figure 1). However, the arrangement must be such that the total pump flow can be determined and monitored by one or a combination of the flow meters.

4.1.8 The sample container shall be constructed of a material that does not contribute to the lubricity of the sample per ASTM D 4306.

4.2 The test setup shall be prepared by installing the test fluid in the test setup and circulating with the test pump or a test equipment pump, in place of the test pump, to obtain the required fluid condition in accordance with 3.2. The affected piece parts shall be replaced if used for set up preparation and if more than 10 h is required to obtain the required fuel condition.

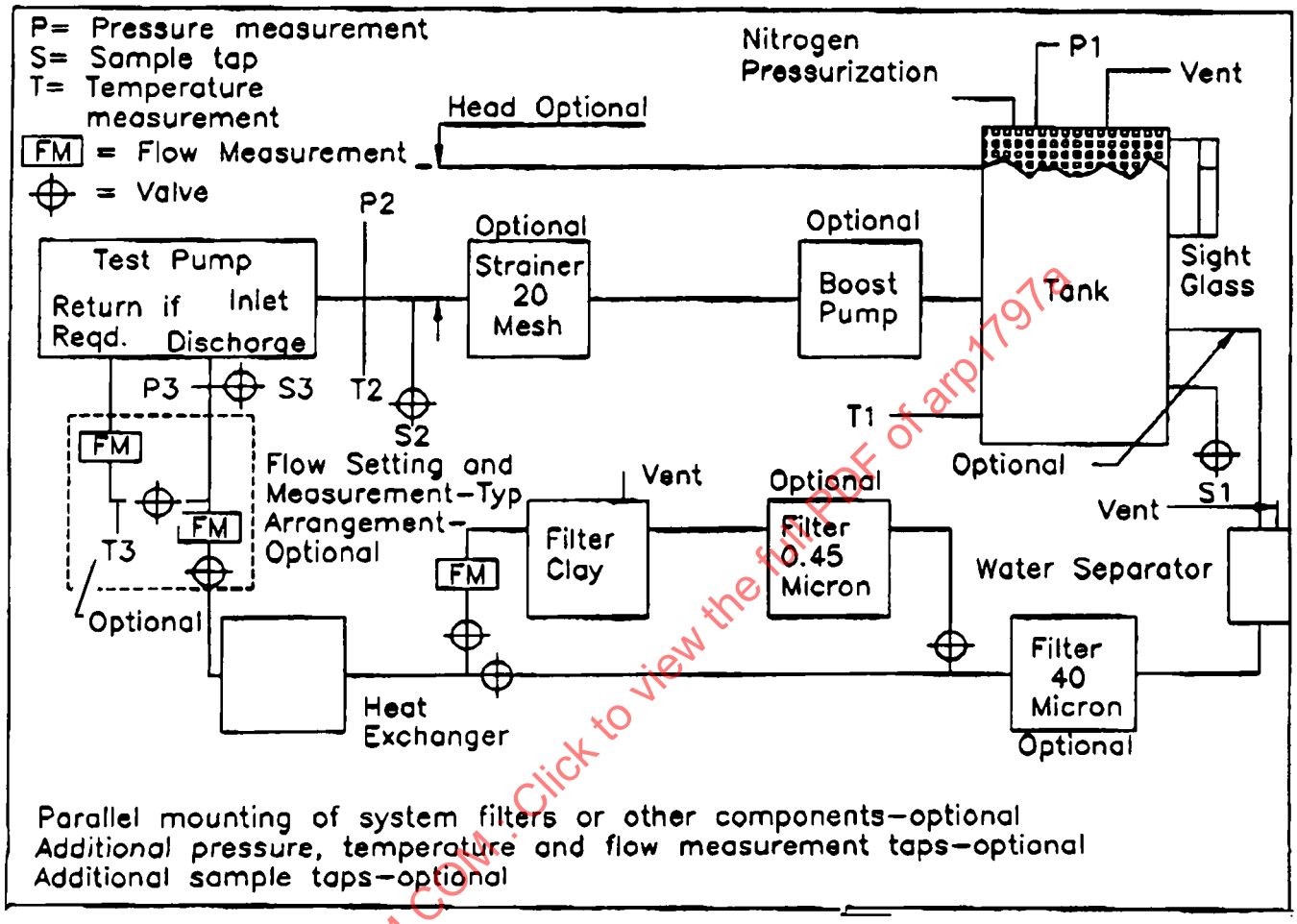

FIGURE 1

4.3 The test pump shall be prepared for test as follows:

4.3.1 The pump shall be assembled and acceptance tested in accordance with applicable assembly and acceptance test requirements. In addition, pump performance shall be recorded at the test conditions at which the pump will be operated during endurance testing per 4.4.

4.3.2 The pump shall be disassembled, visually inspected and photographed, and all unusual part conditions recorded. All pertinent wear surfaces shall be measured and recorded in a manner to provide a basis for wear determination.

4.3.3 Following inspection, each detail part shall be washed with an unchlorinated solvent and then flushed with test fluid that complies with the requirements for test fluid as defined in 3.2.