THE GAMGRAM

No. 75 ARE YOU FUELING AIRCRAFT TOO SLOWLY? APR. 2024

One thing that is certainly true in our industry is that "Time is Money." In this GamGram, we address the subject of efficiency-refueling as quickly, and yet as safely, as possible.

"Quickly" is not a minor detail; properly adjusting the refueler's pressure controls can make a big difference in the flow rate and refueling time, reducing aircraft turnaround times. Obviously, turning aircraft around quickly can save ground time for an airline, but it also saves labor time for refueling personnel and reduces the amount of energy consumed (wasted energy) in refueling. For reference, see GamGrams 32, 33, 51 and 66.

Too much pressure can damage the aircraft, we have seen an aircraft fuel manifold that split open from excessive pressure. But if fueling pressures are set correctly, turnaround times can be reduced.

There is not a simple knob to turn to accurately adjust nozzle pressure, in most cases. We wrote GamGram 32 because there was a lot of confusion just on adjusting a venturi. These days, this concern has not improved due to job turnover.

We need to ensure that we refuel as properly, as safely, and as quickly as possible. "Quickly" not only applies to time, but to efficiency - how much energy is expended. System designs vary but all must meet JIG, IATA, ATA-103, CSA, (or another standard, such as military). On fueling pressure, we always have two independent levels of pressure control. If one fails, the other saves us from disaster. But do we set these pressures at the optimal levels? The answer is "not often enough." Your procedures MUST provide you with confidence that your operations are not only safe and proper, but optimized for efficiency.

In this GamGram, we will give an overview, not specific to your refueling vehicle. It is important to educate yourself. You need instructions or procedures from both the pressure control valve manufacturer(s) and the refueler vehicle manufacturer, plus a detailed understanding of the pressure control systems you are using - to be able to test and adjust them.

OVERVIEW

A dual pressure control system is a simple concept. Simply said, by saying "a dual pressure control system" we mean that you have two separate means, with two separate devices, of controlling the nozzle/refueling pressure. This is done to protect the aircraft from excessive fueling pressures - with the secondary pressure control only being a backup - and yet achieve the shortest refueling time possible. These two pressures have to be checked/set separately. First, we disable the primary and check/set the secondary, then we check/set the primary.

Typically, the primary and secondary controls are set 5 psi apart. For example, the primary nozzle pressure is often set at 40 psi and the secondary set at 45 psi. The only time you should then see 45 psi during a normal fueling event is if the primary pressure control fails or temporarily in a surge.

In a GamGram, it is impossible to address every possible design and philosophy for pressure control. For example, should a Hose End Regulator be the Primary or the Secondary Pressure Control? Should you even have a hose end pressure regulator? Why not two hose end regulators, mounted in a row, on the same nozzle? (It has been done.) See GamGram 33.

Note, Hose End Pressure Regulators are only "adjusted" by changing the main spring, there is no manual adjustment. (Changing a spring is not simple!)

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Regardless of what design your pressure control system may be, you need to test the primary and secondary pressures separately. In addition, you also must test that the deadman control will stop the flow within the correct amount of time, at any flow rate. Checking and setting the pressure controls is done by simulating an aircraft fueling, either on a test stand, or while bottom loading another refueler.

SAFETY NOTE: If you are testing nozzle pressure by flowing into an empty refueler truck (or storage tank), it is critically important that the high level control system on the "target" (receiving) refueler (or tank) be checked for proper operation before such a test, to ensure that you do not overfill the target refueler (or tank). If no high level control is active, <u>you</u> must monitor the receiving tank volume to prevent an overfill. In the normal bottom loading of refuelers, you may rely on a high-level control system on your loading rack (which works with a sensor on the truck.) **CRITICAL:** High-level controls on your loading rack cannot prevent an overfill in this test, the truck must have a working on-board system (such as "Jet Level", coupled usually to the internal valve (or "belly valve"). This is often the backup high level control on the refueler, in case the loading rack based control fails.

First, we need to ensure that the venturi, if fitted, is set correctly. If incorrectly set, the venturi will give erroneous information to the pressure control. Remember, the venturi tells the pressure control system what the nozzle pressure actually is, and must be adjusted correctly. Check the actual nozzle pressure against the "nozzle pressure" gauge on your control panel, first at 20 psi of nozzle pressure, then at 30 and 40 psi of nozzle pressure to ensure the gauges are matching within 3-4 psi. The venturi has a small needle valve for adjustment. (See GamGram 32) Nozzle pressure on your control panel is only "indicated nozzle pressure." Actual nozzle pressure is read with a gauge on the nozzle or just downstream.

Testing control valves, (inline, bypass, hydrant coupler or hose end regulator) is done by first bypassing the primary pressure control (whatever it is) and then check/set the secondary. Then you should make sure that the rate of flow control is set correctly, and only then should you check/set the primary pressure control. Setting the rate of flow control is done with the system set up to simulate the lowest possible downstream backpressure. It is important to not exceed the maximum flow rate your meter and your filter are rated for, whichever is lowest.

The maximum flow rate of a filter separator may not be what is on the name plate. Due to EI-1581 changes over the years, it may be lower, or even higher than the nameplate. Check with your filter supplier/manufacturer.

With a Hose End Pressure Control - the pressure control is usually disabled with a "block-out" device, a small metal device produced by the nozzle manufacturer that is inserted into the atmospheric vent. It prevents the piston inside from moving.

So we first set (or block out) the primary nozzle pressure higher than the secondary to disable it (disabled, relatively), or by disabling the venturi signal to that control valve. For example, if your secondary is supposed to be at 45 psi, then adjust your primary control (temporarily) to 55 psi. This should not exceed 60 psi. Refer to your vehicle manufacture manual to see if you vehicle is fitted with a "primary pressure control override" system. (Never do this while refueling an aircraft!)

Once the secondary pressure control is checked/set (for example at 45 psi), the primary pressure control is returned to normal operation and is checked/set at, for example, 40 psi. Is this optimal? <u>No, it isn't, but it is common</u>. Both Airbus and Boeing allow 50 psi. This is printed right on the aircraft. In our opinion, it makes more sense to set the primary pressure control at 45 psi and the secondary at 50 psi.

The primary pressure control should now be double-checked and checked at different flow rates. In no case should pressure exceed 50 psi, except in surge.

Test the deadman control (and emergency stop feature, if different) at the maximum flow rate, flow should stop quickly, but not too quickly. The "closing time" under the deadman control may be (is often) adjustable. It is recommended that closing time be less than 5% of the maximum flow rate, we recommend 2-3%. When releasing the deadman on a system with a flow rate of 300 GPM (or 1100 lpm) a deadman should stop the flow within 15 gallons or 56 liters. If that same system is running it at half that rate, this may be 10% more, 8-9 gallons or 35 liters.

Commercial note: We have developed a <u>new</u> device, **THE FLOW MAXIMIZER,** to improve underwing/pressure-fueling flow rates, reduce energy waste and save you time and money. It is only available from CarterEaton. It holds an HER wide open until it is needed - it reduces restriction and refueling time. Test have shown a 5% to 25% reduction in fueling time.