

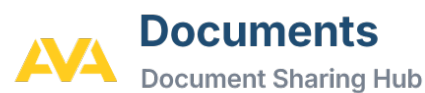
SPECIFICATIONS AND QUALIFICATION PROCEDURES FOR
AVIATION FUEL FILTER MONITORS WITH
ABSORBENT TYPE ELEMENTS

API/IP SPECIFICATION 1583

Third edition
November 2000



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Published jointly by
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and
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CONTENTS

	Page
Foreword	vii
Acknowledgements	viii
1 General	1
1.1 Scope	1
1.2 Disclaimer	1
1.3 Safety precautions	1
1.4 Referenced publications	1
1.5 Abbreviations	2
1.6 Description	2
1.7 Product quality assurance	4
2 Filter monitor elements	5
2.1 Mechanical specifications	5
2.2 Test procedures	6
3 Filter monitor vessels	13
3.1 Mechanical specifications for vessels (50 mm (2 inch) and 150 mm (6 inch) nominal diameter elements only)	13
3.2 Standard accessories	16
3.3 Optional accessories	17
4 Supplementary information	19
4.1 Test materials and facilities	19
4.2 Similarity conditions for elements of lengths other than that of the qualified element	22
4.3 Laboratory analysis of media migration samples	23
4.4 Run 11, compatibility tests	24
4.5 Test sampling schedule and procedure table	27
4.6 Conversion of filter-separator and microfilter vessels	29
4.7 Unit conversion factors	31

FOREWORD

This publication, which has been prepared jointly by the Institute of Petroleum Aviation Committee and the American Petroleum Institute Aviation Technical Services Sub-Committee, is intended to provide the industry with comprehensive specifications and qualification test procedures for filter monitors with absorbent type elements suitable for use in aviation fuel handling systems.

These specifications are for the convenience of purchasers in ordering, and manufacturers in fabricating, filter monitor vessels and elements of the absorbent type. They are not in any way intended to prohibit either the purchase or manufacture of filter monitors meeting other requirements.

Any manufacturer wishing to offer filter monitors conforming to these specifications is responsible for complying with all the mandatory provisions of these specifications, plus any optional provisions requested by the purchaser.

The purchaser may make any investigations considered necessary to confirm that the manufacturer has conformed to these specifications. The purchaser is recommended to exercise this right by inspecting equipment independently of any supervisory inspection furnished by the manufacturer.

Once vessel and element approvals have been granted by a purchaser, no design or materials changes are to be made by the manufacturer without first seeking the purchaser's prior approval. The purchaser will then have the right to insist on a partial or complete retest of the filter monitor by the manufacturer to confirm its performance still complies with these specifications. Purchasers may also request partial or complete retests should they have reasonable grounds for believing the performance of filter monitor elements has deteriorated from the original test standard.

It is anticipated that purchasers may wish to install absorbent type filter monitor elements in vessels originally designed for use with other types of elements. In these cases the element specification and performance requirements of this publication may be used for the purchase of elements without a new filter monitor vessel.

Note that this is the third edition of this specification. The first edition published in 1987 and the second in 1995 are no longer applicable.

In the course of developing this edition of the specification, alignment with other aviation filtration specifications has been the main driver. The need for improved element performance was not a major concern within the industry except in one particular low flow application, now covered by Run 12 compliance. Rig tests of elements meeting second edition requirements using the third edition protocols contained herein have shown that there is equivalence in performance demands between this and the previous edition. It is therefore anticipated that provided the product complies with the requirements of Run 12, second edition equipment covered by this specification may remain approved subject to the purchaser's agreement and rights described above.

Although it is hoped and anticipated that this publication will assist both the manufacturers and purchasers of filter monitors with absorbent type elements, the Institute of Petroleum and the American Petroleum Institute cannot accept any responsibility, of whatever kind, for damage or loss, or alleged damage or loss, arising or otherwise occurring as a result of the application of the specifications or qualification procedures contained herein.

ACKNOWLEDGEMENTS

This edition of API/IP 1583 has been prepared by the IP Filtration Sub-Committee on behalf of the Institute of Petroleum and the American Petroleum Institute. Much of the redrafting was undertaken by Vic Hughes (Shell Aviation Ltd) and Trevor Sanderson (Shell Aviation Ltd).

Draft versions of this third edition were reviewed by representatives of the following companies:

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USAF
Velcon Filters

1

GENERAL

1.1 SCOPE

This publication covers the recommended minimum performance and mechanical specifications for filter monitor equipment and the recommended testing and qualification procedures.

This publication refers specifically to the use of elements of 50 mm (2 inch) and 150 mm (6 inch) nominal diameters.

The specifications do not cover trigger type monitor elements.

The specifications do not cover the operation and performance of this type of equipment in fuels containing Fuel System Icing Inhibitor (FSII). This fuel additive is unique and makes unusually difficult demands on filtration and water separation/removal devices. Operators using such additives in aviation fuels are recommended to ensure for themselves the performance capabilities of filtration equipment by contacting the filter manufacturer for such information.

Note 1: Performance testing of elements of different nominal diameters is outside the scope of this specification. However the test principles described in this document may be adapted to apply to such elements and it is the responsibility of the manufacturer to adjust test parameters accordingly.

Note 2: The document uses S.I. units throughout except where there is no practical conversion equivalent. Where appropriate, alternative units in common usage are given in brackets. Section 4.7 lists the unit conversion factors used in this specification.

1.2 DISCLAIMER

The inclusion of additive packages in this specification is for testing purposes only and does not constitute acceptance or rejection of these additives in jet fuels.

1.3 SAFETY PRECAUTIONS

It has been assumed by the specification writers that all users of this specification will, if not themselves fully trained, at least be under the supervision of a responsible trained person who will be familiar with all normal laboratory and engineering safety practice, and that all such precautions will be observed. It is the responsibility of users of the specification to ensure that the requirements of locally prevailing health and safety legislation are fully complied with.

1.4 REFERENCED PUBLICATIONS

The following publications are cited in this publication, the latest available edition of each referenced publication applies.

IP

IP 216 *Determination of particulate contaminant of aviation turbine fuels by line sampling (ASTM D 2276)*

IP 274 *Petroleum products - Aviation and distillate fuels - Determination of electrical conductivity (ISO 6297)*

IP 452 *Determination of the water shedding property (WASP) of aviation kerosine*

ASME¹

Boiler and pressure vessel code, Section VIII: Rules for construction of boilers and pressure vessels

ASTM²

D 156 *Test method for saybolt colour of petroleum products (Saybolt chromometer method)*

D 381 *Test method for existent gum in fuels by jet evaporation*

D 1094 *Test method for water reaction of aviation fuels*

D 1655 *Specification for aviation turbine fuels*

D 2624 *Test method for electrical conductivity of aviation and distillate fuels containing a static dissipater additive*

D 3240 *Test method for undissolved water in aviation fuels*

D 3948 *Test method for determining water separation characteristics of aviation turbine fuels by portable separometer*

MoD³

Defence Standard 91-91/Issue 3 Turbine fuel, aviation kerosine type, Jet A-1 NATO Code: F-35, Joint service designation: AVTUR (DERD 2494)

JIG⁴

AFQRJOS Aviation fuel quality requirements for joint operating systems

US Military⁵

MIL-I-25017 Inhibitor, corrosion (for aircraft engine fuels)

1.5 ABBREVIATIONS

The following abbreviations are used within this publication:

cu	conductivity unit
FSII	fuel system icing inhibitor
gal.	gallon
gpm	US gallons per minute
kPa	kilopascal
lbf/in ²	pound per square inch
litres/sec/m	litres per second per metre length
mg	milligram
mm	millimetre
mN/m	millinewtons per metre
ppmv	parts per million by volume
pS/m	picosiemens per metre
Ra	arithmetical mean deviation of an assessed profile
RPM	revolutions per minute
SC	solids content
ST	surface tension
TIR	total indicator reading

1.6 DESCRIPTION

1.6.1 Principles

For the purposes of this specification, a filter monitor is defined as a vessel containing water absorbent filter elements that will continuously remove dirt and water from aviation fuels down to a level acceptable for servicing modern aircraft. It will positively shut off the flow if the concentration of water or dirt is unacceptable. Filter monitors can be of a vertical or horizontal orientation.

-
- 1 American Society of Mechanical Engineers, 3 Park Avenue, New York, New York 10016-5990. www.asme.org
 - 2 American Society for Testing and Materials, 100 Barr Harbour Drive, West Conshohocken, Pennsylvania 19428, USA. www.astm.org
 - 3 Ministry of Defence Directorate of Standardization, Room 1138, Kentigern House, 65 Brown Street, Glasgow G2 8EX, UK. www.dstan.mod.uk
 - 4 Joint Inspection Group, c/o 35 Abercorn Place, London, NW8 9DR, UK.
 - 5 US Military, Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120, USA.

1.6.2 Performance features

A filter monitor shall have the following general features:

- (a) It shall ensure effluent contamination levels are not in excess of the limits given in section 1.6.3 throughout its operational life.
- (b) It shall monitor the full flowing stream and may include a fail-safe feature to prevent unmonitored fuel from bypassing the elements.
- (c) It shall require no external power supply.
- (d) It shall be simple, strong, compact and easy to install and service.
- (e) It shall not contaminate the fuel and fuel properties shall remain within the prescribed limits of the relevant fuel specification.
- (f) When triggered by a water slug the total fluid leakage through the device shall not exceed 1 % of the rated flow of the device.

1.6.3 Performance specifications

1.6.3.1 Effluent fuel contamination limits

Determined from samples taken during the qualification test procedures, and analysed by the specified methods therein, the effluent fuel contamination shall not exceed:

Total solids ⁶	-	0.26 mg/litre (1.0 mg/U.S. gal.) average
	-	0.5 mg/litre (1.9 mg/U.S. gal.) maximum
Free water	-	15 ppmv
Media migration ⁷	-	10 fibres/litre
Appearance	-	the effluent fuel shall be clear and bright.

1.6.3.2 Flow rate

Two inch nominal diameter elements shall meet the performance specifications at a nominal flow rate (see section 2.1.1) of 2.5 litres/sec/m (1.0 gpm/inch length).

Six inch nominal diameter elements shall meet the performance specification at a nominal flow rate of 10 litres/sec/m (4.0 gpm/inch length).

More specifically, the flow rates for any length of element shall meet the effective flow rate criteria described in section 4.2.

1.6.3.3 Solids holding capacity

The solids holding capacity is measured as the time taken for an element to reach 1.5 bar pressure differential at full rated flow with an influent solids addition rate of 10 mg/litre.

- Blocking time for 50 mm (2 inch) nominal diameter elements - at least ten minutes.
- Blocking time for 150 mm (6 inch) nominal diameter elements - at least fifty minutes.

1.6.3.4 Water holding capacity

The water holding capacity is measured as the time taken for the element to reach 1.5 bar pressure differential at full rated flow with a water addition rate of 50 ppmv.

- Blocking time for 50 mm (2 inch) nominal diameter elements - at least ten minutes
- Blocking time for 150 mm (6 inch) nominal diameter elements - at least forty minutes

1.6.3.5 Water slug test

A water slug is defined as a volume of water equivalent to at least 1 % of element or vessel rated flow per minute or equivalent to at least the water holding capacity of the element(s). When subjected to a water slug, the element(s) shall effectively shut down flow in accordance with section 1.6.2.

-
- 6 The average total solids in the effluent fuel will be the arithmetic average for each run calculated from the total solids passed and the total sample volume. No individual sample shall exceed 0.5 mg/litre. If a sample is being taken when an element reaches the differential pressure at which the test run should stop, sampling may be discontinued immediately and where possible the pro-rated result should be calculated and included in determining the average.
 - 7 Any particle in the effluent having a length to diameter ratio of 10 to 1 or more and having a length of 100 microns or more, shall be counted as a fibre from the elements. The maximum number of such fibres permissible in the effluent is 10/litre of fuel. Also, the effluent fuel shall be clear and bright.

1.6.3.6 Pressure differential

The differential pressure across a vessel having new elements operating at rated flow with clean and dry fuel shall not exceed 0.55 bar.

1.6.3.7 Element structural strength

The element shall be capable of withstanding a maximum differential pressure of 12 bar for five minutes without structural failure. Deformation of the element shall not prevent the monitor shutting down and stopping the flow.

1.6.3.8 Effluent fuel conductivity requirement

When tested in fuel containing Additive I (in accordance with Section 2) the minimum effluent fuel

conductivity shall be >50 pS/m. The term conductivity unit (cu) is equivalent to pS/m.

1.7 PRODUCT QUALITY ASSURANCE

A product quality assurance programme shall be adopted by the manufacturer. As a minimum, the programme shall include the annual testing of each qualified element type using the mandatory single element test protocols included in this publication. The test results shall be filed with the results of the qualification tests and be made available to the purchaser if requested.