THE GAMGRAM

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Look at the title again. It does not say “Clay Filtration”. Clay is not supposed to filter and if you use it to filter, you are probably in trouble.

Of all the misnomers in jet fuel handling activities, the worst one is the use of the word “filter” when you talk about clay. Let’s get it straight, if you use clay, you are “treating” or “processing”, you are not filtering. “To filter” means to remove particles by entrapment. Clay treatment removes molecules by adsorption - “polar attraction”. If you load up a clay treater with dirt particles, you are preventing it from doing its intended job -- removing surfactants.

The reason that clay is used in jet fuel handling systems is that pipelines, ships and other transportation methods handle other petroleum products that contain surfactants that contaminate the jet fuel. This word is like slang. It means surface active agents. These are chemicals that seek or act at surfaces between two different materials. Some of them act between water and dirt -- like hand soap. Some act between petroleum and dirt - like a detergent additive in motor oil. Some surfactants act between petroleum and water. These are the surfactants that prevent a filter separator from working because they form a surface film around water drops that keeps two drops of water from joining together. In other words, they prevent coalescing.

Clay has a marvelous ability to capture molecules of surfactants. The best type is known as “attapulgus” clay, and cartridges are usually made of a grade that is between 50 and 90 mesh. It looks like very fine sand but each particle consists of hundreds of tiny, fiber-like crystals. The net surface area of one pound of attapulgite is over 13 acres. (In the metric system, 1 Kg has about one ninth of a square kilometer of area.)

This incredible amount of surface area makes it possible for clay to capture molecules of surfactant very effectively. The most important factor is time. We call it residence time or contact time. If you pump the fuel through so fast that the surfactant molecules do not have time to migrate to the clay crystal surfaces, you will obtain poor performance. The slower the flow, the better the clay will work. Does this sound like filtering? It surely is not!

Clay cartridges or elements are made in a somewhat standard size of 7” OD x 18” long. Never exceed a flow rate per element of 7 gpm (26.5 1/m) but 5 gpm (19 1/m) is better. Some manufacturers have rated their vessels as high as 10 gpm per element but this is clearly ridiculous, and you will never find a petroleum chemist who will recommend such a flow rate, because no grade of clay exists that will work under such conditions.

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Clay treatment is not a simple process to use because pressure drop is not the basis for determining that the elements must be replaced. Unfortunately, our industry has no sure way to measure surfactant content of fuel. Lacking this ability, we recommend the Emcee field kit called Microseparometer (ASTM Method 3948). By running tests before and after the clay, you obtain a measure of the improvement in MSEP rating (formerly called WSIM). More often, filter membrane color rating (ASTM Recommended Practice D2276) is used but this really gives a far more indirect indication. Generally, clay elements are changed because poor results are being measured at the outlet of a filter separator downstream.

Discolored water in the filter separator is a sure indication of failed clay for two reasons. First, if water is found downstream of clay, you know that the clay is full of water. Second, a brown or black colored water often indicates surfactants. Water is the “enemy” of clay because it effectively blocks the pores in the clay particles, preventing contact by surfactants. Therefore, you must take every precaution to keep water out of clay. Many very successful installations have been made using modernized versions of the old-fashioned excelsior dehydrator (hay-pack) to knock down as much water as possible.

To prevent dirt from blocking clay elements, more and more installations are made with pleated paper pre-filters. Our experience has been that two micrometer rated paper or finer is the correct choice. The economics are obvious. A set of paper elements costs roughly one-tenth (1/10) that of clay when you include the extremely high freight rates for clay.

If you have read all the way through this GamGram, you are probably astounded that anyone would propose four units all in a row to clean up jet fuel (dehydrator, pre-filter, clay treater and then a filter separator). Our only response is to repeat -- clay is a process. It is not filtration. When you get into the “processing” business, you have graduated from the use of a filter separator as a “safety device”. You are a mini-refinery!

In conclusion, a few words should be said about the two different types of elements that are sold -- bag type and canisters.

COST	Bag elements are much less costly, roughly 25 - 35% less than canisters.
CAPACITY	Bag elements hold about 15 lbs. of clay while canisters hold 11 - 12 lbs.
INSTALLATION	Bags are very tricky to install properly because they bypass fuel through creases where their ends contact one another. With great care and hours of hand forming, a perfect job can be done and no bypassing will take place.
PERFORMANCE	Canisters excel in 90% of installations because bags are rarely installed perfectly. There are, of course, poorly designed canisters. Before you purchase, take one apart to see how flow is prevented from passing through above the clay, after settling has taken place. The perforations at the upper end of the center tube are blocked on good elements.