Aviation Jet Fuel Information
AVIATION TURBINE FUEL (JET FUEL)

CIVIL JET FUELS

Aviation turbine fuels are used for powering jet and turbo-prop engined aircraft and are not to be confused with Avgas. Outside former communist areas, there are currently two main grades of turbine fuel in use in civil commercial aviation: Jet A-1 and Jet A, both are kerosine type fuels. There is another grade of jet fuel, Jet B which is a wide cut kerosine (a blend of gasoline and kerosine) but it is rarely used except in very cold climates.

JET A-1

Jet A-1 is a kerosine grade of fuel suitable for most turbine engined aircraft. It is produced to a stringent internationally agreed standard, has a flash point above 38°C (100°F) and a freeze point maximum of -47°C. It is widely available outside the U.S.A. Jet A-1 meets the requirements of British specification DEF STAN 91-91 (Jet A-1), (formerly DERD 2494 (AVTUR)), ASTM specification D1655 (Jet A-1) and IATA Guidance Material (Kerosine Type), NATO Code F-35.

JET A

Jet A is a similar kerosine type of fuel, produced to an ASTM specification and normally only available in the U.S.A. It has the same flash point as Jet A-1 but a higher freeze point maximum (-40°C). It is supplied against the ASTM D1655 (Jet A) specification.

JET B

Jet B is a distillate covering the naphtha and kerosine fractions. It can be used as an alternative to Jet A-1 but because it is more difficult to handle (higher flammability), there is only significant demand in very cold climates where its better cold weather performance is important. In Canada it is supplied against the Canadian Specification CAN/CGSB 3.23

MILITARY

JP-4

JP-4 is the military equivalent of Jet B with the addition of corrosion inhibitor and anti-icing additives; it meets the requirements of the U.S. Military Specification MIL-PRF-5624S Grade JP-4. JP-4 also meets the requirements of the British Specification DEF STAN 91-88 AVTAG/FSII (formerly DERD 2454), where FSII stands for Fuel Systems Icing Inhibitor. NATO Code F-40.
JP-5

JP-5 is a high flash point kerosine meeting the requirements of the U.S. Military Specification MIL-PRF-56245 Grade JP-5. JP-5 also meets the requirements of the British Specification DEF STAN 91-86 AVCAT/FSII (formerly DERD 2452). NATO Code F-44.

JP-8

JP-8 is the military equivalent of Jet A-1 with the addition of corrosion inhibitor and anti-icing additives; it meets the requirements of the U.S. Military Specification MIL-T-83188D. JP-8 also meets the requirements of the British Specification DEF STAN 91-87 AVTUR/FSII (formerly DERD 2453). NATO Code F-34.

AVIATION FUEL ADDITIVES

Aviation fuel additives are compounds added to the fuel in very small quantities, usually measurable only in parts per million, to provide special or improved qualities. The quantity to be added and approval for its use in various grades of fuel is strictly controlled by the appropriate specifications.

A few additives in common use are as follows:

1. Anti-knock additives reduce the tendency of gasoline to detonate. Tetra-ethyl lead (TEL) is the only approved anti-knock additive for aviation use and has been used in motor and aviation gasolines since the early 1930s.

2. Anti-oxidants prevent the formation of gum deposits on fuel system components caused by oxidation of the fuel in storage and also inhibit the formation of peroxide compounds in certain jet fuels.

3. Static dissipator additives reduce the hazardous effects of static electricity generated by movement of fuel through modern high flow-rate fuel transfer systems. Static dissipator additives do not reduce the need for 'bonding' to ensure electrical continuity between metal components (e.g. aircraft and fuelling equipment) nor do they influence hazards from lightning strikes.

4. Corrosion inhibitors protect ferrous metals in fuel handling systems, such as pipelines and fuel storage tanks, from corrosion. Some corrosion inhibitors also improve the lubricating properties (lubricity) of certain jet fuels.

5. Fuel System Icing Inhibitors (Anti-icing additives) reduce the freezing point of water precipitated from jet fuels due to cooling at high altitudes and prevent the formation of ice crystals which restrict the flow of fuel to the engine. This type of additive does not affect the freezing point of the fuel itself. Anti-icing additives can also provide some protection against microbiological growth in jet fuel.

6. Metal de-activators suppress the catalytic effect which some metals, particularly copper, have on fuel oxidation.
7. Biocide additives are sometimes used to combat microbiological growths in jet fuel, often by direct addition to aircraft tanks, as indicated above some anti-icing additives appear to possess biocidal properties.

8. Thermal Stability Improver additives are sometimes used in military JP-8 fuel, to produce a grade referred to as JP-8+100, to inhibit deposit formation in the high temperature areas of the aircraft fuel system.

**POWER BOOSTING FLUIDS**

It used to be commonplace for large piston engines to require special fluids to increase their take-off power. Similar injection systems are also incorporated in some turbo-jet and turbo-prop engines. The power increase is achieved by cooling the air consumed, to raise its density and thereby increase the weight of air available for combustion. This effect can be obtained by using water alone but it is usual to inject a mixture of methanol and water to produce a greater degree of evaporative cooling and also to provide additional fuel energy.

For piston engines, methanol/water mixtures are used and these may have 1 percent of a corrosion inhibiting oil added. The injection system may be used to compensate for the power lost when operating under high temperature and/or high altitude conditions (i.e. with low air densities) or to obtain increased take-off power under normal atmospheric conditions, by permitting higher boost pressure for a short period.

Both water alone and methanol/water mixtures are used in gas turbine engines, principally to restore the take-off power (or thrust) lost when operating under low air density conditions. Use of a corrosion inhibitor in power boost fluids supplied for these engines is not permitted.

The methanol and water used must be of very high quality to avoid formation of engine deposits. The water must be either demineralised or distilled and the only adulterant permitted in the methanol is up to 0.5 percent of pyridine if required by local regulations as a de-naturant. In the past there were several different grades of water/methanol mixtures, e.g. 45/55/0 for turbine engines, 50/50/0 for piston engines (this was also available with 1% corrosion inhibiting oil and was designated 50/50/1) and 60/40/0, however, with decreasing demand Shell now only supplies 45/55/0. The table shows the principal characteristics of Shell demineralised water and of the commonly used methanol/water blend.