



SURFACE VEHICLE STANDARD

J1985™

DEC2023

Issued 1993-10
Revised 2023-12

Superseding J1985 OCT2013

(R) Fuel Filter - Initial Single-Pass Efficiency Test Method

RATIONALE

The previous method required gravimetric measurements of the injection system's contamination level to be used as one criteria for acceptance of a performed test. A replacement acceptance criteria has been added that is based on the upstream particle counts that correspond to the expected counts at the original required contamination gravimetric level. The distribution of upstream particle counts provides more detail of the contaminant challenging the test filter than a gravimetric value and can be used to assess the stability of the filter's upstream challenge. Further, gravimetric results can have a large variation at low contaminant concentrations. The revised standard provides a range and standard deviation of acceptable upstream particle counts for the sizes analyzed which are used to assess the acceptance of a completed test.

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Documents

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1. SCOPE

This SAE Standard is intended for all sizes of fuel filters, so a variety of test stands may be required depending upon flow rate. The low contamination level, downstream clean-up filter, and short duration of the test ensure that the particle retention ability of the filter is measured in a single pass, as no appreciable loading or regression will occur.

1.1 Purpose

The purpose of this test is to provide a method to determine the ability of a fuel filter to retain a given size of particle in a single pass.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J1696 Standard Fuel Filter Test Fluid

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM D2624 Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels

ASTM D4308 Test method for Electrical Conductivity of Liquid Hydrocarbons by Precision Meter

2.1.3 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 2942 Hydraulic Fluid Power - Filter Elements Verification of Fabrication Integrity and Determination of the First Bubble Point

ISO 3968 Hydraulic Fluid Power - Filters Evaluation of Differential Pressure Versus Flow Characteristics

ISO 4021 Hydraulic Fluid Power - Particulate Contaminant Analysis - Extraction of Fluid Samples from Lines of an Operating System

ISO 4405 Hydraulic Fluid Power - Fluid Contamination - Determination of Particulate Contamination by the Gravimetric Method

ISO 11171 Hydraulic Fluid Power - Calibration of Automatic Particle Counters for Liquids

ISO 11943 Hydraulic Fluid Power - On-Line Automatic Particle Counting Systems for Liquids - Methods of Calibration and Validation

ISO 12103-1 Road Vehicles - Test Dust for Filter Evaluation - Part 1: Arizona Test Dust

3. TEST MATERIAL AND EQUIPMENT

3.1 Test Fluid

Use test fluid conforming to SAE J1696 at $40\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

3.2 Test Contaminant

3.2.1 Use ISO 12103-1, A2 Fine test dust.

3.2.2 The test contaminant should be dried using an open container with a contaminant depth of less than 25 mm in a convection oven at a temperature of 110 to 150 °C for 2 hours. Dried dust should be stored in a desiccator prior to filter testing.

3.2.3 The test contaminant should be poured into the injection system reservoir in a slurry form. The slurry can be prepared using a clean, 200 to 300 mL sample of the test fluid and a mixing jar. After combining the fluid and contaminant in the jar, mix vigorously. Placing the jar in an ultrasonic bath for 2.5 minutes $\pm$ 0.5 minutes after initial mixing is recommended. Add slurry to injection reservoir immediately after removal from ultrasonic bath. Rinse remaining contaminant from jar with a spray bottle of clean test fluid or an adequate volume from the injection reservoir to transfer any remaining contaminant.

3.3 Filter Performance Test Circuit

Use a filter performance test circuit comprised of a “filter test system” and a contaminant “injection system” as shown in Figure 1.

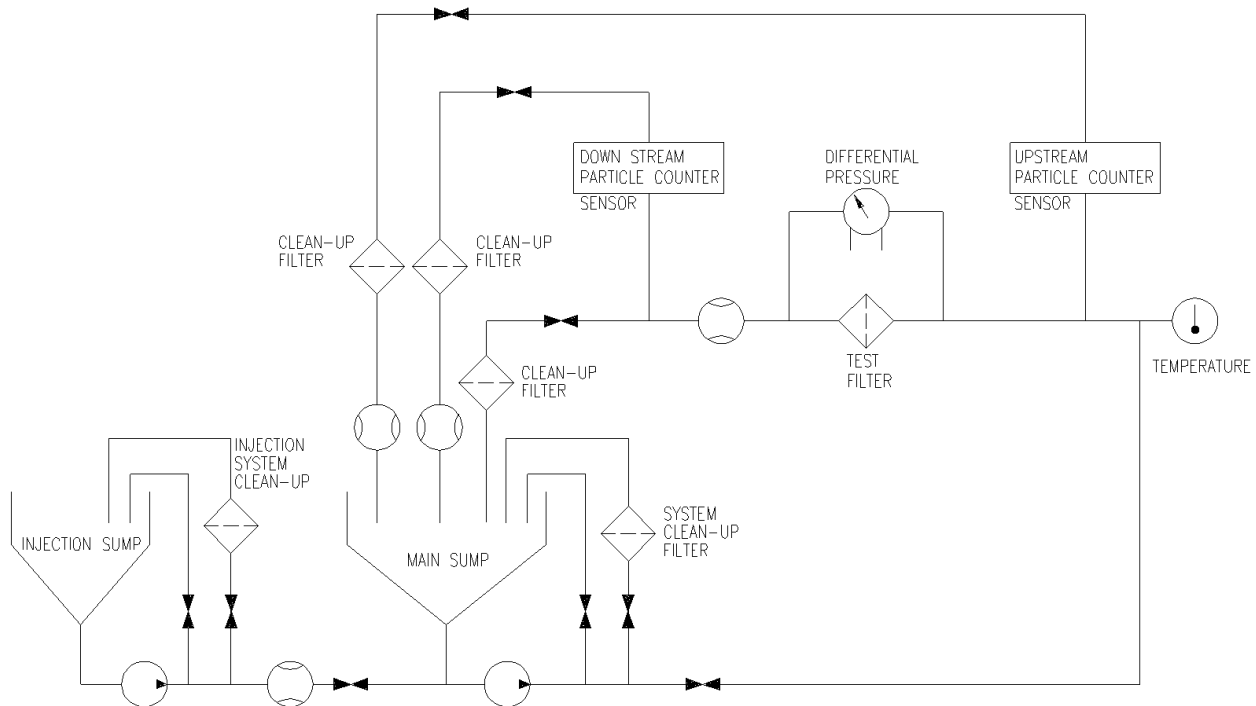


Figure 1 - Informative filter performance test circuit diagram

3.4 Filter Test System

3.4.1 Reservoir

A reservoir constructed with a conical bottom having an included angle of not more than 90 degrees and where the fluid is diffused below the surface.

NOTE: This reservoir design avoids a horizontal bottom and minimizes contaminant settling while the subsurface diffusion reduces the entering of air and gives good mixing capabilities.

3.4.2 Pump

The pump(s) should be insensitive to the contaminant.

WARNING: Pumps exhibiting excessive flow pulses cause erroneous results.

3.4.3 System Clean-Up Filters

The system clean-up filters necessary to obtain initial system cleanliness level of less than 1% of the minimum level specified in Table 2 for the smallest particle size to be counted.

3.4.4 Instrumentation

Pressure gauges, temperature indicator, and flow meters in locations as shown in Figure 1.

3.4.5 Pressure Taps

Pressure taps in accordance with ISO 3968.

3.4.6 Sampling

Upstream and downstream sampling means in accordance with ISO 4021.

3.4.7 Interconnecting Lines

Interconnecting lines which ensure turbulent mixing conditions exist throughout the filter test system and avoids silting areas and contaminant traps.

3.4.8 Particle Counter

Use automatic particle counters calibrated per ISO 11171.

3.4.9 On-Line Counting System

The on-line counting system shall be in accordance with ISO 11943.

3.5 Contaminant Injection System

3.5.1 Reservoir

A reservoir constructed with a conical bottom having an included angle of not more than 90 degrees and where the fluid is diffused below the surface.

NOTE: This reservoir design avoids a horizontal bottom and minimizes contaminant settling while the subsurface diffusion reduces the entering of air and gives good mixing capabilities.

3.5.2 Pump

Use a hydraulic pump (centrifugal or other type) which does not alter the contaminant particle size distribution.

3.5.3 System Clean-Up Filters

A system clean-up filter capable of providing an initial system contamination level less than 1% of the minimum level specified in Table 2 for the smallest particle size to be counted.

3.5.4 Instrumentation

Flow meter in location as shown in Figure 1.

3.5.5 Pressure Taps

Pressure taps shall be in accordance with ISO 3968.

3.5.6 Sampling

A sampling means for the extraction of a small flow (injection flow) from a point in the contaminant injection system where active circulation of fluid exists. Sample per ISO 4021.

3.5.7 Interconnecting Lines

Interconnecting lines which ensure turbulent mixing conditions exist throughout the filter test system and avoids silting areas and contaminant traps.

NOTE: Alternate contaminant injection system may be used provided that injection system meets validation requirements.

4. TEST CONDITION ACCURACY

Set up and maintain equipment accuracy within limits given in Table 1.

Table 1 - Equipment accuracy limits

Test Conditions	Unit	Maintain Within $\pm$ of True Value
Flow	L/min	2%
Pressure	kPa	2%
Temperature	°C	5 °C
Volume	L	2%

5. VALIDATION OF CONTAMINANT INJECTION SYSTEM

- 5.1 Validate at the maximum gravimetric level, the maximum injection circuit volume, minimum injection flow rate and for the length of time required to deplete the usable volume.
- 5.2 Add the required quantity of contaminant in slurry form to the injection fluid and circulate for a minimum of 15 minutes. Initiate injection flow from the contaminant injection system, collecting this flow external to the system.
- 5.3 Obtain an initial injection fluid sample at this point and measure the injection flow rate.
- 5.4 Maintain the injection flow rate within $\pm 5\%$ of the desired injection flow rate.
- 5.5 Obtain samples of the injection flow and measure the injection flow rate at 30 minutes, 60 minutes, 90 minutes, and 120 minutes, or at a minimum of four equivalent intervals depending on the system's depletion rate.