Application News

Turbine Meter System Optimizes Aircraft Fuel Flow Measurement

Industry: Aerospace ***Service: Onboard Flow Rate*** ***Fluid: Jet A***

Overview

Energy costs have become a major factor in the operation of aircraft today. Maximizing aircraft efficiency is a concern for most aerospace industry manufacturers. To determine aircraft efficiency, accurate fuel flow data is critical. Turbine flow meters are the choice when accuracy, range, dynamic response and compact size are required.

Situation

A leading aircraft manufacturer sought a reliable, high-accuracy flow meter to measure Jet A fuel flow. This application involved a flow range of 480 to 5,750 PPH (1.25 to 15 GPM) over a temperature range of -40°C to 85°C. It required a flow meter with compact size and low weight - as well as the best possible accuracy. Used on board aircraft, the meter was required to meet qualification specifications to RTCA/DO-160D.

Turbine flow meters are one of the most precise flow sensors on the market if used and calibrated properly. However, like other meters, they are only as good as their last calibration. The kinematic viscosity of the fluid being measured affects turbine meter accuracy. For this reason, a calibration in fluid of the same kinematic viscosity is required to achieve the best accuracy. Because fluid kinematic viscosity changes due to temperature, multiple calibrations at different kinematic viscosities are often mandatory.

Solution

Modern turbine flow meters can use a technique known as a "Universal Viscosity Curve" to operate over varying kinematic viscosity values. This process involves calibrating the flow meter over the viscosity range, and then using electronics to determine the correct flow rate based on the input temperature of the fluid and the frequency from the meter. Limitations of this technique include calibrating the flow meter at kinematic viscosities that do not vary by more than a 10:1 ratio from one another over the range of kinematic viscosities, and restricting the meter range to a 10:1 turndown. Operation at extended ranges is possible, however, output accuracy will degrade due to a drop off in meter linearity in situations beyond the 10:1 normal flow range.

System Description

Flow Technology provided the customer with a flow measurement system providing the best possible accuracy over a wide temperature range on board aircraft. The system consists of a custom bore flow meter paired with an integrated LinearLink™ Temperature Compensated Interface (TCI). The turbine meter utilizes a proven flow measurement technology ensuring exceptional accuracy and reliability. The Linear Link TCI performs meter temperature viscosity compensation and linearizing functions. For this application, the unit was modified for RTCA/DO-160D qualification test requirements.

In order to address the wide temperature range, the flow meter was calibrated in three different fluids with kinematic viscosities matching Jet A over the temperature range.

Technical Information

Flow Meters (Model Number):	IM Series Custom Flow Meter
Electronics (Model Number):	Linear Link TCI modified for RTCA/DO-160D qualification testing
Flow Rate:	1.25 to 15 GPM
Fluid:	Jet A

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