

THE CLARIFIER

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A Dissertation on Delta P

Differential pressure (often referred to as Delta P) is observed across pre-filter and filter/separator vessels to predict when to change out the filter and coalescer elements.

Differential pressure across elements will increase when one or more of the following occurs:

1. At a steady flow rate, the elements are removing particulate matter (dirt, pipe scale, metal shavings from machinery, etc.) from the fuel. Finer particulate matter can increase the Delta P faster than coarse (large size) particulate matter.
2. With no new particulate matter, if the flow rate increases, the Delta P will increase.
3. With no new particulate matter, and at a steady flow rate, if a batch of "wet" fuel is encountered (wet fuel has a high level of free water), the Delta P can increase as the water "saturates" the fiberglass coalescing media in the coalescers. The Delta P will then decrease if the wet fuel is followed by dry fuel (the water will be "pushed out" of the fiberglass). Exception: sometimes a small batch of slightly wet fuel will redistribute the particulate matter in coalescers and the Delta P can drop before climbing again.

Manufacturers usually recommend that filters and coalescers be changed at or before 15 psid Delta P. Per the API-1581 and other coalescing specifications, the coalescers must be designed to withstand a minimum of 75 psid Delta P before bursting (rupturing or breaking apart). Most coalescers withstand higher than 75 psid Delta P

before rupture.

If the coalescers can take 75 psid or higher before bursting, why change at or before 15 psid Delta P?? When the elements get close to 15 psid, and the system shuts down (most fuel systems are constantly starting up and then shutting down), the next time the pump "kicks on", it can kick on with a momentary (split second or so) pressure surge which can reach 4 to 5 times the normal Delta P. Five times 15 psid is 75 psid. Exceeding the 15 psid Delta P at normal flow rate may result in burst elements the next time the pump kicks on and water and dirt could pass downstream, possibly into the aircraft! This has happened!!!

DON'T EXCEED 15 PSID DELTA P!!!!

Systems with Varying Flow Rates

In systems where the flow rates can vary because of conditions such as more than one pump (one or more pumps can be online at a time), more than one loading position at a truck loading rack, etc., the reading of differential pressure across a filter/separator vessel may involve correcting the reading or using a chart to see if the observed reading at less than full flow is okay or would be higher than 15 psid Delta P at the standard 100% flow rate through the system. See the following example.

Using the graph found on Velcon data sheet #1415, shown on page 3, you can see if the coalescers need changing in a VARIABLE FLOW RATE system.

For example, if you have a 600 USGPM rated F/S vessel in a system where the

maximum system flow rate will be 600 USGPM but could sometimes be less due to various reasons, 600 USGPM is the 100% rated flow through the vessel. Change at or before 15 psid Delta P when reading the Delta P at 600 USGPM.

However, if for some reason when the differential pressure reading is being taken, the flow rate is lower than 100%, say 360 USGPM, than use the graph. At 60% (360 USGPM is 60% of 600

(cont. on pg. 3)

New Improved ACO Filters



This photo shows a picture of the improved ACO-60901K Aquacon cartridge. It contains the new media that can be used in low flow situations. It also has new injection molded endcaps that improve its appearance.

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Frequently Asked Questions & Answers

Q How do I obtain copies of Material Safety Data Sheets for Velcon products?

A Material Safety Data Sheets (MSDSs) are not required for manufactured filter elements as these products do not contain hazardous chemicals defined under the OSHA Hazard Communications Standard (29 CFR 1910.1200). The only exception to this would be for our HydroKits. MSDS for HydroKits can be obtained by calling 800-531-0180 and asking our Order Entry Dept. to send you a copy.

Q Can Velcon's standard cartridges be used for naphtha? If yes, what is the flow rate?

A Yes, our standard products can be used for naphtha. Since naphtha has a wide range of specific gravities and viscosities, we normally size the element based on our recommendations for diesel fuel.

Pre-Mixed Fuel? Don't Forget to Drain!

There have been a couple of incidents, lately, where large amounts of water have passed through IP qualified water absorbing cartridges. In both cases, it was found that the water bottoms, in the upstream tanks, were about a 50% water/50% Di-EGME (anti-icing additive) mix.

Tests at the Velcon laboratory on the returned cartridges showed that water injected per the IP Monitor tests was trapped in the cartridges. It was also verified that a 100% water slug test will shut off the flow. However, a slug test with 50% water/50% Di-EGME results in increasing differential pressure, but an incomplete shutdown of flow, with a 10% or higher "leak rate" through the cartridge. Considering the possibility of this situation with water bottoms heavily saturated with Di-EGME in pre-mixed fuel (Jet Fuel pre-mixed upstream with anti-icing additive) occurring in other systems, Velcon recommends the following precautions:

- A. Drain all sumps and tanks DAILY. Do not let water bottoms sit for long periods of time as they will increase in Di-EGME concentration.
- B. We recommend installation of a delta P set switch (set at between 15 - 25 psid) on existing Gammon

gauges. When this triggers shut, replace the water absorbing cartridge(s), and also check downstream (AIRPLANE!) to see if any water has migrated downstream.

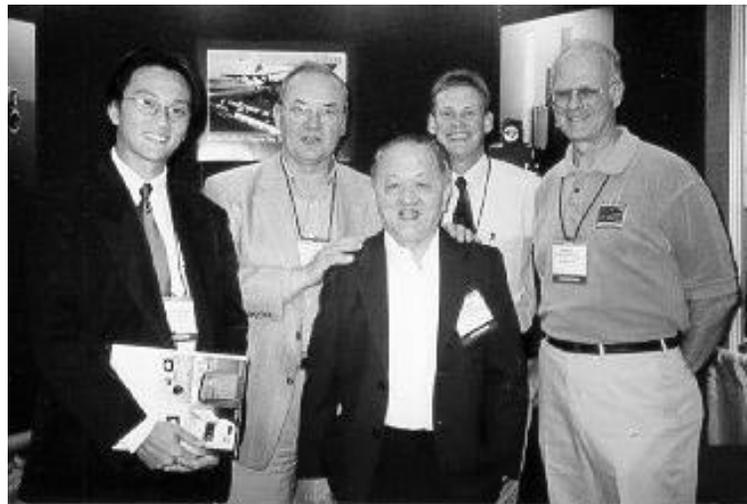
C. We recommend using the more expensive water finding paste that is available for the pre-mixed fuels. Use of the "normal" water finding paste will not change color in a 50% water/50% Di-EGME mix.

D. We also recommend checking with your probe manufacturer as to what concentration of water/Di-EGME mix would obscure the probe from reading correctly. We checked with Whittaker who advised that their water detecting probes will detect water up to 35% Di-EGME in the water. Above a 35% concentration, the probes would probably not detect water.

So remember, to prevent an accumulation of water in pre-mixed fuel, follow the above steps. Most importantly - don't forget to drain!

This article deals only with our water absorbing cartridges. In the next issue of The Clarifier, we will discuss the effects of Di-EGME on coalescers.

David Ngiam, Robin Mason, Sam Ngiam, Rick McKenna and Rick Waite in the Velcon Booth at GSE Expo in Las Vegas, October, 1999. David and Sam are from our affiliate, Hanevel, in Singapore.



USGPM) on the X axis (lower horizontal line), go up the 60% line to where it intersects the bold diagonal line. Read across to the Y axis (left vertical line). Read 8 psid differential pressure. Thus, if the observed Delta P at 360 USGPM is less than 8 psid, there is still some life left in the coalescers. If the observed Delta P at 360 USGPM is 8 psid or higher (on the diagonal line or above) then the reading at 600 USGPM would be 15 psid or higher. Time to changeout the coalescers!!!

Oversized Filter and Filter/Separator Vessels

There are a number of filter/separator vessels that are intentionally or unintentionally oversized. That is, the maximum flow rate the vessel was designed for is higher than the maximum flow rate the system (pump) can produce. For example, the F/S vessel may be qualified to API-1581, Group II, Class B (fixed vessel) at 1200 USGPM. However, the maximum flow rate through the system will never exceed 800 USGPM due to piping restrictions, a small pump, etc. In this situation, 800 USGPM is the 100% rated flow. If a Delta P reading were taken at a lower flow rate than 800 USGPM in this system, say at 400 USGPM, this 400 USGPM is 50% of the maximum SYSTEM Flow Rate. Checking the graph, if the Delta P at 400 USGPM (50%) is 6-1/2 psid or lower, there is still life left in the coalescers. If the reading is 6-1/2 psid or higher, then it's time for a changeout!

You astute readers will see that oversizing the F/S vessel, or pre-filter vessel will give you a longer life before changeout. The elements will hold more particulate matter (dirt!) at lower

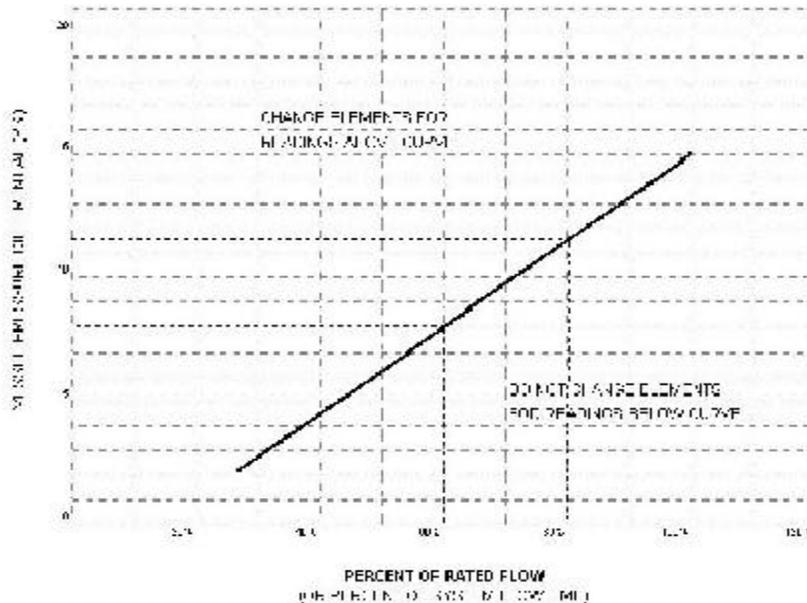
flow rates before the 15 psid Delta P is reached. This is ALMOST like getting something for nothing! (Not quite though.) But if you want to stretch out the time between changeouts (and labor and downtime can be the determining factors in many places), then oversized pre-filter and filter/separator vessels are our recommendation.

Changeouts on Time vs. Delta P

This brings up another point. A large number of fixed F/S vessels are changed out on TIME, rather than an increase in Delta P across the coalescers. These vessels might be qualified at a higher flow rate than the SYSTEM maximum flow rate. There are some factors to consider here:

- the vessels may not be seeing much dirt (clean fuel from upstream).
- the vessels may be oversized to minimize the labor for changeouts.
- the coalescers may last longer before possibly being disarmed by surfactants.
- there is a "buffer" for unexpected higher dirt load.

Taking into consideration the factors listed above, and possibly deciding that the history of clean fuel will continue, some operators might reduce the coalescers in these F/S vessels to save costs on element changeouts. (This approach has worked successfully in a large number of Class C into-plane F/S vessels.) Use caution when reducing the number of elements in a pre-filter or filter/separator vessel.



Vessel Pressure Drop Characteristics with "Spent" Cartridges

Separators in ACI Converted F/S Vessels?

A number of customers have asked Velcon whether we recommend leaving the TCS separators in place in filter/separator vessels when the coalescers have been replaced with the ACI series Aquacon cartridges

Our response is that it is somewhat arbitrary whether the TCS separators are left in place or removed. There are no strong

functional issues in support of either decision. However, our recommendation is to leave the TCS separators in place as a "secondary" strainer, in the remote chance that a slug of water may cause a differential pressure in excess of 12 bar (174 psid). This might cause rupture of the ACI cartridges.

Some companies advise their operators to remove the TCS

separators when converting to the Velcon ACIs. They might use the separators elsewhere; or they might want to increase the charge relaxation area in the vessel.

We invite any comments or recommendations on this subject, which can be discussed in a future Clarifier issue. 

If you know anyone who would like to receive *The Clarifier*, fax their name, company and address to:



We also welcome your comments and suggestions on topics covered in *The Clarifier*.

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