



AEROSPACE RECOMMENDED PRACTICE

ARP1953™**REV. B**

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Superseding ARP1953A

(R) Acceptance Test Procedures and Standards
to Ensure Clean Fuel System Components

RATIONALE

This document has been modified to: (1) Update outdated references and delete references that are no longer valid, (2) Add references to ISO 4402 and AIR5455, (3) Reference ISO 11171 for the calibration of automatic particle counters and provide the corresponding size ranges with this calibration in Table 1, (4) Add a paragraph 4.2.2.1 discussing the ISO 11171 automatic particle counter calibration, and (5) Editorial changes.

TABLE OF CONTENTS

1.	SCOPE.....	3
1.1	Purpose.....	3
2.	APPLICABLE DOCUMENTS.....	3
2.1	SAE Publications.....	3
2.2	U.S. Government Publications.....	3
2.3	ISO Publications.....	3
2.4	ANSI Publications.....	4
3.	GUIDELINES FOR ACHIEVING PROPER LEVELS OF CLEANLINESS.....	4
3.1	Cleaning of Detail Parts.....	5
3.1.1	Vapor Degreasing.....	5
3.1.2	Sonic Cleaning.....	5
3.1.3	Probing.....	5
3.1.4	Vacuum Cleaning.....	5
3.1.5	Flushing.....	5
3.1.6	Rinsing.....	5
3.2	Inspection of Detail Parts.....	5
3.2.1	Particle Contamination.....	6
3.3	Preservation and Handling of Detail Parts Following Inspection.....	6
3.4	Assembly.....	6
3.5	Flushing after Final Assembly.....	7
3.6	Calibration and Acceptance Tests.....	8
3.7	Preparation for Shipment.....	8

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4.	TEST PROCEDURES FOR VERIFICATION OF LEVEL OF CLEANLINESS	8
4.1	Methods to Obtain Fluid Samples.....	8
4.1.1	Static Components.....	8
4.1.2	Dynamic Components.....	8
4.1.3	System Specified Requirements.....	9
4.2	Methods of Sample Evaluation	9
4.2.1	Particle Count Analysis – Optical Microscope	9
4.2.2	Automatic Particle Count	9
4.3	Comparison of Sample with Allowable Cleanliness Level (ACL)	10
5.	NOTES	10
APPENDIX A	BIBLIOGRAPHY	11
Table 1A	Allowable cleanliness level (ACL) particle size and count per 100 ml sample volume	4
Table 1B	Typical areas in which these classifications can be used.....	5
Table 2		6
Table 3		7

1. SCOPE

To describe general guidelines for achieving selected levels of cleanliness in gas turbine engine fuel system components and to describe laboratory methods for measuring and reporting the contamination level of the wetted portion of fuel system components. As in SAE J1227 (covering hydraulic components) this practice includes guidelines for levels of acceptance but does not attempt to set those levels.

1.1 Purpose

To provide standards and procedures for processing and verification to insure an acceptable level of product cleanliness in gas turbine engine fuel system components.

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 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

ARP598	Aerospace Microscopic Sizing and Counting of Particulate Contamination for Fluid Power Systems
AIR5455	Impact of Changes in Test Dust Contaminants and Particle Counter Calibration on Laboratory Filter Element Performance and Fluid Cleanliness Classes
J1227	Assessing Cleanliness of Hydraulic Fluid Power Components and Systems

2.2 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-C-15074	Military Specification: Corrosion Preventive, Fingerprint Remover
MIL-STD-2073-1	Department of Defense Standard Practice for Military Packaging
MIL-PRF-7024	Performance Specification, Calibrating Fluids, Aircraft Fuel System Components
MIL-PRF-16173	Performance Specification: Corrosion Preventive Compound, Solvent Cutback, Cold Application

2.3 ISO Publications

Available from International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland, Tel: +41 22 749 01 11, www.iso.org.

ISO 4021	Hydraulic Fluid Power - Particulate contamination analysis - Extraction of fluid samples from lines of an operating system
ISO 4402 ¹	Hydraulic fluid power - Calibration of automatic-count Instruments for particles suspended in liquids - Method using classified AC Fine Test Dust contaminant

¹ ISO 4402 has been withdrawn as of 12/9/1999.

ISO 11171 Hydraulic Fluid Power - Calibration of automatic particle counters for liquids

ISO 14644 Clean Rooms and Associated Controlled Environments Package

2.4 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI B93.44 (1978) Extracting Fluid Samples from a Reservoir of an Operating Hydraulic Fluid Power System

3. GUIDELINES FOR ACHIEVING PROPER LEVELS OF CLEANLINESS

Most manufacturers of gas turbine engine fuel system components rely on process control to maintain the necessary degree of cleanliness in the products they produce. However, a quantitative cleanliness requirement, issued by the airframe or engine manufacturer, consistent with the contamination tolerance of the most sensitive components in the fuel system, will establish a logic for each component manufacturer to follow. Subtier vendors would then have a clearly established allowable cleanliness level for their particular application which would be included as a detailed specification for that component. The vendor specification should define two terms in order to be consistent with existing hydraulic system cleanliness guidelines.

- a. Allowable Cleanliness Level: The allowable cleanliness level must be consistent with the contamination tolerance of the most sensitive component in the fuel system. It will be abbreviated throughout the remainder of this document for simplicity and called "ACL". The ACL is organized as a series of particle sizes per 100 ml of test fluid arranged into classes. The classes are defined in this document in Table 1.
- b. Recommended Cleanliness Level: The recommended cleanliness level is the initial cleanliness of the entire test apparatus used for measuring ACL and should be specified as not more than 10% of the count permitted for ACL. This will insure that test apparatus will have a minor impact on the ACL measurement. This level will be abbreviated throughout this document as "RCL".

The subtier vendor will then select appropriate processes consistent with the specification and could, if required, verify on a statistical basis, compliance with that requirement. The phases of production which must be controlled and monitored to achieve satisfactory levels of cleanliness will be described in this section. No order of preference for methods is implied. No attempt will be made to establish what level of control is required to lead to a level of cleanliness. This must be established and verified separately by suppliers in their own facilities. The proof of conformance will be with periodic verification tests of the end product against the specified system allowable cleanliness level.

Table 1

**Table 1A - Allowable cleanliness level (ACL)
Particle size and count per 100 ml sample volume**

Particle Size Range		ACL 6	ACL 5	ACL 4	ACL 3	ACL 2	ACL 1
Optical Microscope Count (µm)	Automatic Particle Counter; ISO 11171 calibration [µm(c)] ¹						
> 100	> 71	1	1	1	1	4	10
50 – 100	38 - 71	2	5	15	40	100	270
25 - 50	21 - 38	30	85	250	600	1700	4200
15 - 25	14 - 21	170	480	1300	3500	9000	24 000
10 - 15	10 - 14	550	1500	4000	11 000	29 000	75 000
5 - 10	6 - 10	2700	17 000	19 500	50 000	130 000	350 000
1 - 5	4 - 6	11 000	30 000	85 000	210 000	600 000	1 500 000
Total Particle Count		14 453	39 071	110 066	275 141	769 804	1 953 480

Note 1: ISO 11171 particle size ranges equivalent to the size ranges for optical microscope count. See 4.2.2.1 for more information regarding ISO 11171 automatic particle counter calibration.