Operations Bulletin

jigonline.com

Bulletin No 113 **Filter dP measurement and trend monitoring** 10th August 2018

Introduction

The filtration of aviation fuel is mandated by the JIG standards at key stages in the supply of aviation fuel, up to and including the point at which it is delivered into an aircraft.

The recording and tracking of filter differential pressure (dP) on a routine basis, is the primary means of determining:

- When the maximum allowable dP has been reached and filter elements require replacement
- When filtration effectiveness may have been compromised: a drop in dP may indicate filter element rupture or bypassing, and
- Trends in filter performance over time

Analysis undertaken by JIG of common inspection findings and their underlying causes, has revealed that incorrect filter dP monitoring and graphical recording are amongst the most common inspection findings.

JIG 1 and JIG 2 (section A6.2.2) include requirements for observation and recording of dP, and preparation of weekly dP graphs either by correcting the observed dP to the maximum achievable flow rate or by recording the dP at the maximum achievable flow rate. When the correction method is chosen for the weekly graphs, the correction shall be established by using a conversion graph, table or calculator supplied or endorsed by the filter manufacturer.

Inspection reports often indicate that confusion exists about how to accurately plot the weekly dP graphs, particularly when dP correction is required, and provide a valid dP trend which can be used to initiate the corrective action necessary to maintain filtration effectiveness.

In addition, a recent technical review of filtration system differential pressure trend analysis, issued by the EI Aviation Committee, highlighted the preference to use dP values recorded during times of maximum flow rate, as opposed to dP values derived from a correction calculation, for trend analysis purposes.

As a result of this review and the ongoing number of inspection findings regarding dP, this bulletin has been issued to revise the requirements for dP recording and plotting in the JIG standards to:

- **Avoid the need for dP correction, whenever practicable**
- **Where dP correction cannot be avoided, ensure that it is done correctly and in accordance with the filter OEM requirements for the filtration technology in use**

Background Information

Filter Differential Pressure and Flow Rates

In the context of aviation fuel filtration, the differential pressure (dP) is the difference between the inlet (upstream) pressure and the outlet (downstream) pressure of a filter vessel. Even when new filter elements have been installed, restrictions caused by the filter vessel design and the filtration media cause a dP (known as the start-up dP). The maximum allowable start-up dP is specified in the governing EI filter specification. During service, the filter elements remove contaminants from the fuel and hold them within the filtration media. This further restricts the fuel flow through the filter and causes the dP to increase.

JIG requires the filter dP to be routinely monitored to identify any abnormal variations in dP which require investigation and ensure the dP at maximum achievable flow rate does not exceed the maximum dP recommended by the filter manufacturer.

A dP drop, either sudden or progressive, may indicate a failure in the filter element (e.g. due to mechanical damage, MBG, surfactants, etc.) or fuel bypassing the element at its seals. Regardless of the cause, further investigation is required before the filter can be returned to service.

In order to create a graphical dP plot which can give a meaningful comparison of dP variations over time, the dP values used in the graph shall either:

- *be recorded at the maximum achievable flow rate, or*
- *if the dP is recorded at a flow rate less than the maximum achievable flow rate, the dP value shall be corrected to the maximum achievable flowrate using a conversion graph, table or calculator supplied or endorsed by the filter manufacturer.*

The dP correction has long been considered an acceptable method to predict what the observed dP would be if the filter had been operating at the maximum achievable flow rate. However, when dP readings are taken at flow rates below 50% of the filter vessel's rated flow rate, the correction method is not accurate and considered not valid. (See JIG 1 A6.2.2)

*The **MAXIMUM ACHIEVABLE FLOW** rate is specific to an individual filtration system and is dependant upon several factors including pumping systems and operating environments. The **RATED FLOW** of the vessel is the maximum flow rate the filter vessel can be subjected to while still meeting the performance requirements detailed in the relevant EI specifications. The rated flow rate is specified on the original data plate of the filter, provided by the filter manufacturer. It is critical that the **MAXIMUM ACHIEVABLE FLOW** rate does not exceed the **RATED FLOW** of a vessel.*

Changes to JIG Requirements for dP weekly graphs

Based upon the information published in the EI Technical paper, the results of the JIG inspection findings and input from JIG Operations and PQ Committees, JIG standards are hereby revised to avoid the need for dP correction to maximum achievable flow rate, whenever possible.

Weekly graphs of dP shall be prepared for each filter using only one of the following three options, in the order of preference:

- Option 1: The dP recorded weekly at the filter's maximum achievable flow rate, subject to a maximum variation in the flow of up to 5%, provided also that the rated flow of the filter is not exceeded. This is the preferred option for filters both with and without dP switches fitted.
- Option 2: The dP recorded weekly at a high flowrate, which is consistently the same every week, subject to a maximum variation in the flow of up to 5%, provided also that the rated flow of the filter is not exceeded. The high flowrate shall be greater than 50% of filter's rated flow and as close as possible to the maximum achievable flow rate. This option can only be used for filters fitted with a dP switch (1).
- Option 3: The dP corrected to the maximum achievable flow rate, where both options 1 and 2 are not practical. The correction of dP values, which shall be taken at an observed flow rate exceeding 50% of filter's rated flow rate, shall be accomplished by using a conversion graph, table or calculator supplied or endorsed by the filter manufacturer.

Where either Option 1 or 2 is selected, the dP shall be recorded:

a. For fixed filters: during routine pumping operations
b. For filters on mobile fuelling equipment: either during fuelling operations or by connecting to a test rig and circulating fuel through the filter at the required flow rate. For fuellers, circultating fuel through its tank is an acceptable alternative.

For each filter, only **ONE** of the above three options shall be used for preparing the weekly dP graphs. Where possible, for consistency and simplicity purposes, a single method should be used for all filters belonging to the same type of operation (fixed or mobile) at a location.

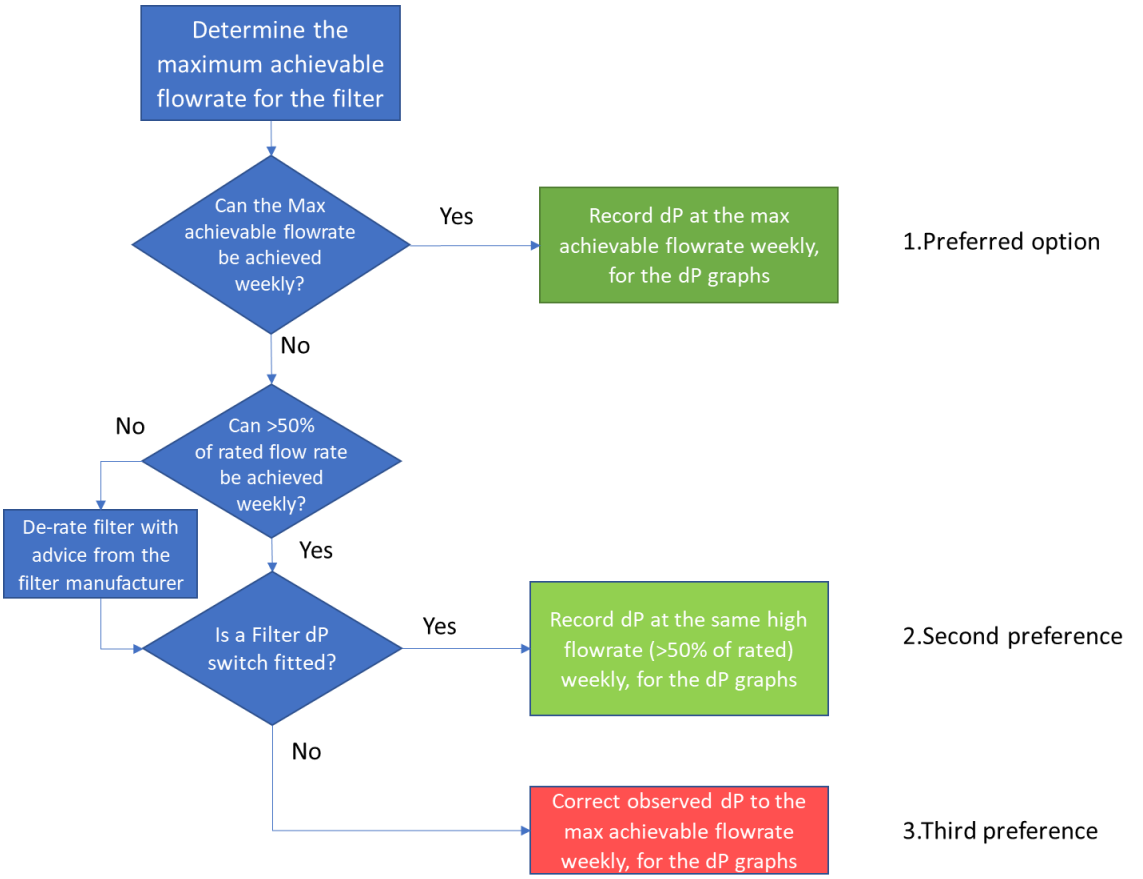
Given the inaccuracy of dP correction method, options 1 or 2 above are preferred for dP trend monitoring over using a correction calculation, as it reflects the actual contamination loading of the filtration system at real time and flow conditions. Moreover, it eliminates the need to use a dP correction algorithm approved by the filter OEM (**Note:** dP correction algorithms are unique to each filter manufacturer and are not interchangable) and the potential for introducing errors during correction of dP. If the required flow rate cannot be achieved, derating the filter vessel shall be considered to enable this(2). The flow chart below (Figure 1) illustrates the decision path to arrive at the preferred method for weekly dP graphical plotting.

Notes:

(1) A dP switch is required for this option as a higher dP than recorded may be experienced when the filter is operated at a flow rate higher than used for the weekly plot. Should this occur, the dP switch activates and stops the operation.

(2) Derating filter vessels to reduce the rated flow rate of the filtration system is achieved by replacing elements with either blank or dummy elements in the case of filter monitors, or blinds or caps in the case of filter water separators. (See EI 1550 Chapter 13 for further information.)

Figure 1 – Decision path for determining the method for preparing the weekly Filter dP graphs



Managing the change

Operators involved in the implementation of actions defined in this Bulletin, shall exercise due diligence in the implementation of the recommended actions, and follow appropriately developed and approved Management of Change plans. 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

Inspections

The JIG Inspection checklists (in the JITS and the standalone checklists maintained in JIG's website) have been updated to reflect the changes in JIG standards introduced with this Bulletin.

Actions to Implement this Bulletin (See Table 1 for Action Type Codes)

Action Description	Action Type	Target Completion Date
Establish the maximum achievable flowrate for each filter and determine whether it can be achieved at least once a week. Use this observed dP at the max achievable flow for the weekly dP graphs.	JS	1st Jan 2019
If the maximum achievable flow cannot be achieved weekly **but the filter is fitted with a dP switch,** prepare the weekly dP graphs using the dP recorded consistently at the same high flow rate as close as possible to the maximum achievable flow (but at least >50% of rated flowrate)	JS	1st Jan 2019
If it is not practicable to prepare the graphs using actual flowrates as defined above, the weekly graphs shall be prepared by correcting measured dP (taken at a flow rate exceeding 50% of filter's rated flow rate) to maximum achievable flow rate, by using either a conversion graph, table or calculator supplied or endorsed by the filter manufacturer.	JS	1st Jan 2019
Only one method of preparing the weekly dP graphs shall be used for each filter, in accordance with the preferred order defined in this Bulletin. All personnel shall be trained to apply the selected methodology correctly, in accordance with a management-approved Management of Change plan	JS	1st Jan 2019

Table 1 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.	

Note: *This document is intended for the guidance of Members of JIG and companies affiliated with Members of JIG, and does not preclude the use of any other operating procedures, equipment or inspection procedures. The information contained in this publication is subject to constant review in the light of changing government requirements and regulations. Although efforts are made to keep this information up-to-date, accurate, complete,*