

Bulletin 2022.1 Water Barrier Filtration January 2022



Following the IATA Super Absorbent Polymer (SAP) Special Interest Group report, the aviation fuel industry has collaborated to evaluate alternative technologies that can be fitted into existing fueling equipment. After rigorous evaluation, ATA103 is being modified to incorporate the second of these replacement technologies: the water barrier filter. Airlines for America (A4A) will continue working together with the International Air Transport Association (IATA) and the Joint Inspection Group (JIG) to assess other replacement technologies for potential inclusion in ATA103.

As outlined in A4A Bulletin 2019.1, an **interim** decision had been made to continue accepting EI 1583 (7th edition) filter monitor elements in the ATA103 beyond the specification withdrawal in 2020. A4A reiterates that filter monitors containing SAP have no future in commercial aviation and will be phased out. Additional guidance on filter monitor phase out timing is expected soon. It is imperative that into-plane fueling providers continue strict adherence to A4A Bulletin 2017.2 and the ATA103 filter monitor operational parameters.

What are EI 1588 Water Barrier Filters?

EI 1588 qualified water barrier filters remove free water, dirt, and solid particulates from fuel. The hydrophobic water barrier repels free water on the filter's upstream side, functioning like a waterproof jacket or a non-stick cooking pan. No water is absorbed into or retained by the element. Free water is repelled back into the upstream side of the vessel while fuel flows through. When flow stops the free water collects in the vessel sump or low point where it can be drained. Dirt and solid particulates are retained on the elements themselves.

These filters come in a variety of formats and can be fitted into existing vessels currently used for filter monitors. Currently, only 2" (inch) diameter elements are EI qualified; additional element diameters are expected to undergo EI qualification testing soon. **Because not all formats have been EI qualified, operators shall verify with the filter manufacturer that a valid qualification exists for the water barrier filter.**

Important factors in the use of water barrier filters

While the water barrier filters are being incorporated into the ATA103 as one replacement for filter monitors, operators should consider several critical factors when using water barrier filters:

- This system may not be suitable for all fueling operations. Data collected during an 18-month in-service evaluation of water barrier filters, showed filters were very efficient at removing both free water and solid contaminations from jet fuel. However, water barrier filters are prone to premature blocking (relative to other filtration types) due to dirt and solid contaminants in fuel. Premature blocking is due to the relatively small pore size, allowing water barrier filters to trap and remove ultra-fine particulates. Unfortunately, this potential for increased fuel cleanliness comes with a decreased useful element service life. Operators should consider performing site-specific small-scale technology evaluations (for example: use in a small number of vehicles/equipment initially) to understand service life expectations for water barrier filters at their location.

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- Water barrier elements may see an increase in differential pressure due to accumulation of dirt, water, or both. When accumulated water is the sole cause for increased differential pressure on water barrier filters, that water can be drained/sumped and the differential pressure should decrease. A decrease in differential pressure (under similar flow conditions) after draining water from the water barrier filter vessel is normal. However, a sudden drop in differential pressure under similar flow conditions without associated draining/sumping being performed, may be a sign of element damage or rupture.
 - Example 1: A fueling takes place on day 1 at a flow rate of 300gpm and the dP is recorded at 7psi. In the morning of day 2, the vessel is drained where it was observed that water was present in the vessel. A fueling occurs on day 2 at a flow rate of 300gpm and the dP is observed at 5psi. Thus, at the same flow rate (300gpm), the dP dropped from 7psi down to 5psi on day 2. However, water was drained from the vessel on the morning of day 2 explaining the decrease in differential pressure. This decrease is normal and expected since the water barrier repels the water on the upstream side of the element rather than retaining the water in the element as filter monitors did.
 - Example 2: A fueling takes place on day 1 at 300gpm and the dP is recorded at 7psi. Later in the day on day 1, another fueling at 300gpm takes place. Once the fueler reached 300gpm it was noted that the dP was still 7psi but 5 minutes later still flowing at 300gpm the dP is observed to have dropped to 3psi. There was no draining of water in that 5-minute period to explain the drop in dP. This decrease is abnormal and indicative of a possible problem with the elements. In this case, fueling should cease, equipment should be pulled out of service and an investigation conducted and/or elements changed.
- Although there was no evidence of increased microbial activity during the in-service evaluation, operators should be aware that any system that holds water may be prone to microbial growth. Annual vessel interior visual inspection is critical to detecting and managing microbial growth.
- There was no evidence of water barrier element disarming due to surfactants during either the in-service evaluation or the laboratory testing of water barrier filters. Monthly checks for water content downstream of filter vessel can help monitor for and expose any potential issues with surfactant disarming.
- Water barrier filters must be installed in accordance with manufacturer procedures. Care should be taken when handling and installing water barrier filters. Ensure that the o-ring and the end cap are properly lubricated prior to insertion in the filter vessel, in accordance with manufacturer procedures. Although water barrier filters are not screw-base elements, some users may apply a gentle twisting motion when inserting filter elements; do not apply significant torque/twisting force during the installation process.
- During this time of transition between filter monitors and other types of 2" diameter filtration technology, it is critical that operators use good Management of Change practices, especially when operating with a fleet of mixed filter types. Operators with mixed fleets must take care to ensure the correct filter is loaded into its intended vessel/vehicle. Each of the 2" diameter filtration technologies operate differently from one another, and operators must be aware of those differences. **Filter elements (water barrier, filter monitors, etc.) may**

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look very similar, use caution to ensure the correct part numbers are installed. Operators shall implement filter segregation and/or labeling to avoid mismatched or incorrect filters from being installed.

A4A welcomes operator feedback on water barrier filter use by emailing fuel@airlines.org.

ATA103 Modifications:

Airlines for America is immediately modifying ATA103 to ***allow the use of water barrier filters.*** The below modification will serve as an interim change to ATA103 until a full revision can be published. Other replacement filtration technologies continue to be evaluated for potential inclusion in ATA103. **ATA 103, revision 2019.1, is modified as follows:**

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2.1. General

[...]

2.1.2. Records

[...]

Records shall indicate when equipment is not used. Retain records in local files as follows:

Record Type	Record Retention Length
Daily Check Records Weekly Check Records Monthly Check Records Quarterly Check Records Semi-Annual Check Records Annual Check Records Fuel Receipt Records Fuel Quality Test Records	12 months
Filter Change Records Filter Inspection Records Product Reclaim Tank Inspection and Cleaning Records Sump Separator Tank Inspection and Cleaning Records Refueler Tank Inspection and Cleaning Records	36 months
Storage Tank Inspection and Cleaning Records Training Records	Indefinitely

[...]

2.8. Aircraft Fueling Equipment Requirements

[...]

2.8.2. Filters

All aircraft fueling equipment shall have a ~~Filter/Separator or a Filter Monitor~~ filter or filter system outlined in [Section 2.8.2.1], [Section 2.8.2.2], [Section 2.8.2.3], or [Section 2.8.2.4].

All filtration vessels shall include:

- (a) Air elimination provisions
- (b) Direct reading differential pressure gauges with an accuracy of +/- 2 PSI
- (c) Manual sump drains - Valves with handles spring loaded to the closed position are recommended

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- (d) Upstream and downstream membrane sampling connections, including probes and dust covers
- (e) Pressure relief valve or other device that will prevent over-pressurization due to thermal expansion of fuel. Include a means for accommodating relieved fuel
- (f) Placards indicating upstream/downstream connections for sampling
- (g) Placard indicating date (month and year) of last filter element change
- (h) An operational data plate in accordance with [\[EI 1596\]](#)

NOTE: An API monogram (API placarding) is not necessary to meet the requirements of this document.

[...]

2.8.2.4. Water Barrier Filters

Water barrier filter elements shall meet the requirements of [EI 1588]. Only 2" (inch) water barrier filter elements shall be permitted.

Water barrier elements shall be replaced on the conditions described in [Section 3.14], not to exceed 12 months.

In addition to the requirements in [Section 2.8.2], water barrier filter vessels shall be equipped with:

- (a) Pressure limiting device that will shut down flow if 15 psi (the changeout differential pressure of the filter) is reached
- (b) Restrictions on reset procedures in the event of a shutdown
- (c) Ability to perform periodic testing of the differential pressure limiting switch
- (d) Placard indicating date (month and year) of last visual inspection of elements and vessel interior

In the event that the pressure limiting device is activated, the operator shall be questioned about the proper monitoring of differential pressure during fueling. Differential pressure records on the vessel shall be examined and corrective action taken if necessary.

NOTE: Water barrier elements will see an increase in differential pressure due to accumulation of dirt, water, or both. When accumulated water is the cause for increased differential pressure on water barrier filters, that water can be drained/sumped and the differential pressure will decrease. A decrease in differential pressure (under similar flow conditions) after draining water from the water barrier filter vessel is normal and elements do not need to be replaced. However, a sudden drop in differential pressure under similar flow conditions without associated draining/sumping being performed (for example: in the middle of a fueling event), may be a sign of element damage or rupture. In such circumstances, fueling shall cease, equipment shall be pulled out of service, and an investigation conducted and/or elements changed. The affected airline shall be notified.

[...]

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2.9. Aircraft Fueling Equipment Checks

[...]

2.9.3. Daily Checks

[...]

2.9.3.2. Filter Sumps

- (a) Filter vessel shall be under pressure, but fuel does not have to be flowing through the vessel when the sample is taken
- (b) Drain approximately one gallon of fuel into a suitable container. Fuel flowing from sump drain valve should be at maximum practicable flow to ensure adequate flushing occurs
- (c) Perform fuel appearance test of filter sumps according to [\[Section 3.1\]](#)
- (d) Record findings of first sample taken according to [\[Section 3.1\]](#)
- (e) Continue to sample until clean, dry fuel is obtained
- (f) Remove unit from service if unable to obtain clean, dry sample after three samples have been drained. Report unusual contamination to aircraft operators if it is anticipated that such contamination may impact aircraft operations

2.9.3.3. Filter Differential Pressure

Under normal flow conditions, check and record differential pressure (Ref. [\[Section 3.9\]](#)).

NOTE: Filter differential pressure shall be periodically monitored during fueling operation. Sudden drops or increases of differential pressure indicates a problem. Fueling shall be immediately terminated and unit removed from service to investigate the problem.

If differential pressure exceeds 15 psi on filter/separators, ~~or~~ 15 psi on filter monitors, 15psi on dirt defense filters, or 15psi on water barrier filters, the equipment shall be removed from service.

[...]

2.9.4. Weekly Checks

[...]

2.9.4.2. Filter Differential Pressure Recorded at, or Corrected to, Maximum Achievable Flow Rate

At the maximum achievable flow rate, check and record the differential pressure and flow rate. Preferably, flow rate should be above 50% of maximum vessel rated flow. Where the filter cannot be

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exposed to the maximum achievable flow rate of the facility, use a procedure endorsed by the manufacturer of the filter elements to correct the differential pressure to maximum achievable flow rate and record the value. Record method used.

[...]

2.9.5. Monthly Checks

2.9.5.1. Filtration Test & Free Water Test

Perform a membrane color/particle (Millipore) test, under flow, downstream of each filter/separator, ~~and filter~~ monitor, dirt defense filter, and water barrier filter vessel.

Perform a free water test downstream of each filter/separator, ~~and filter~~ monitor, dirt defense filter, and water barrier filter vessel.

NOTE: Use of bottom loading connections on tank trucks for recirculation should be avoided in order to prevent erroneous test results.

(Ref. [\[Section 3.2\]](#) and [\[Section 3.3\]](#))

[...]

2.9.8. Annual Checks

2.9.8.1. Filter Vessels and Elements

- (a) A visual inspection of all vessel interiors is to be performed on an annual basis regardless of filter element replacement frequency (Ref. [\[Section 3.13\]](#))
 - 1) Verify that the vessel interior is generally clean and free of water, sediment, evidence of microbial growth or other contamination. Clean interior and repair coating, as necessary
 - 2) Verify that all elements are undamaged and secure
- (b) Verify filter element condition by utilizing procedures outlined in [\[Section 3.14\]](#):
 - Filter coalescer elements service life shall not exceed 36 months
 - Teflon and synthetic separator elements may be reused up to 36 months, provided that they are **cleaned and tested** in accordance with the element manufacturer procedures
 - Filter monitor elements service life shall not exceed 12 months
 - Dirt defense elements service life shall not exceed 36 months
 - Water barrier element service life shall not exceed 12 months

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[...]

3.9. Filter Vessel Differential Pressure

The purpose of observing differential pressure across a filter vessel is to monitor the changing condition of the elements. Whenever fuel passes through a filter, a drop in pressure should occur. The difference in pressure between the inlet and outlet of the filter vessel is known as differential pressure and is one of the more apparent indicators of filter element condition. Differential pressure will fluctuate proportionately to flow rate. Fuel must be flowing through a filter vessel in order to have a differential pressure.

The differential pressure reading shall be taken and recorded daily. For accuracy, these checks should be undertaken when the flow rate is steady, and as close as possible to maximum operating flow rate. Tests on individual filter vessels should be carried out at the same flow rate, if possible.

The filter elements shall be replaced when a sudden drop in differential pressure occurs under similar flow conditions or the filter vessel differential pressure exceeds the following limits:

- Coalescer elements - 15 psi
- Monitor elements - 15 psi
- Dirt defense elements – 15 psi
- Water barrier elements – 15 psi

A recommended best practice is to label differential pressure gauges with the applicable maximum pressure limit.

NOTE: Water barrier elements will see an increase in differential pressure due to accumulation of dirt, water, or both. When accumulated water is the cause for increased differential pressure on water barrier filters, that water can be drained/sumped and the differential pressure will decrease. A decrease in differential pressure (under similar flow conditions) after draining water from the water barrier filter vessel is normal and elements do not need to be replaced. However, a sudden drop in differential pressure under similar flow conditions without associated draining/sumping being performed (for example: in the middle of a fueling event), may be a sign of element damage or rupture. In such circumstances, fueling shall cease, equipment shall be pulled out of service, and an investigation conducted and/or elements changed. The affected airline shall be notified.

Verify proper operation of filter differential gauge(s) in accordance with gauge manufacturers' procedures. Accuracy shall be within +/- 2 PSI. The differential pressure gauge lines and valves should be checked periodically to ensure they are not plugged or restricted.

Some direct reading gauges have small filters in their inlets and other auxiliary components. They shall be maintained according to manufacturer's recommendations.

[...]

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3.14. Filter Element Replacement Criteria

3.14.1. Element Replacement Criteria and Frequency

Filter elements (water barrier, filter monitor, etc.) may look very similar, use caution to ensure the correct part numbers are installed. Operators shall implement filter segregation and/or labeling to avoid mismatched or incorrect filters from being installed. Responsible staff shall be trained to recognize and prevent installation of the wrong filter type.

[...]

3.14.1.5. Water Barrier Filter Elements

Water barrier filter elements shall be replaced when any of the following conditions are met:

1. Differential pressure exceeds 15psi or there is a sudden drop in differential pressure at a comparable flow rate
2. Continuous sump samples indicate surfactants, microbial or solid contaminants
3. 12-month service life has expired
4. Filter Membrane Test indicates elements are not performing (Ref. [Section 3.2])
5. Chemical water detection test indicates a positive reading of more than 30 ppm (Ref. [Section 3.3])

[...]

Questions or requests for further information should be submitted to fuel@airlines.org

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