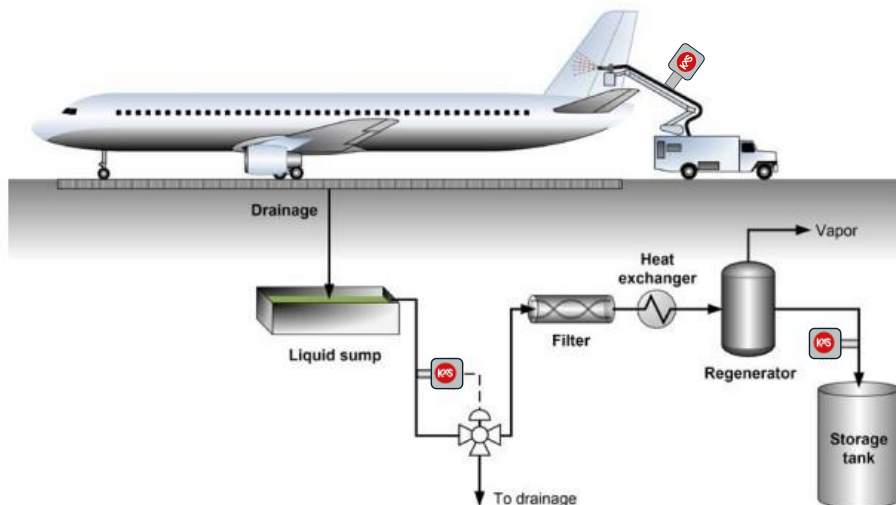




Spraying and recovery of de-icing fluids |
Ethylene glycol CH_2OH_2 , Propylene glycol $\text{C}_3\text{H}_8\text{O}_2$

Benefits of R.I. measurement

- Refractive Index is directly related to glycol concentration and freezing point, making real-time RI measurements crucial for safety, efficiency and environmental control of operations.
- Regularly checking the refractive index of the de-icing fluid with a process refractometer ensures glycol concentration remains effective.
- KxS refractometer provides accurate, bubble-resistant, and temperature-compensated RI readings in the field in both spraying and recovery of the de-icing fluids.



Overview

Aviation de-icing and anti-icing fluids, such as ethylene glycol (EG) or propylene glycol (PG), play a critical role in maintaining aircraft safety by preventing ice accumulation on flying and control surfaces. Ice accretion can significantly compromise an aircraft's aerodynamics, potentially leading to catastrophic loss of control.

De-icing is typically performed on the ground by spraying the aircraft with de-icing fluids. These fluids are subject to stringent operational and quality control standards established by the **Society of Automotive Engineers (SAE) G-12 Committee on Aircraft Ground De-icing/Anti-icing**.

Proper management of de-icing fluids is essential to prevent environmental contamination. Used de-icing fluids must be collected and processed to comply with regulatory requirements, as airport stormwater discharges containing glycol are often subject to environmental controls.

Refractive index measurement applications

Spraying

De-icing involves the application of glycol-water mixtures to aircraft surfaces using spray nozzles. These nozzles may be part of fixed platforms or mobile tanker trucks operating in the

apron area. Ensuring the quality of de-icing fluids is paramount for safety and performance.

Key parameters monitored include viscosity and Refractive Index (RI), as these relate to the fluid's freezing point. The freezing point of de-icing fluids decreases with increasing water content due to contamination or precipitation, reducing their effectiveness.

While the **ASTM D1177 method** is the standard for freezing point determination, it is impractical for field use.

Instead, measuring the Refractive Index (RI) real-time provides a quick and accurate way to monitor the freezing point of glycol-based de-icing fluids. For example, the acceptable RI range for ethylene glycol-based fluids at 20 °C (68 °F) is 30.5–33.5 °Brix, corresponding to a freezing point of approximately -36 °C (-32.8 °F).

The KxS Technologies DCM-20 Process Refractometer is specifically designed for such applications. It offers:

- Automatic temperature compensation, ensuring precise measurements.
- Uninterrupted performance in the presence of air bubbles, which are common in de-icing fluids.

Hydrometers, by comparison, lack the precision required for de-icing formulations, making the DCM-20 an indispensable tool for field operations.

Recovery

After application, the glycol-water mixture is recovered using airport drainage systems or centralized recovery facilities. Recovery involves:

- Collecting de-icing fluid, melted ice, and snow into a sump through apron drainage channels.
- Pumping the fluid mixture to sludge tanks, where solids and free water are separated via settling and filtration.
- Heating the filtered fluid using sequential heat exchangers before transferring it to a regenerator.

In the regenerator, the glycol-water mixture undergoes a dehydration process in a reflux stripping column.

This process evaporates water and condensate, concentrating the glycol solution. The concentrated fluid is then stored in an accumulator and returned to the storage tank for reuse.



Instrumentation and installation considerations

The KxS Technologies DCM-20 Process Refractometer is deployed at critical control points during both spraying and recovery processes:

1. Spraying platforms and mobile units:

- Ensures the glycol concentration meets operational standards for freezing point suppression.
- Provides on-site safety and quality control.

2. Recovery systems:

- Monitors glycol concentration to direct pure water to drainage and diluted glycol to sludge tanks.
- Verifies the final concentration after dehydration to ensure glycol is suitable for reuse.

With its robust design and precise measurements, the DCM-20 Process Refractometer supports safe and efficient de-icing operations while minimizing environmental impact.