THE GAMGRAM

No. 56 MONITORING DIFFERENTIAL PRESSURE DURING REFUELING

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If you had a “bullet-proof” vest on, such as some police and soldiers wear, would you allow someone to shoot you? Most people wouldn't, simply because it isn't smart to take chances, even with the best safety equipment. You just never know for sure.

From the time jet fuel is refined, it is usually filtered every time it is moved to provide the maximum level of safety. At the airport, we take sump samples from storage and transport trailer tanks to remove water. We take sump samples from filter vessels. We perform membrane tests, water tests and take white bucket samples. We check for dirt, water and mixed fuels.

Why do we take so much care? Because people do make mistakes and equipment can fail. In performing all these tests, we are trying to catch any human error or equipment failure before contaminated fuel reaches the aircraft. Yet, water reaches refueler vehicles and aircraft from time to time.

The filter manufacturers in our industry make their elements as safe as possible using exhaustive tests, science and engineering. The API/IP tests that these filters are subject too are difficult to pass, just ask the filter manufacturers. But do they provide 100% protection? Unfortunately, you just can't be sure. That's why we must carefully monitor them.

This GamGram is primarily on the subject of the water absorbing type of final filters, located on many refueler vehicles that deliver to aircraft. Recently, it has been learned that these water absorbing filter elements we have relied on for many years are not perfect. It doesn't matter what manufacturer makes them, you can't be 100% confident in them. In several instances operators have kept on pumping fuel even though the differential pressure was high; water has reached aircraft! Yes, really!

How can these elements fail? At the time this GamGram is being written, we still are not sure. It is believed that a trace chemical in the fuel is the cause. But is this the only problem to be concerned about? No. Elements can be damaged or structurally destroyed as a result of excessive differential pressure and from system pressure surges when operated at high differential pressure.

So what is excessive differential pressure? Many people believe the elements should be expected to work correctly right up to their burst strength (typically 75 to 175 psid). This is not correct! The elements are not tested to remove water at high differentials! You should **NEVER** operate at differential pressure above 25 psid and the maximum allowed by your oil company or airline may be from 15 to 25 psid.

So you must be very careful so that you do not exceed the differential pressure maximum allowed. But if your readings are not accurate, you are not safe. We must check everything carefully, and **MOST IMPORTANTLY** -- Get good differential pressure readings.

Sounds easy, right? **WRONG!** Even if your gauges are perfectly accurate, the readings your people take are most likely not accurate.

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So why do we say you are likely getting inaccurate readings? It is not due to inaccuracy in your gauge, but in not taking the readings at the right time.

Differential pressure varies as the flow rate varies. In underwing fueling, flow rate varies on different aircraft, and as different tanks are fueled. In overwing fueling, you don't hold the nozzle fully open during the entire fueling; this varies for different aircraft.

When you begin refueling, and you are flowing into empty tanks, the flow rate will be at the highest for that aircraft.

So the secret is to take your differential reading when you are flowing at the highest flow rate your vehicle can achieve, preferably into empty aircraft tanks. A further complication is that different aircraft allow different flow rates. For example, a B777 takes fuel easier that a B757. And a B737, with only one hose attached, can't possibly take fuel as fast as a B777 with two deck hoses connected.

So how do you get good differential readings? Well, first answer this question: “Can you even see the differential pressure gauge while you are refueling?” From most lift decks it is impossible! Even in daylight, you can't see the differential gauge when fueling from a side reel, you are too far away.

But what if you suddenly get a “slug” of several gallons of water? It does happen, and more often than most people think. To catch the sudden increase in differential pressure, you have to monitor the differential pressure gauge. This is really not possible on most refueling equipment in use today.

One more note, the new ATA-103 requires an automatic differential pressure control to prevent element failure on refueling trucks and hydrant carts. The IATA, JIG now requires an automatic control on all hydrant carts.

So to get accurate readings, you must either watch the gauge constantly or rely on a device to do this job for you. Ha! You say about now; Gammon is now going to tell you they have such a device and this was all a commercial GamGram! So much for GamGrams “never being commercial”!

Sorry to disappoint you, but there are several ways to do this; other manufacturers also make such equipment. So here are your possible solutions:

1. A Differential Pressure Limiting or Differential Control pilot, such as the Gammon DP Pilot or those made by Cla-Val, OCV and others. These devices reduce flow rate automatically to prevent differential pressure from rising enough to cause physical damage. It is not the best solution because you still don't get accurate data, but it protects you from a high differential situation and advises you that something is wrong by reducing the flow rate. It is also not a fast reacting solution, a differential switch is safe in a high pressure system.

2. A recording type, or “Peak-Hold” differential gauge, so that when you do look at the gauge, even if you don't look at it when it is at the highest flow rate, it will tell you the highest reading that has occurred since you last reset it. Better than nothing, but while you get good readings, you don't have automatic shutdown.

3. A differential pressure switch and control box (with a test/reset switch, indicator light and latching relay). This device is wired to shutdown through your deadman if differential pressure gets too high. This is a good method, but you must test it regularly to make sure it works.

OK, so what is the best solution? Number 3, an automatic shut down system with a 3-way test valve. Which allows you to test both the gauge and the shut down system. Do we offer this? Of course we do, even as a retrofit onto existing Gammon Gauges. But you don't have to do it that way. Many companies offer differential switches and you can build your own control. This isn't rocket science. But we strongly suggest you add this ability to your truck or hydrant cart because otherwise you will be leaving too much to chance! (The advantage of adding this to your Gammon Gauge is in the simple testing).