

Anti-Icing Fluid Residues

**Kirsten Dyer, BAE Systems Regional Aircraft,
SAE G12 Chair of Residue Workgroup**

Anti-Icing Fluids – what are they?

- Type II, III and IV fluids approved to SAE AMS 1428
- Uses:
 - De-icing + Anti-icing
- Composition: water, glycol, polymer thickener
- Fluid Properties:
 - Higher Initial Viscosity and Holdover
 - Non-Newtonian

Anti-icing Fluid Residues – how they occur...

- Fluids collect in aerodynamically quiet areas of the aircraft
- Water and glycol evaporate, leaving polymer thickener as powder, thin film etc
- Polymer thickener rehydrates in contact with water, expands up to 600 times in thickness forming a gel
- Gels can freeze in flight at temperatures close to 0°C.
- On critical surfaces, such as primary flying control circuits, frozen gels can cause control restrictions. This is a serious matter of flight safety.



Factors and Potential Solutions

1. Aircraft Design

- Non-powered
- Gap sizes
- Sealing

- **Solutions:**
- aircraft modifications

- **Stakeholders:**
- OEM'S
- Regulators

Factors and Potential Solutions

2. Fluid Application

- Spraying into fairings from rear
- Amount
- 1- or 2-Step Process

- **Solutions:**
- Increased use of the 2-step process in Europe
- Increased availability of Type I fluid
- Training and licensing of service providers

- **Stakeholders:**
- Operators
- Regulators

Factors and Potential Solutions

•3. Inspection and Cleaning Programmes

- Frequency of inspection
- Frequency of cleaning
- Areas
- Standard

- **Solutions:**
- Establish rigorous programme and review regularly

- **Stakeholders:**
- Operators
- Regulators

Factors and Potential Solutions

- 4. Fluids

- Neat or diluted
- Type
- Brand

- **Solutions:**

- Develop new fluids that don't cause residues
- Improve existing fluids

- **Stakeholders:**

- Fluid Manufacturers
- SAE
- Regulators
- OEM's

SAE G12 Residue Workgroup

- Workgroup consists of fluid manufacturers, airframe manufacturers, airlines, test laboratories and regulators, including UK CAA, TC and FAA.
- Responsible for developing tests to determine a fluid's residue characteristics in SAE AMS 1428.
- SAE AMS 1428 Annex A (Buehler test) measures a fluid's dryout and rehydration characteristics.

SAE G12 Residue Workgroup – Work so far...

- Reproducible

- May 2006 to May 2007 spent improving test reproducibility
- Test known to work as a comparison test between fluids per laboratory
- Comparison set of testing has just been completed on all current neat AMS 1428 fluids. This data is potentially publishable.
- This set of test results will also be used to compare reproducibility of the test between laboratories.

SAE G12 Residue Workgroup – Future Work

- Representative

- Test simulates vertical areas not horizontal areas like control rods.
- Adhesion of the gel to the surface is not measured.
- The variation in mechanical strength between frozen gels is not measured.
- There is no test to measure the interaction of aircraft and runway de-icer.

- Reproducible and Representative

- A reproducible and representative test can be used to set residue limits for the fluids, or to categorise them into bands, potentially leading to development of improved fluids.