### A310 FUEL TEMPERATURE LIMITATIONS TheAirlinePilots.com

## Assessing the Tank Fuel Temperature

The tank fuel temperature is defined with reference to the outer tank for the following reasons:

- Outer tank is the coldest tank, due to its low thermal inertia (relative thickness, capacity, thin air gap insulation above fuel surface).
- Outer tank is the back-up tank in case of loss of fuel feed capability from center and inner tanks.

In absence of outer tank fuel temperature indication, the tank fuel temperature is assessed through correlation with the TAT.

After thermal stabilization (2-3 hours after the top of climb) the outer tank fuel temperature is within 2 deg of TAT.

Prior to thermal stabilization TAT is a conservative indicator of the outer tank fuel temperature. However incase of TAT increase (warmer area or step descent) the TAT / Outer tank fuel temp relationship is reversed.

The fuel temperature in the CTR, inner and trim tanks is typically 3-8 deg C above that of the outer tank. Engine fuel feeding from the outer tank is therefore the limiting criteria. This is because incase of center tank there is an absence of direct contact with outside static or total temperature. Inner tanks have high thermal inertia and in trim tank there is mixing of center and inner tank fuel during aft transfer.

The tank fuel temperature response to any significant change in the TAT typically features a 10 minute time lag.

#### Fuel Temperature Limitations

Whether the outer tank fuel temperature is assessed through a correlation with TAT or by direct reading, the resulting value is accurate within  $\pm 2 \deg C$ .

This results in a common definition of the applicable TAT or Outer tank fuel temperature limitation, relative to the fuel freezing point as:

#### Actual Fuel Freeze Point + Engine Manufacturer Margin + 2 deg C (3 for FAA)

The engine manufacturer's margin depends on the engine design philosophy in terms of overall heat management (fuel/oil heat exchange). These margins are:

Pratt and Whitney: 0 deg C

General Electric: 3 deg C

For additional fuel temperature limitations see "Operating Limitations" in Vol 2.

## **Operational Guidelines**

- Assess the forecast SAT/TAT temperature profile over the route (forecast accuracy is +/- 2 deg C).
- Plan the flight at a lower altitude. However this may not be effective when tropopause is substantially low e.g. polar tropopause, winter periods.
- Planning the flight at faster Mach number. Increasing the Mach by 0.01 increases the TAT by 0.5-1 deg C.
- Lower altitude or increased Mach number will involve extra fuel which should be catered for.
- Plan via a random route avoiding low SAT area. This may also need extra fuel which can limit the payload. Moreover this may not even be possible due to ATC constraints.
- Consider additional contingency fuel during flight planning.
- Without outer tank fuel temperature indication, TAT should be recorded at periodic interval to keep a record of TAT history throughout the flight.

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