



AEROSPACE RECOMMENDED PRACTICE

ARP900™**REV. C**

Issued 1975-07
Revised 2019-12
Reaffirmed 2026-01

Superseding ARP900B

(R) Methods for Evaluating Cryogenic Filters

RATIONALE

This document has been rewritten to reflect its use as a Recommended Practice. In addition, other technical and editorial improvements have been made.

ARP900C has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

The purpose of this document is to present test methods that can be utilized to evaluate the filtration and operating characteristics of filters that will be utilized in a cryogenic system. The methods presented herein are intended to supplement standard filter testing specifications to allow evaluation of filter performance characteristics in areas that could be affected by extreme low temperatures.

1.1 Field of Application

The test methods can be utilized to evaluate filters for particle sizes equal to or greater than 5.0 μm and flows up to and including 60 gpm (230 L/min) capacity. If higher flow rate filters are to be evaluated in accordance with the test methods presented herein, it will be necessary to increase the system flow capacity and the size of effluent sampling system from those recommended in this document.

NOTE: The test methods presented herein do not encompass testing of cryogenic bypass relief valves, differential pressure indicators, gages, or components other than a basic filter housing and element.

2. REFERENCES

2.1 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.

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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.

ARP901 Bubble-Point Test Method

AS598 Aerospace Microscopic Sizing and Counting of Particulate Contamination for Fluid Power Systems

2.1.2 Military Standards

Available from the Document Automation and Production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://quicksearch.dla.mil/>.

MIL-STD-810 Environmental Engineering Considerations and Laboratory Tests

3. TEST EQUIPMENT

3.1 Liquid Nitrogen Source

The liquid nitrogen source should be capable of maintaining a constant single phase flow rate of 60 gpm (230 L/min), or a flow rate equal to the test filter's rated flow if less than 60 gpm (230 L/min), at a gage pressure of 200 psi (1379 kPa) for a minimum period of 3 minutes.

3.2 Membrane Filter Holder

Holders designed for 47 mm diameter membrane filters should be used downstream of the test filter. Such holders should have suitable backing to support the membrane without rupture for the pressure drops involved. The effective filtering area of the holders should be measured in accordance with AS598. It may be necessary to modify the filter holders by installing a polytetrafluoroethylene seal to eliminate external leakage at cryogenic temperatures.

3.2.1 Membrane Filters

Membrane filters as defined in AS598 should be used in the holders when taking effluent samples.

3.3 Desiccator

A desiccator should be utilized to remove moisture from the membrane filters prior to test.

3.4 Effluent Optical Inspection Equipment

The effluent samples obtained during the maximum particle test, specified herein, should be examined and sized utilizing the microscopic equipment described in AS598.

3.5 Pressure Gages

All pressure gages should have an accuracy equal to or better than $\pm 0.5\%$ at the point of measurement. They should be attached to the system utilizing a minimum length of 18 inches (46 cm) of 0.25 inch (6.4 mm) diameter tubing to ensure an ambient temperature at the pressure gage.

3.6 Differential Pressure Instruments

All differential pressures should be observed utilizing a differential pressure gage or transducer. The overall error, inclusive of the recording system, should not exceed $\pm 1\%$ at the point of measurement. The pressure lines to the differential gage should have a minimum length of 18 inches (46 cm) of 0.25 inch (6.4 mm) diameter tubing between the gage and the system to ensure temperature stabilization at the gage.

3.7 Temperature Measuring Instruments

A temperature sensor having an accuracy of $\pm 10^\circ\text{F}$ ($\pm 5.5^\circ\text{C}$) at the point of indication should be utilized to record temperatures. The response time of the temperature sensor should not be more than 1.0 second.

3.8 Flow Meters

A differential head orifice type flowmeter, or a cryogenic fluids compatible turbine flowmeter, should be utilized to determine the system flow rate. The flowmeter should have traceability to National Institute of Standards and Technology (NIST). The overall error of the flow meter and recording system combined should not exceed a root mean square of $\pm 4\%$ at the point of measurement.

3.9 Manometer

A manometer calibrated in 0.1 inch (2.5 mm) subdivisions should be utilized for pressure measurements below 2 psig (14 kPa).

3.10 Mass Spectrometer Leak Detector

A mass spectrometer capable of detecting a minimum leakage of 1×10^{-5} std cc/s should be used.

3.11 Sampling Chamber

The sampling chamber utilized in the low temperature leakage test system shown in Figure 1 should have an internal volume of no more than 300 in³ (5 L) after deducting the volume of the test filter. The complete chamber should be sealed prior to testing. The sampling port should be located at the top of the helium sampling box.

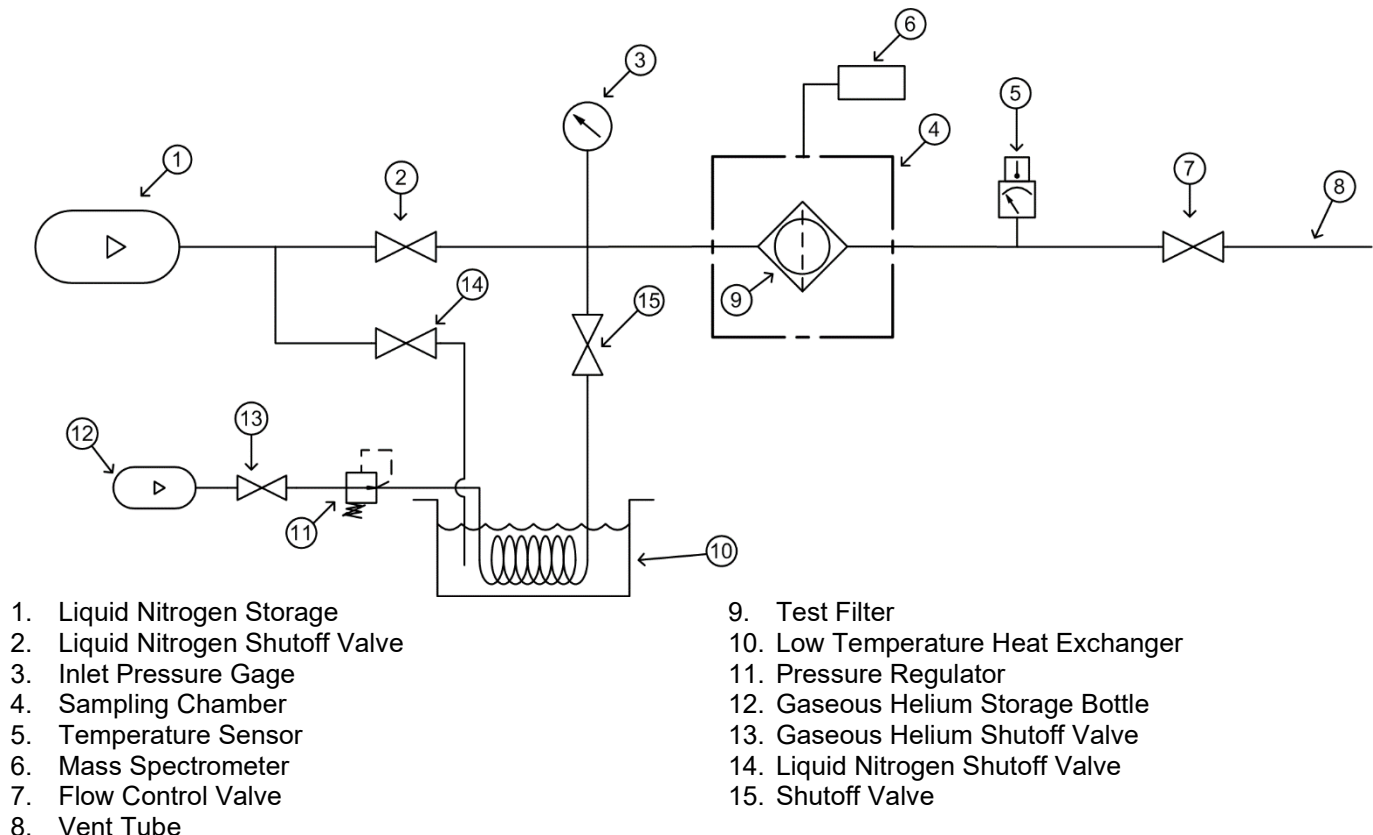


Figure 1 - Low temperature external leakage test system