Bio aviation fuel certification, testing

Fuel must meet industrial specifications, be free from other products, additives

by Kurt Tyssen

As energy-efficient standards and environmental considerations evolve, all industries are finding the use of renewable fuels is becoming a necessity. Specifically, the aviation community is at the forefront of the adaptation of biofuels.

Fuel quality is vital to the safety of an aircraft in flight. The aviation fuel needs to meet the relevant industrial specification and be free from other products, unapproved additives and contaminants.

Aviation fuel is generally stored, distributed and transported in shore tanks, ships or trucks. The fuel is stored here during the production time and before the aircraft is filled with the fuel. This is because the risk for potential fuel contamination is high. Therefore, monitoring the quality at several points during the distribution chain is mandatory — not just for fossil aviation fuel, but even more for bio aviation fuels. Facilities that supply biojet fuel are usually smaller in scale than a fossil fuel refinery, which typically means there is a more complex distribution chain. This increases the products susceptibility to contamination.

Any alternative fuel would have to be compatible with conventional fuel or it would require separate storage (or distribution) and airport delivery system.

NEW GUIDELINES, STANDARDS

Today, there are several established guidelines and standards to control the quality of aviation fuel. According to American Society for Testing and Materials (ASTM) or Institute of Petroleum Test methods (IP), typical characteristics to be tested are composition, volatility, fluidity, combustion, corrosion, stability, contaminants and lubricity characteristics.

The Joint Inspection Group (JIG) produces guidelines for aviation fuel quality control and operating procedures for jointly operated supply and distribution facilities. Latest amendments to these guidelines were published in 2009. These new amendments now include updated procedures and guidelines to avoid the risk for fatty acid methyl ester (FAME) contamination in aviation fuel.

Recently, ASTM also published a new standard ASTM D7566 for aviation fuel containing synthesized hydrocarbons (SPK), which is only valid at point of batch production.

KEEPING FUEL CLEAN

While new guidelines and standards are important, it is equally important to keep the fuel clean and without pollutants. Potential contaminations issues can be avoided. Most, if any contamination, will occur during the supply of aviation fuel into the distribution chain because there is an increase in the presence of foreign particulates (e.g. dirt, metals, water).

Aviation fuel cleanliness means it is free from solid particles and visually free from water.

In order to ensure that the fuel has avoided contamination, testing of the particles needs to be done. Simple testing — even by visual appearance — can be one way to identify if there are particles in the fuel. Other tests such as Milipore filtration tests and particle size laser distribution are also recommended to ensure fuel purity. Presence of particles can lead to plugging of fuel filters and increase of wear on the fuel pumps in the aircraft.

Water can appear as dissolved water or "free water," which is a separate layer on the bottom. The presence of water can lead to a negative effect on the ignition properties of the fuel because it can form ice at high altitudes. Additionally, water is an ideal source for microbiological growth.

Surfactants (chemicals) can reduce the interfacial tension of certain substances in aviation fuel. Surfactants are tested by a well-known industry technique called the micro-separometer technique. It can lead to deactivation of filters and water separation equipment and blocking of filters.

Additives are mixed in by small concentrations to enhance properties important to fuel performance or fuel handling. These industry approved additives are fuel-system icing inhibitors (prevent water freezing), anti-oxidants (prevents peroxide formation and avoid fuel aging problems), metal deactivator (prevents copper and other dissolved metal catalysis oxidation), corrosion inhibitors (prevents corrosion), lubricity improvers (improve lubricity) and electrical conductivity additive (safety issue), which

ultimately keep the fuel at a level set for peak performance.

Aviation fuel may become contaminated with micro-organisms. The risk for microbiological contamination is even greater with biofuels than fossil fuels. Free water is an ideal breeding ground for microbiological growth. At storage facilities and airports, the presence of microbiological activity is tested by Microbe Monitor 2 systems. Microbial growth can cause plugging fuel filters and corrosion problems.

AVOIDING CONTAMINATION

Biodiesel can contaminate aviation fuels through multi-product pipelines or by previous shipping of diesel cargoes which contains FAME .

Potential impacts from biodiesel contamination include failure in freezing points (-47 degrees C maximum), which can cause pumping concerns, reduction in energy, and water and metal contamination. To avoid these potential impacts for contamination, it is important that the required specification is met. This industry requirement is a maximum of 5 parts per million (ppm) biodiesel in the actual aviation fuel.

The approved test method to determine this industry amount without contamination is based on a gas chromatographic mass spectrometer technique developed by the Energy Institute with the analytical support of the technical fuel center of Intertek Sunbury.

Intertek works with a number of companies around the globe. Specifically, Intertek was involved during a detailed analytical investigation of synthetic paraffinic kerosene (SPK) with Air New Zealand and Rolls Royce. During the testing, Intertek was able to provide results that met the current aviation fuel specification. In fact, the quality of the bio aviation blend fuel used in both cases seemed to be better compared to the 100% conventional aviation fuel.

Recently, Intertek also was involved in a testing program of a high-octane aviation fuel used to power many aircraft and racing cars. Avgas is used in aircraft that have piston or Wankel engines. During this project, 20% bio methanol was added to the avgas as a bio-blend component. The bio avgas was then screened on water content, acidity, vapor pressure, gum residual content, specific energy and corrosion aspects. The bio avgas also was screened on a phased separation during the blending stage.

While bio aviation is still an emerging industry, the airlines and the marketplace are ready for it. Other alternative fuels such as hydro-treated kerosene have large potential as a blend component with fossil aviations fuels. As the industry moves forward, any future alternative aviation fuel will need to be compatible with conventional fuel or it will require a separate storage and airport delivery system. BB

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