APPLICATION NOTE A055-GP04 LUBRICANT DOSING IN AIRPLANE MANUFACTURING

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Airplanes consist of many parts of various materials. An important part of such an aircraft is the fuselage, the main body part that surrounds crew, passengers and cargo. Fuselage parts are connected by making use of rivets, and to that purpose holes need to be drilled in these fuselage parts.

A French manufacturer makes complete robot arm drilling solutions. To reduce friction, wear, and to dissipate heat, drilling oil is needed as a lubricant during drilling operation. In fact, some of the aircraft companies demand a perfect quality with respect to the rivet joining, and insist that all holes are lubricated during the drilling operation. If one or several holes are drilled without lubricant, the fuselage part is declared not suitable, leading to considerable loss and high costs. To meet this quality requirement, the drilling oil supply needs to be monitored, so Bronkhorst was asked for help.

Fuselage part of an aircraft

Application requirements

The ultimate question that has to be answered is, whether or not lubricant has really been dosed during the drilling of a certain hole. Are we sure that if we 'do' this hole, we have oil inside? Furthermore, this 'measuring device' needs to operate close to the drilling head, so it goes beyond saying that it needs to be sturdy to withstand the drilling head vibration. Moreover, there is limited space available at the robot arm, so the measuring device needs to be compact.

Important topics

- 'Binary' answer: flow or no flow?
- Robust system on vibrating robot arm
- Small measuring device, to be integrated in the robot arm

Process solution

The solution by Bronkhorst that met the requirements for this application is the LIQUI-FLOW L13 thermal mass flow meter for liquids. The drilling oil used here is an oily/water emulsion with 100 grams per hour flowing through a 10 to 20 meters long tube between a pressurised vessel at 4 bars and the drilling head.

Tests using an active drilling head in operation with the LIQUI-FLOW L13 mass flow meter attached revealed a good performance. In this way their customer - the aircraft manufacturer, in fact the user of the robot arm - can observe that indeed there is some oil at the hole, as part of their quality control. Earlier tests, placing a measuring device immediately downstream of the pressurised vessel gave no good results, mainly due to the large distance between the meter and the drilling head.

In this setup, the mass flow meter communicates via the Profibus protocol to transfer measuring data to a data processing unit. If there is no signal, the mass flow meter will not measure any flow of drilling oil, and something is wrong in the lubricant supply, to which immediate action can be taken. This will result in less waste, with respect to rejected aircraft fuselage parts.

A follow-up to this qualitative 'flow or no flow' test is a quantitative approach in which the measured signal will be mathematically integrated in order to measure the actual amount of drilling oil that has been supplied to each hole.

(Photo: www.kuka.com)

Recommended Products

LIQUI-FLOW™ L13

Min. flow 0,25 ... 5 g/h
Max. flow 5 ... 100 g/h

Pressure rating 100 bar

Compact, IP40 design

Analog, RS232 or fieldbus I/O

LIQUI-FLOW™ 'INDUSTRIAL STYLE' L13I

Min. flow 0,25 ... 5 g/h
Max. flow 5 ... 100 g/h

Pressure rating 100 bar

Compact, IP65 design

Analog, RS232 or fieldbus I/O

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