

Bananas laid the foundation for performance in mass production

A few temperature sensors have played a greater role than others in the development of more precise temperature measurement. One of these is the “banana sensor” that Pentronic has been manufacturing since the 1980s.

The original customer was Stal Refrigeration, now Johnson Control Systems & Service AB. The company develops refrigeration systems for ships for the transport of goods, including bananas. Transporting bananas is strictly regulated by classification societies and other authorities. The ripening process must be precisely controlled so that the bananas will be attractively yellow in the shops. Measures must also be taken against the risk of spreading harmful insects.

“For instance, if the temperature goes above certain limits, the ship is not allowed to unload its cargo in the United States,” explains Anders Martinson of Johnson Control in Norrköping, Sweden.

THE CORRECT TEMPERATURE

The banana is extremely sensitive, and its



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entire journey from the plantation to the retail shop must be planned in detail. The temperature must be right the whole way. If it gets too warm the bananas will ripen too early. In extreme cases ships may have to pump a semi-liquid banana sludge overboard. If the temperature gets too cold, the result is black speckled bananas that customers reject in the shops.

“The correct temperature varies for different kinds of bananas,” Anders says.

As they ripen, bananas also emit heat, which rises up through the cargo. A typical temperature is an internal banana temperature of 12.7 °C at the bottom of the banana cargo and 13.0 to 13.2 °C at the top.

LABORATORY-LEVEL PERFORMANCE

Today’s cargoes are not as sensitive as they used to be. Modern banana ships have airtight cargo holds with internal atmospheric conditions that delay the ripening process, but the temperature measurement requirements are still just as strict.

In technical terms, probe sensors are inserted into bananas at strategic points throughout the cargo. The detector is a four wire connected Pt100 that conforms to the 1/10 DIN tolerance band at 0 °C – a band that is normally found only in laboratories. The challenge has been to retain the detector’s performance levels in the sensors being manufactured.

“At their final inspection here with us the sensors are within 1/6 DIN,” says Leif Jansson, head of mechanical design at Pentronic.

The final measurement uncertainty for the entire system is within ± 0.15 °C, which meets the Lloyd’s classification society’s



Edin Beganovic with a “banana sensor” being manufactured.

requirements with good margin to spare. This banana sensor was one of the first sensors from Pentronic to be classified. Nowadays it has been joined by a growing number of sensors with various classification types and certificates.

PRECISION IN MASS PRODUCTION

Production of the banana sensor has varied over time. For a number of years it was one of Pentronic’s biggest selling products. When Sweden joined the European Union, sales fell due to penal duties on bananas grown outside areas given preferential treatment by the EU. Sales went up again as imports increased once more.

The “banana sensors” have also paved the way for pressure-resistant temperature sensors that meet laboratory requirements but are used in mass production processes. These characteristics are becoming increasingly important as societies and companies focus more and more on energy savings and a smaller environmental footprint. 