Australian Government
Civil Aviation Safety Authority

AIRWORTHINESS BULLETIN

Diesel Fuel

AWB 28-015 **Issue** : 1
Date : 26 May 2014

1. Effectivity

Australian registered aircraft fitted with turbine engine(s) conducting operations utilising diesel fuel.

*Note For the purpose of this bulletin the term **diesel fuel** includes commercially available automotive diesel fuels.*

2. Purpose

To provide a set of guiding principles and parameters which have been identified as having either a direct or indirect impact on the selection and use of diesel fuels.

3. Background

CASA requires the pilot in command of an aircraft to ensure that the aircraft is not flown unless the fuel complies with the specification and grade required or approved for the purpose by CASA, *(Civil Aviation Order 20.9, Para. 3 refers)*.

The use of any fuel is dependent on that fuel being listed, by specification and grade, for a particular purpose in a manual or manuals promulgated by the aircraft and/or aircraft engine manufacturer. It matters not that diesel fuel is simply identified as an approved fuel for certain aircraft or engines, if the diesel is not to the *specification* listed (e.g. ASTM D975), then it cannot be used.

The current Australian Standard for automotive diesel fuel does not have any legislative basis. It is essentially an industry guideline and its main purpose is to specify requirements that are consistent with commercial diesel engine development practice and reliable operation.

The use of diesel fuels in aircraft turbine engines is only acceptable when:

a) The fuel is listed as an approved fuel in the manufacturers approved data, and

b) The fuel conforms to a specification detailed in that approved data.

Note Approved data includes the Airplane Flight Manual (AFM), the Pilots Operating Handbook (POH), aircraft and engine manufacturers approved maintenance data (CAR 2A) and the aircraft and engine Type Certificate Data Sheet (TCDS).

4. Recommendations

a) To establish the actual suitability of a particular fuel and any associated limitations, all pertinent data sources for the aircraft/engine combination are to be consulted prior to making a final determination.

The following scenario illustrates an acceptable level of due-diligence that should be exercised during this process. The stated fuel requirements are a direct excerpt from each of the referenced documents.

Operator 'A' is considering the use of automotive diesel fuel in an Air Tractor AT-502 aircraft which is fitted with a Pratt & Whitney Canada PT6A-34AG turbine engine.

Document	Fuel Requirements
FAA TCDS A17SW Rev. 13, (Air Tractor, Inc. Model: AT-502)	Per specifications CPW 46, PWA 522, GB 6537-94 (Peoples' Republic of China RP-3 kerosene), or Automotive diesel fuels.
FAA TCDS E4EA Rev. 26 (Pratt & Whitney Canada Corp. PT6A-34AG)	FUEL (See NOTE 8) - Fuels conforming to P&WC Spec. CPW204 & CPW46. For PT6-AG engines CPW381 also. NOTE 8. Emergency use of MIL-G-5572, Grades 80/07, 91/98, 100/130 and 115/145 is permitted for a total time period not exceeding 150 hours during any overhaul period. It is not necessary to purge the unused fuel from the system when switching fuel type.
P&WC S.B. No. 1344R10 ENGINE FUELS & ADDITIVES - REQUIREMENTS AND APPROVED LISTING	TABLE 12, Alternate Fuels Approved Fuels Subject to Restrictions on Use. Low Sulphur Diesel Fuel (CP-43)(Arctic Grade), ASTM D975 No. 1D, Canadian CGSB CAN 3.6 Type A. Automotive Diesel Fuel (CPW46)(Arctic Grade), ASTM D975 No. 1D, Canadian CGSB CAN 3.6 Type A. Low Sulphur Diesel Fuel (CP-48)(Arctic Grade), Canadian CGSB CAN 3.6 Type A. Automotive Diesel Fuel (Winter Grade), Canadian CGSB CAN 3.6 Type A. Automotive Diesel Fuel (Regular Grade),ASTM D975 No. 2D, Canadian CGSB CAN 3.6 Type B. NOTE: 1. Unless otherwise specified intermittent or continued use of these fuels for up to 1000 hours is allowed provided satisfactory fuel nozzle inspection results are achieved at the approved intervals.

	NOTE: 2. Unless otherwise specified continued use of these fuel for more than 1,000 hours is allowed provided periodic fuel nozzle inspection results are found acceptable by P&WC. NOTE: 3. After the use of diesel fuel containing dyes or Grade 80 aviation gasoline, the fuel system must be flushed.
FAA Approved AT-502 Airplane Flight Manual	FUEL – ASTM D1655-70, JET A, JET A1 (NATO Code F34, F35) JET B (NATO Code F40) MIL-T-5624, JP-4 (NATO Code F40), JP-5 (NATO Code F42, F44) Aeromatic Fuels prohibited. Automotive Diesel fuel, VV-F-800, DF-1 and DF-2 may be used. DF-1 should not be used below 25°F (-4°C), and DF-2 should not be used below 40°F (4,5°C).

In the above scenario, if the referenced documents were read in isolation an inaccurate conclusion may be reached regarding the approval of a particular fuel type. It is not until all the pertinent documents are viewed in their totality that an accurate judgement on the suitability and operational limitations of a fuel be made.

The correct determination in this scenario is that only specific grades of diesel may be used as an alternate fuel with its usage restricted and contingent on specific maintenance actions.

The use of any other fuel not specifically listed or conforming to the specifications detailed in the approved data would therefore not be acceptable.

b) The following items should also be considered when evaluating the acceptability of diesel fuel for use in an aircraft turbine engine.

1) Cloud Point

Cold flow performance is one of the most fundamental criteria for fuel quality in relation to engine performance. Diesel fuel can have a high content of paraffinic hydrocarbons which, if cooled sufficiently, will form as wax in the solution. As diesel fuel is cooled, there comes a point at which the waxes begin to separate and appear as a cloud or haze in the fuel. If cooling is continued, more of the waxes come out of solution until a point is reached where wax begins to cover the fuel filter thickly enough to impede the flow of fuel.

The cloud point detailed in the diesel fuel specification therefore becomes an important consideration when using diesel fuel in areas of low atmospheric temperatures.

2) Additives

Additives are generally used to influence properties such as the cold flow, lubricity, storage and combustion characteristics of diesel fuel, to differentiate products and to meet trademark specifications. The actual properties of automotive diesel depend on the refining practices employed and the nature of the crude oils from which the fuel is produced.

As Australian fuel quality standards are progressively tightened the need to use additives to manage certain diesel properties will increase.

The primary concern is that these additives have not been tested for use in aviation fuels and the potential effect on the continuing airworthiness of associated aeronautical products has not been ascertained.

3) Fuel Blends

Even though diesel or blended fuels may seem to be chemically similar to approved jet fuels, specific characteristics which are normally controlled during the refining process may not remain intact or continue to meet the prescribed fuel property limits. Any fuel or combination of fuel products must conform to the approved fuel specification(s).

4) Sulfur Content

The sulfur content of diesel fuel depends on both the source of the crude oil and the refining process. The sulphur content of diesel may result in sulphidation. This chemical/corrosive reaction primarily exists in the extremely high temperature, high pressure environment of the engines tubine, affecting turbine blade roots, shrouds and blade airfoils.

Sulfidation is a critical parameter that requires regular monitoring and strict adherence to Hot Section Inspection (HSI) procedures and the timely replacement of sulphidated turbine components is necessary to address potential airworthiness concerns.

5) Cleanliness

Diesel does not burn as cleanly as aviation turbine fuels, causing problems with fuel nozzles, combustion liners and hot section parts, primarily due to its carbon-forming tendencies.

It may also be necessary to purge the fuel system when changing fuels or using fuels containing certain additives.

6) Handling & Storage

As Australian fuel companies do not supply diesel fuel specifically for use in aircraft turbine engines, tanker and storage tank cleanliness is not a prime consideration. Adherence to appropriate fuel quality procedures is essential to ensure that the fuel is free from un-dissolved water, sediment, and suspended matter.

Operators utilising drum stocks or fuel distribution networks with low turnover rates need to remain particularly vigilant in this regard.

5. Enquiries

Enquiries with regard to the content of this Airworthiness Bulletin should be made via the direct link e-mail address:

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or in writing, to:

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