The FAUDI Factsheet
Water in Jet Fuel Misconceptions

Key Points

- Predominantly no free water in jet fuel at point of delivery into aircraft
- All filtration technologies have their characteristics and "cannot be regarded as fail-safe on their own"[1]
- Monitoring benefits all into-plane filtration technologies
- Installation of an EWS downstream, fulfills the requirement for a comprehensive system to protect aviation fuel cleanliness

Aircraft Management of Water

- Dissolved water is naturally present in jet fuel and vaporises during combustion
- Water precipitates from solution to free water in jet fuel during flight
- Aircraft fuel and engine systems are designed to handle small amounts of water safely
- Aircraft are fitted with water scavenge systems where pumps draw water and fuel from the bottom of the tank, emulsifying the mixture with the primary fuel flow before entry into the engine

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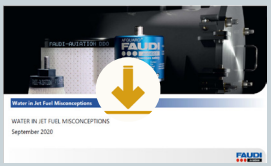
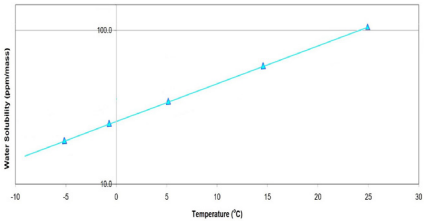


Jet fuel at point of delivery into aircraft contains predominantly no free water or particulate. Into-plane fuelling filtration technologies have performance characteristics and "cannot be regarded as fail-safe devices on their own"[1]. The use of Electronic Water Sensors (EWS) provides the required assurance to refuelling operators and airlines that every single litre of fuel delivered into aircraft is monitored and prevents water from reaching the aircraft by triggering a deadman shutdown.

The Purpose of the Removal of Water in Transportation and Storage is to Prevent Microbiological Growth

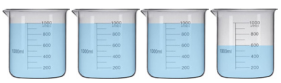
Dissolved water is naturally present in jet fuel and cannot be avoided or removed by filtration. It is considered a constituent of fuel, not a contaminant. At an average global ground level temperature of 15°C, jet fuel can contain up to 60 parts per million (ppm) of dissolved water. As jet fuel cools, the amount of water that it can hold in solution reduces and takes the form of suspended and free water. These forms of water are regarded as fuel contaminants and are removed during transportation and storage by qualified filtration technologies, settling and draining. The purpose of the removal of water along the supply chain is to prevent microbiological growth on the interface between the fuel and water.



Typical curve of water solubility in jet fuel[2]. Fuels with a high aromatic content can dissolve much more water than those with low content.

Misconception of Water Content in Jet Fuel during Aircraft Refuelling

The removal of water during transportation and storage, is why jet fuel at point of delivery into aircraft contains predominantly no free water. If airport hydrants were 'wet', even with as little as 4 ppm water, in a refuelling of 80,000 litres, 2" filter monitors would require replacement every two days and filter/water separator sumps would contain 160 ml water after every fuelling (see table below). If airport hydrants were as 'wet' as some suggest, contrary to real airport conditions for at least 70 years, 2" filter monitors with their negligible water holding capacity would potentially require replacement every day and would have never been a commercially viable into-plane filtration technology. Filter monitors lasting 12 months is the clearest indication that jet fuel at point of into-plane delivery is basically free of water.

Example:	Filter Monitor Vessel with 36 Monitors (2" x 30")	Filter/Water Separator with 6" Coalescers
Flight from Frankfurt to New York	~ 80,000 litres of jet fuel	~ 80,000 litres of jet fuel
Water at Filter Inlet	4 ppm	4 ppm
Water at Filter Outlet	2 ppm	2 ppm
Water Absorbed/Coalesced during Fuelling	2 ppm = 160 ml (0.16 litres)	2 ppm = 160 ml (0.16 litres)
Changeout dP for ITP	1 bar (15 psi)	1 bar (15 psi)
Water Holding Capacity per 36 Monitors (2" x 30") to 1 bar dP	1 Monitor = 0.1 litres = 36 x 0.1 litres = 3.6 litres	Coalesces to drain
Changeout dP of 1 bar/ Water Drainage	22 Refuellings to reach changeout dP of 1 bar	Coalesce just 2 ppm and drain off 0.16 litre water per fuelling
Is this really happening?		

Refuelling Into-Plane Requires Monitoring

Into-plane fuelling filtration technologies have performance characteristics and "cannot be regarded as fail-safe devices on their own"[1]. A zero tolerance limit of SAP on the part of industry and engine OEMs has led to the EI 1583 specification being withdrawn by the end of 2020. Alternative into-plane filtration technologies are required to replace filter monitors. **An Electronic Water Sensor (EWS) benefits all filtration technologies**, it is not specifically designed for use with Dirt Defence Filters. An EWS monitors filter/water separator performance and in case of disarming or overwhelming of the filter, signals a deadman shutdown.

The AFGUARD® EWS provides the required assurance to refuelling operators and airlines, that every single litre of fuel delivered into aircraft is monitored and prevents water from reaching the aircraft by triggering a deadman shutdown when it detects water concentrations greater than maximum allowable in the fuelling specification. The AFGUARD® EWS is capable of continually detecting water in the range of 0-50 ppm. Into-plane operators would benefit from the sensor data capture system and could take appropriate action if fuel at point of delivery into aircraft is not consistently 'clear and bright', trace back to source and resolve the problem upstream at the fuel farm or hydrant system.

1) EI specifications 2) Research Project EASA.2010/01

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