Operations Bulletin

Bulletin 105	Filter Monitors	11 Dec 2017

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Introduction

This bulletin deals with issues of immediate and significant relevance to all users of Filter Monitor filtration systems in Aviation Fuel service (both Avgas and Jet), including upstream of airport locations. The purpose of this bulletin is to inform current users of all filter monitor filtration systems of:

- Changes in the governing EI 1583 specification for filter monitors
- The position of the IATA SAP Special Interest Group on the future use of filter monitors
- The "Road Map" to phase out filter monitors and provide guidance to manage the change required

This Bulletin is intended to be the first of a series of communications for the implementation of JIG's strategy on phasing out all filter monitor technology, in line with the position of the IATA SAP Special Interest Group. This bulletin supersedes JIG Bulletins 49 and 72. The circumstances that have caused this reissue require immediate consideration and action by all users of Filter Monitor filtration systems in Aviation Fuel service.

Background

- An IATA Special Interest Group (SIG) was set up to share information relating to the presence of Super Absorbent Polymer (SAP) in aircraft engines/fuel systems components
- The SIG is aware of eight safety incidents since April 2010 where the presence of SAP was confirmed in engine/fuel system components
- The SIG has reported that engine and airframe OEM's have not identified a level of SAP that is acceptable in aviation fuel, and that filter monitor manufacturers cannot guarantee that no SAP will pass downstream of filter monitor elements
- The SIG is of the opinion that in light of this filter monitors shall be phased out of all aviation fuel handling systems
- The Energy Institute has issued a revised EI 1583 in consequence
- The experimental work which forms part of SIG's consideration considered only 2 inch filter monitor elements made by three manufacturers and used at Differential Pressures of 15 or 22 psi. Lower Differential Pressure appears to be associated with reduced migration of SAP
- As a result of this work SIG have recommended amongst other actions, that all elements operating at or above 15 psi at maximum flow shall be replaced and that hose-end strainers shall be cleaned as part of commissioning and routine check
- This bulletin seeks to identify initial steps to achieve within a realistic timeframe compliance with EI 1583 7th edition and SIG recommendations for revised hose end strainers and flushing and cleaning procedures in order to reduce (but probably not eliminate) the risks from SAP contaminated fuel.

EI 1583 7th edition

On the 3rd of November 2017, the Energy Institute issued EI 1583 7th edition, which supersedes all earlier EI 1583 editions. The only change in the EI 1583 7th edition is the inclusion of a requirement that SAP is not detectable in fuel downstream of a filter monitor element under test during Qualification Test 1 and 10.

As no other changes have been made to the qualification testing requirements that were included in the 6th edition, existing qualifications to EI 1583 6th edition are recognised as also meeting the requirements of the 7th edition, if the ICP copper values obtained during both qualification test 1 and 10 were below the lower limit of detection for the method (⩽ 50 ppb). This read-across from the 6th to 7th editions applies only to the specific model qualified. However, quoting from the EI statement on filter monitors: "(The) EI will not be maintaining or updating EI 1583 beyond its current 7th edition and will withdraw the specification by no later than 31st December 2020."

As of the 22nd of November 2017, the only elements known by JIG to be claiming compliance to EI 1583 7th edition that are commerically available are those listed in Table 1 below.

Table 1: Filter Monitor Models meeting the requirements of EI 1583 7th edition (as of 22th November, 2017)

	2”	6” Out to In	6” In to Out
FAUDI	M.2-XXX/6B	MO6.X-XXXX/6B	-
PARKER VELCON	2" CDF	None (Note1a)	None (Note1b)
PECO FACET	FG-2XX-7 (Note2a)	None (Note2b)	None (Note2c)

Notes based on information provided by Parker Velcon and PECOFacet, which can be made available to JIG members upon request:

2” elements:

- 2a: Peco Facet’s FG-2XX-6 (EI 1583 6th ed.) do not meet the 7th ed requirements. The stated intention is to start supplying 2” elements from another filter supplier whose elements meet the EI 1583 7th ed. qualification, branded as FG-2XX-7.

6” elements Out to In:

- 1a: Parker Velcon’s stated intention is to requalify the ACO (Out to In) 6” monitor to EI 1583 7th ed. in 2018. It is not known whether this will be successful.
- 2b: PecoFacet’s stated intention is to requalify the Out to In 6” monitor to EI 1583 7th ed. in 2018. It is not known whether this will be successful.

6” elements In to Out. There are no 6” In to Out filter monitor elements qualified to EI 1583 7th edition and there is no plan to qualify any elements of this type in the future:

- 1b: ParkerVelcon will not requalify the ACI (In to Out) 6" monitors – most of these vessels may be converted (back) to FWS
- 2c: PecoFacet will not requalify the In to Out 6" monitors – most of these vessels may be converted (back) to FWS

Position of the IATA SAP special interest group

During the 14th of Novemeber 2017 IATA Fuel Forum in Vancouver, the IATA SAP Special Interest Group released a position statement on the future of filter monitors. This was subsequently disseminated to industry stakeholders and is copied in Appendix 1, with some of its key excerpts being quoted below:

> “The Special Interest Group is aware of eight incidents since April 2010, where the presence of SAP in engine/airframe fuel system components has been confirmed by those involved. More than one engine manufacturer, airframe manufacturer and location have been affected. It has not been possible for these events to be investigated sufficiently to explain SAP migration mechanisms. To date, the Special Interest Group has been unable to identify any significant fuel handling irregularities at the locations implicated in the events. However, work undertaken by the Special Interest Group has identified SAP migration mechanisms within normal operating parameters, that were previously unknown.
>
> **It is the position of the Special Interest Group that filter monitors shall be phased out of all aviation fuel handling systems.** ”

The IATA SAP Special Interest Group was established by IATA, following reports of operation issues with aircraft FMU (Fuel Management Units) and/or HMU (Hydro-mechanical Units) that were linked to the presence of SAP. The special interest group was formed of industry subject matter experts (Representatives of airlines, engine and airframe manufacturers, aviation fuel filter manufacturers and the EI) with the objective of investigating the reported incidents to determine whether there was a demonstratable influence of SAP on FMU and HMU operability.

Part of the work undertaken on behalf of the special interest group was to investigate SAP migration at different Differential Pressures on 2” monitor elements from all 3 filter manufacturers with qualified filter monitor elements. This work suggested that limiting the maximum Differential Pressure to 15psi (1.0 bar) at maximum fuel flow, would help to reduce potential SAP migration. Whilst this work has not been repeated on 6” elements, the results have been used in conjunction with the outcome of their other investigations, to develop the IATA SAP Special Interest Group position.

It is noted that the Special Interest Group activity has now been concluded with the issue of the data summary found in Appendix 2 of this Bulletin, including a proposed roadmap for adoption by standards organizations, including JIG and A4A.

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Filter monitor phase out roadmap

The proposed roadmap of the IATA SAP Special Interest Group includes immediate and short term actions as well as actions required in the longer term, in order to phase out the use of existing Filter Monitor technology. JIG, IATA and A4A committed to work together on a common implementation roadmap for the wider user community which they collectively represent.

JIG has reviewed the proposed roadmap and timeline proposed by the IATA SAP Special Interest Group and liaised with FAUDI Aviation, ParkerVelcon and PECOFacet to understand from the suppliers the options for the manufacture and supply of qualified filtration systems to the user community. The objective, in the short term, and based on these considerations, is to arrive at a roadmap with feasible implementation timelines that can lead to additional mitigation of the potential risks from Filter Monitor technology with no interruption in aircraft fuelling operations.

Longer term, the objective is the replacement of all existing Filter Monitor systems with alternative filtration options. Longer term alternatives to filter monitor systems need to be adequately designed and the change out properly planned.

Filter Water Separator (FWS) systems complying with EI 1581 6th edition (Type S-M) are a currently available alternative that may require the replacement of the existing Filter Monitor vessel, unless a vessel conversion is possible. FWSs are the most widely available viable alternative, where it is practical for them to be installed. The further development and evaluation of possible alternative filtration options is underway.

JIG is currently evaluating additional options for other filtration/sensing technologies covered by EI specifications. JIG intends to encourage an accelerated industry development program to bring new and viable filtration technologies into service, in conjunction with a more extensive use of sensing technologies. Options for the development of other technologies are being discussed at an industry level, within the Aviation Fuel Filtration Committee (AFFC) of the Energy Institute with JIG participation and contribution. Discussions for standardizing future testing of new filtration products with JIG participation and contribution are currently being held.

In addition to the above, a set of short-term actions has been defined and are presented in this Bulletin. These actions have been endorsed by IATA TFG and A4A, considered as the ones that offer a rapid but orderly exit from the Filter Monitor technology whilst reducing the potential for SAP migration in the interim.

These actions include the following actions to be initiated IMMEDIATELY:

- **Replacement of Filter Monitors operating at a Differential Pressure (DP) of greater than 15 psi (1.0 bar), at max achievable flow**
- **Limit of the operational DP for all filter monitors to max 15 psi (1.0 bar), at maximum achievable flow.**
- **Introduction of a new protocol for inspection and cleaning hose-end strainers, as part of commissioning of new filter monitors on fuelling equipment and the routine strainer check procedure.**

Managing the change

It is JIG's position that all airport and into-plane operators involved in the implementation of actions defined in this Bulletin, shall exercise due dilligence in the implementation of the recommended actions, and follow appropriately developed and authorized Management of Change plans throughout the transition period.

As a minimum, the following shall be considered:

- Local operating manuals, procedures, forms and training documents shall be updated to reflect the actions defined in this Bulletin, and training to all relevant personnel shall be provided as necessary.
- Local operating procedures and manuals referring to filter monitors shall follow the manufacturer's recommendations and good practice at all times. Among others, it is reminded that filter monitors shall:
    - never be exposed to fuel containing fuel system icing inhibitor;
    - never be operated outside of their qualified performance envelope;
    - never be moved onto a lower flow rate application to extend service life once high (15 psi) DP has been reached

- Where 2" filter monitors are being replaced by elements from different manufacturers or by re-branded elements, the users shall change the operational data plates on the filter vessels accordingly.
- For a vessel that is converted to a EI 1581 6th ed. filter water separator, a new operational data plate and conversion plate shall be installed, (unless the vessel was originally a FWS that was converted to a filter monitor and is being converted back, in which case any conversion plate fitted may be removed), and Similarity Certificate obtained from the filter supplier.
- On vehicles fitted with filter monitors where the hose-end strainer will change from 60mesh to 100mesh, as defined in the table of actions below, it is recommended that each venturi circuit is checked and re-adjusted, if necessary, during the next scheduled check of the PCVs (for compensated systems)
- Specifications of new builds (vehicles/facilities) need to consider the requirements outlined in this bulletin regarding the phase out of Filter Monitors. It is noted that currently only the use of FWS offers a viable replacement for filter monitors (in light of SIG's position on the latter) until new technologies are qualified and available for use.
- In addition, the supporting notes at the end of the table of actions below shall be used for futher guidance and reference for the respective action.

Inspections

The JIG Inspection checklists (in the JITS and the standalone checklists maintained in JIG's website) are being updated as appropriate to reflect the changes in JIG standards introduced with this Bulletin and to facilitate verification of Bulletin implementation, through the JIG Inspection process. A separate communication to all qualified JIG inspectors will follow.

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Actions to Implement this Bulletin (shall be read in conjunction with the supporting notes at the end of Table 2)

The actions and respective timelines specified below have been endorsed by the IATA TFG and by A4A.

Operations that cannot implement any of the actions listed below by the implementation dates shown, shall either:

- Take the respective equipment out of service, and the equipment shall not be returned into service until the action has been implemented, **or, if this is not practicable,**
- Only continue with the equipment in service under a management approved Variance, with additional effective mitigation procedures and controls identified and applied to avoid the potential of SAP migration. The Variance shall be limited by a closure date that address the required action as quickly as is reasonably practicable.

	Table 2 - Actions to be implemented as soon as possible but in any event no later than the implementation dates defined in this table	**Action Type**	**Implementation Date**
1	Replace all 2" and 6" filter monitors operating at or above 15 psi (1.0 bar) at maximum achievable flow, with new (unused) filter elements. Where EI 1583 7th edition models can be obtained, they shall be used immediately.	JS	Initiate action Immediately
2	Limit the operational DP for all filter monitors to maximum 15 psi (1.0 bar), at maximum achievable flow rate.	JS	Initiate action Immediately
3	Apply the new protocol for commissioning Filter Monitor elements (in Appendix 4) and hose-end strainer inspection and cleaning following the commissioning of new filter monitors on fuelling equipment (in Appendix 5)	JS	Initiate action Immediately
4	For all fuelling equipment fitted with filter monitors: Perform an initial inspection and cleaning of hose-end strainers, in accordance with the new protocol (see Appendix 5) and apply the same protocol to the monthly hose-end strainer inspection procedure for all subsequent monthly inspections.	JS	31/1/2018
5	Adjust the activation point of DP switches currently fitted on all filter monitor vessels to 15psi (1.0 bar), in accordance with the equipment manufacturers' procedures.	JS	31/1/2018
6	If not already in place, change all hose-end strainers on fuelling equipment fitted with filter monitors to 100 mesh size.	JS	31/1/2018
7	All 2" filter monitor elements in service shall be compliant to EI 1583 7th edition	JS	30/6/2018
8	All 6" Out to In (direction of flow) filter monitor elements in service, that cannot be converted to an EI 1581 6th ed. FWS, shall be compliant to EI 1583 7th edition. Note: If the due date cannot be met due to limited supply options of EI 1583 7th ed. 6" elements, a revised due date will be considered by JIG in a future JIG Bulletin.	JS	30/6/2018
9	Regardless of their element flow configuration, all converted filter monitor systems (i.e. converted from a previous FWS configuration) with 6" filter monitor elements shall be re-converted to EI 1581 6th edition FWS, with advice from the filter manufacturer	JS	30/6/2018
10	DP switches shall be installed on all Filter Monitor vessels used for into-plane fuelling purposes, if not already fitted, with the activation point set at 15psi (1.0bar). DP switches are recommended to be installed on Filter Monitors not used for into-plane purposes (e.g. depot receipt and loading filters)	JS	30/6/2018
11	For all non-converted (from previous FWS configuration) filter monitor systems with 6" In to Out (direction of flow) filter monitor elements that cannot be retrofitted with a FWS system in the existing vessel, the vessel shall be replaced with an EI 1581 6th ed. FWS filtration system.	JS	31/12/2018

Supporting Notes for the above actions (the numbering of notes below corresponds to the numbering of actions in Table2)

(General) The actions in this Bulletin modify JIG 1 (3.1.4 (a, c), 3.1.6, 4.10.3, 4.16, A6.2.2, A6.3.4, A6.3.5, A13.4), JIG 2 (3.4.1 General, A6.3.4) and JIG4 (4.4.1, 7.1.2, 7.1.4, 8.18, 10.5.5, A1.2.2, A1.3.4, A7.1) for EI 1583 Filter Monitors, accordingly.

(1) Where EI 1583 7th edition compliant elements can be obtained, they shall be used immediately. Where EI 1583 7th edition compliant elements cannot be obtained (having used best endeavours to obtain a supply) by the due date, due to limited supply options, new (unused) 6th edition models should be installed as a temporary solution, subject to a replacement by 7th edition by 30/6/2018. In any event, the recommended hose-end strainer inspection procedure shall be followed (Appendices 4 and 5) and the max change out DP of 15 psi (1.0 bar) shall be applied, both with immediate effect, as specified above.

(2) For all Filter Monitor Systems, the max allowed Operational DP is limited to 15 psi (1.0 bar) at maximum flow. For Filter Monitor systems that are not controlled by the EI 1583 (Filter Monitor) or EI 1596 (Filter Vessels) specifications (e.g. single element type filters), the end users need to satisfy themselves that they are fit for purpose, will not permit detectable SAP migration and shall operate them in strict compliance with the manufacturers' recommendations and their use shall be limited to a maximum operational DP of 15 psi (1.0 bar). Additional guidance for the phase out of these systems will follow in a future JIG Bulletin.

(3)(4) Ensure adoption of the recommended protocol (Appendices 4 and 5) into the local operating practice and documentation, with appropriate training for relevant personnel within the required timelines, as part of a Management of Change plan.

(5) For the most commonly used DP switches, re-programming the switch to an activation point of 15psi (1.0 bar), may be undertaken by trained in-house technicians, in accordance with manufacturers' procedures. The manufacturer's recommended procedures shall always be followed. Where re-setting the DP switch activation point can only be undertaken by the manufacturer or supplier, the operator shall ensure that timely arrangements are made with the supplier, to meet the timelines in this Bulletin.

(6) See also Appendix 3 in this Bulletin
(7) Modifies all references to EI 1583 Filter Monitors in JIG standards to "Filter monitors qualified to EI 1583 *latest edition*"

(8) The due date for migrating 6" Out to In Filter Monitor systems to 7th ed. by 30/6/2018 may be revised by JIG, if the intended plans of some Filter suppliers/manufacturers to re-qualify their Out to In 6" monitors to 7th ed. will not be successful or will take longer than anticipated, which will result in limited supply options of 7th ed. 6" elements. A new JIG Bulletin will be issued in the next months to inform the User community accordingly. The alternate approach (to 7th edition elements) of using 2" elements has been evaluated by JIG, in consultation with some filter manufacturers. In moving from a 6" out to in type monitor to a 2" carousel approach, there may be significant flow reductions of up to approximately 45%, with more significant effects on elements over 30" long, as there is no production of 2" elements longer than 30". This may create operational difficulties especially at busy airports. In addition, over-flowing the max design flowrate of a monitor has been considered by some investigators to result in increased SAP migration, therefore the use of carousels would need to be very carefully controlled to limit flow rates. **On that basis, a carousel replacement for 6" filter monitor systems is <u>not</u> supported by JIG, due to the enhanced inherent risk factor.**

(9)(11) It is assumed that all vessels using In to Out elements are conversions of FWS vessels. Where this is not the case and no compliant element system can be retrofitted to the existing vessel, the vessel shall be replaced to enable a compliant filtration system, by end of 2018. Conversions of 6" In to Out Filter Monitor systems back to EI 1581 (6th edition) filter water separators shall be carefully planned and executed, with advice sought from the filter supplier. Due consideration is required for: installation of drainage points of the sumps and water protection systems, operational data plates and Similarity Certificates. Also, the impact on the new max achievable flowrate of the converted system should be considered.
(11) Note: Currently only the use of FWS is assured, until new technologies are qualified and available for use.

(10) The scope of actions defined in JIG standards, in the event of a DP switch activation during aircraft fuelling, and subsequent investigation, is extended to include fueller-based operations, in case of DP switch activations on fuellers. It is noted that the installation of a DP switch may not be possible with some of the single element type vessels. In any case, all JIG requirements for the observation/monitoring of filter DP to ensure that Filter monitors are not be operated outside the limits shall be strictly adhered to.

Appendices

Appendix 1 - IATA SAP Special Interest Group position statement for filter monitor filtration systems

Appendix 2 – IATA SAP Special Interest Group data summary

Appendix 3 – Comparison of 60 and 100 mesh sizes for strainers

Appendix 4 – Commissioning of new filter monitor elements

Appendix 5 – Recommended hose-end strainer inspection and cleaning protocol

Appendix 1 - IATA SAP Special Interest Group communication to all users of filter monitor filtration systems

(as read to the IATA Fuel Forum, Vancouver 14 Nov 2017)

Representatives of airlines, engine and airframe manufacturers, aviation fuel filter manufacturers and the EI have been meeting as an IATA Special Interest Group to share information relating to the presence of super-absorbent polymer (SAP) in engine/fuel system components.

The Special Interest Group is aware of eight incidents since April 2010, where the presence of SAP in engine/airframe fuel system components has been confirmed by those involved. More than one engine manufacturer, airframe manufacturer and location have been affected.

The SAP involved in these events can only come from filter monitors, qualified to the industry specification, EI 1583.

It has not been possible for these events to be investigated sufficiently to explain SAP migration mechanisms. To date, the Special Interest Group has been unable to identify any significant fuel handling irregularities at the locations implicated in the events. However, work undertaken by the Special Interest Group has identified SAP migration mechanisms within normal operating parameters, that were previously unknown.

Engine and airframe OEMs have not identified a level of SAP that is acceptable in aviation fuel. Filter monitor manufacturers and SAP manufacturers have confirmed that it is not possible to guarantee that no SAP will pass downstream of filter monitor elements when in service.

It is the collective opinion of the Special Interest Group that the continued use of filter monitor filtration systems in aviation fuel handling is incapable of reliably meeting the aircraft and engine operating requirements.

It is the position of the Special Interest Group that filter monitors shall be phased out of all aviation fuel handling systems.

The Special Interest Group activity will be concluded with the issue of a data summary and proposed roadmap for adoption by the industry.

Appendix 2 - IATA SAP Special Interest Group data summary

(released by the IATA SAP Special Interest Group for public review on the 11th of December 2017)

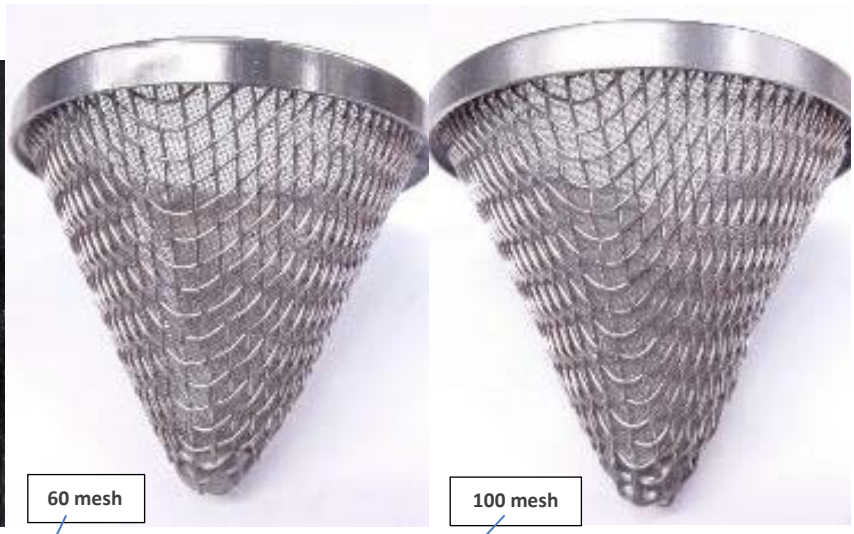
To view attachment, click here

If you are not able to open the attachment, please follow the link within the Bulletin email notification or contact andrea.wixey@jigonline.com

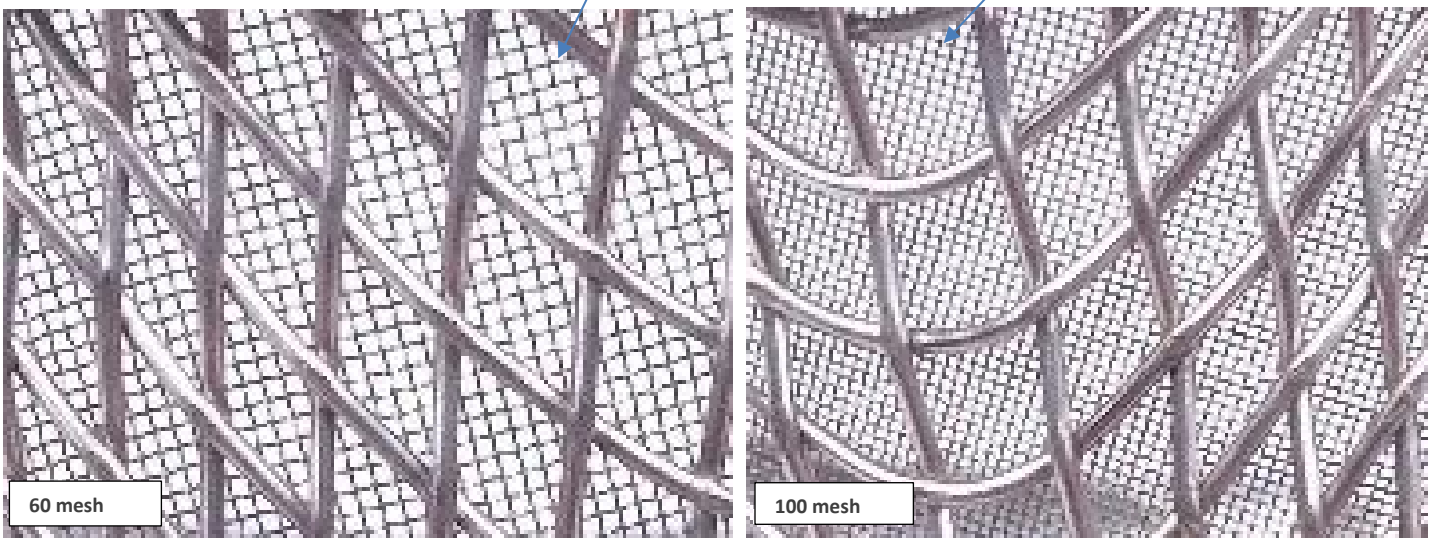
Appendix 3 - Comparison of 60 and 100 mesh sizes for strainers

(Mesh Cards shown):

(Hose-end strainers 60mesh vs 100mesh):



(Hose-end strainers 60mesh vs 100mesh)



Appendix 4 – Commissioning of new Filter Monitor elements

This protocol describes the recommended flushing procedure, when new filter monitor elements have been installed in fuellers and hydrant servicers, in accordance with requirements outlined in this Bulletin.

The protocol below modifies JIG 1-A6.3.5 for into-plane equipment fitted with filter monitors only

1. Safety

The procedures outlined below assume that all relevant PPE, safeguards, task safety controls, work control procedures in effect at the site and instructions of equipment manufacturers shall be followed by appropriately trained personnel, as necessary to control the hazards associated with the respective tasks to be undertaken.

2. Flushing procedure

When new filter monitor elements have been installed in fuellers and hydrant servicers, the following procedure shall be applied, before the units are returned to service:

1) Prepare and attach vehicle to test rig in preparation for commencing fuel flow.
2) Slowly fill vessel and ensure system is purged of all air.
3) Start flow through vehicle and perform usual checks per company and industry guidance.
4) Begin flowing fuel at the maximum achievable flow rate (within the limits of the filter elements and vessel installed on the vehicle) for at least 5 minutes. Perform at least 4 stop/starts via the deadman within this time frame, at 1-minute intervals. Stop / starts via the deadman can send pressure pulses through the system which may maximize the amount of debris released.

   Note: A similar protocol for flushing an overwing circuit should be followed.
5) At the end of the flushing run, safely disconnect the vehicle from the test rig and fuel supply.

3. Hose-end strainer inspection and cleaning

Upon completion of the above flushing procedure of the new filter monitor elements, apply the procedure for cleaning the strainer, as described in Appendix 5 below.

Appendix 5 – Hose-end strainer inspection and cleaning protocol for vehicles fitted with Filter Monitors

This protocol describes the recommended procedure for inspecting and cleaning the hose-end strainer, in accordance with requirements outlined in this Bulletin. The protocol below modifies JIG 1-A13.4 Fuelling nozzle (hose-end) strainers, for into-plane equipment fitted with filter monitors.

1. Safety

The procedures outlined below assume that all relevant PPE, safeguards, task safety controls, work control procedures in effect at the site and instructions of equipment manufacturers shall be followed by appropriately trained personnel, as necessary to control the hazards associated with the respective tasks to be undertaken.

2. Equipment Required

- Any required tools to remove hose end strainer from nozzle.
- Any required tools to remove and replace filter elements (only required when this protocol is used following installation/commissioning of new filter monitor elements).
- Clean bucket of contaminant free and dry fuel filled to a height of roughly 4" (enough to submerge hose-end strainer standing upright). Use the same grade of fuel that the hose end strainer is used with (i.e. Jet Fuel or Avgas).
- Bonding cable
- For Compressed Air Method (Option 1) - Lubricant-free compressed air source (roughly 100 psi "shop air", if permitted by Occupational Health and Safety Regulations in effect at the site). Compressed air cans may be used in place of an air compressor, in this case be sure not to discharge cans upside down as freezing may occur.
- For Jet Fuel Wash Bottle Method (Option 2)– Suitable wash bottle with nozzle, containing clean jet fuel (Not suitable for cleaning hose-end strainers used in Avgas service)
- For Brush Cleaning Method (Option 3) – Clean fine stiff haired 1/4" width brush

Equipment for hose-end strainer cleaning procedure.

3. Strainer Removal Procedure

Before beginning the procedure to remove the hose-end strainer for inspection and cleaning, ensure that the suitable PPE for the task are worn (gloves, safety glasses, etc.), in accordance with site and company policy.

1) Detach nozzle from the hose if no strainer ball valve is fitted. For nozzles without dry-break quick disconnect, use suitable equipment to drain hose and nozzle before removing the hose-end strainer from the nozzle. If dry-break quick disconnect feature is fitted to the nozzle, take care to remove the remaining fuel in the nozzle. Handle the hose so that any debris in the hose will be flushed into the hose-end strainer and captured. Handle nozzle at the upright /45degree connection position, to ensure that any contaminant that may be present is not dislodged from the strainer before examination.
2) Follow nozzle manufacturer's procedure to remove the hose-end strainer used from its respective housing, taking care to dispose of drained fuel appropriately.
3) **The hose end strainer shall be cleaned following the procedure described below. Always check strainer for any damage before you start the cleaning procedure. Verify condition of associated fittings such as retention clips.** If any damage is observed, replace with a new hose-end strainer (100mesh size) immediately, before starting the cleaning procedure.

4. Strainer Cleaning Procedure

Before beginning the hose-end strainer cleaning procedure, ensure that the suitable PPE for the fuel grade in use (gloves, safety glasses, etc.) are worn in accordance with site and company policy.

Note – Some of the debris captured may not be visible to the human eye, and therefore even a seemingly clean hose-end strainer shall still be cleaned per the below procedure.

1) Invert hose-end strainer and tap it on a clean surface to dislodge and examine any contents (dirty side down). Any debris found shall be documented.
2) Completely submerge into the bonded bucket of clean fuel.
3) Vigorously agitate hose-end strainer while submersed in the bucket of fuel of the same grade for about 1 minute. Take care not to splash any fuel outside of the bucket.
4) While keeping the hose-end strainer below the top level of the container, successively lift and lower the hose-end strainer into and out of the fuel to back flush any debris into the fuel bucket. Perform this process at least 10 times.

After agitating the hose-end strainer in fuel as described above, at least one of the below procedures shall be followed to complete the cleaning process. In any case, regardless of the option chosen, rinse the strainer in fresh fuel before returning the strainer to service.

Options are listed below to allow for differences in infrastructure and equipment at various locations. The preferred option is the use of the compressed air cleaning method, as described below, if local operating procedures can ensure that all safety precautions have been considered and hazards managed properly, for the task to be carried out safely. The Jet Fuel Wash Bottle Method or the Brush Cleaning Method are acceptable alternatives, if a suitable compressed air system is not available.

4.1. Option 1 - Compressed Air Cleaning Method

A lubricant-free compressed air system shall be used.

Safety precautions: The use of compressed air systems shall be treated with care, and shall be subject to additional task safety controls and in accordance with work control procedures in effect at the site. Caution to be exercised to avoid creating mists.

1) Using the compressed air, blow any potential debris from the "clean side" of the hose-end strainer towards the "dirty" or "upstream" side of the strainer.
   a. Follow a systematic approach to ensure that the small jet of air passes over the entire surface area of the hose-end strainer cone.
   b. Repeat the air cleaning process at least three times over the entire exterior surface area of the hose-end strainer.
2) Verify hose-end strainer cleanliness and repeat cleaning if necessary.
3) Dispose of the fuel and any contaminants within the bucket according to the site's hazardous waste disposal processes. This fuel shall not be returned to the vehicle product recovery tank as it could contain super absorbent polymer or other fuel contaminants.

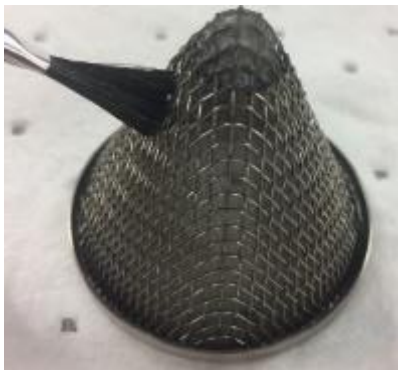
4.2. Option 2 - Jet Fuel Wash Bottle Method (Not suitable for cleaning hose end strainers in Avgas service)

Safety precautions: The use of Jet Fuel Wash Bottles shall be treated with care, and should be subject to additional task safety controls and in accordance with work control procedures in effect at the site. Due consideration is required for the selection of a bottle made of an appropriate material for jet fuel.

1) Using the jet fuel wash bottle, wash any potential debris from the "clean side" of the hose-end strainer towards the "dirty" or "upstream" side of the strainer.
   a. Follow a systematic approach to ensure that the small stream of fuel passes over the entire surface area of the hose-end strainer cone.
   b. Repeat the jet fuel wash cleaning process at least three times over the entire exterior surface area of the hose-end strainer.
2) Verify hose-end strainer cleanliness and repeat cleaning if necessary.
3) Dispose of the jet fuel and any contaminants within the bucket according to the site's hazardous waste disposal processes. This fuel shall not be returned to the vehicle product recovery tank as it could contain super absorbent polymer or other fuel contaminants.

4.3. Option 3 - Brush Cleaning Method

1) Using a fine stiff haired 1/4" brush, stipple the downstream side of the hose-end strainer to loosen any potential debris pushing it towards the upstream side of the hose-end strainer. Be sure to cover the entire exterior of the hose-end strainer with the stippling process. See next picture.



2) Wet the brush using clean fuel.
3) Starting from the interior point of the hose-end strainer, use the brush to carefully brush any debris towards the rim and out of the hose-end strainer. Re-wet the brush frequently in clean fuel to aid the cleaning / flushing process. Ensure that no brush bristles are dislodged and get caught in the hose-end strainer. See below pictures.
4) Verify hose-end strainer cleanliness and repeat cleaning if necessary.
5) Dispose of the fuel (as described for the other cleaning options above)

Verification of Hose-end strainer Cleanliness

When the strainer cleaning process by one of the options outlined above has been completed, the strainer shall be visually inspected for cleanliness and damage before reassembly.

5. Re-Installation and Re-commissioning

1) Ensure that hose-end strainer has no signs of damage or residual debris from the flushing process or cleaning procedure.
2) Re-install hose-end strainer into hose end nozzle following the manufacturer's protocols.

Left: Re-installation of the hose-end strainer into the hose end nozzle. Right: Clean hose-end strainer reinstalled with retainer ring in place.

3) Reassemble and secure swivel disconnect (where applicable) in accordance with manufacturer's maintenance instructions.
4) When new elements have been installed, return vehicle to the test stand and flow at the maximum achievable flow for the vehicle, for about 5 minutes and check for leaks, especially around nozzle and hose-end strainer re-installation. For fuellers, recirculation is an acceptable alternative.
   - When the protocol has been applied during the monthly strainer check procedure, and the hose-end coupling had to be disassembled to remove the strainer for inspection, the integrity of the coupling shall be checked by pressurising the hose to working pressure after reassembly.
5) If no leaks are found, return the refueling vehicle to service following the operating standards mandated by the present location.

Action Type Codes

Action Types	JIG Bulletin Action Type Definition
JS	Change to JIG Standard – to be adopted by JV and/or Operator to continue to meet the JIG Standard(s) (JIG 1, 2, 4, EI/JIG 1530 and the JIG HSSE Management System).
RP	JIG Recommended Practice which the JV should consider adopting as its own practice (**).
I	Issued for information purposes only.
Note (**) - If the JV agreements require any of the JIG Standards and/or any of the JIG Common Processes as the governing operational standard then adoption of changes to applicable JIG Standards and/or Common Processes should not be considered optional by the JV Board.	