

## **AN ONLINE MEASUREMENT OF THE MOISTURE IN A BLOCK CHEESE ON A MOVING CONVEYOR PRIOR TO BRINING**

### **Introduction:**

From 2004 until the Present, a leading Dutch cheese manufacturer has been successfully using Microwave Technology to measure the *Moisture Content of a Block of Cheese Online and in Real Time prior to Brining*, (see Pictures at the end of White Paper).

### **The new Measuring Technique:**

1. Greatly reduces the amount of laborious and destructive testing, which is currently done after brining.
2. Delivers results, which are being used to optimize of the plant's efficiency and quickly predict and react to failures in production.

In principle, there were two non-contacting methods currently available:

1. Infrared (IR)
2. Microwave Measurement.

## **CONTRASTING INFRARED (IR) AND MICROWAVE TECHNOLOGIES**

### **Infrared (IR)**

1. The IR Measuring Technique was established long before the Microwave Measuring Technique.
2. The IR Measurement has a very small depth of material penetration and can be considered as a surface measurement. The Microwave Measurement passes through the Cheese from Top to Bottom, making a measurement of the entire Cheese Product.

### **Microwave Technology (1 mW)**

1. Is very simple to Calibrate and Use.
2. Overcomes:
  - a. The problem of unevenly distributed moisture and the fact that the Rind has a different Moisture than the Center of the Cheese Block, by measuring the total Cheese Block.

### **Installation and Calibration**

1. The Measurement takes place while the cheese is moving at 0.2 m/second on a conveyor.

2. A highly accurate laser device:
  - a. Is used to determine the height of the Cheese Block,
  - b. Assures that no readings are taken in the open space between the Cheese Blocks.
3. Using one or more "reference blocks", the calibration line of the analyzer can be checked very simply and quickly at random.
4. Calibration checks only take about one minute.
5. To analyze salted and unsalted cheeses, two different sensors (antennae) must be used.

## **Conclusions**

1. The radiation pattern of microwaves is completely reproducible and, thanks to the leveling, the analyzer is always measuring the correct cheese volume in relation to the amount of detected water molecules making the analysis absolutely reliable.
2. The Dutch Cheese Manufacturer has decided, after thoroughly checking the results of the Microwave Installation, to go with Microwave Equipment for all of their plants.
3. The most important reason for their decision to select the Microwave System over the IR System is the fact that the IR measurement is just a surface measurement.
4. Since the Microwave Measurement is of the whole Cheese Block, it can analyze up to 5 liters and more of a sample - a thousand-fold increase in sample size over the IR System.
5. The cheese manufacturer has agreed on an accuracy of  $\pm 0.5\%$  for Individual Cheese Blocks, and  $\pm 0.3\%$  as an average of five cheeses.
6. The Cheese Manufacturer initially opted to measure only one type of cheese with almost identical thickness of the blocks. Since the initial test has concluded, system software has been upgraded and it is now possible to analyze different cheese types in random succession.
7. The results delivered by microwave analysis have been better than initially expected.
8. The analyzer has been used for two years and the cheese manufacturer is very satisfied.

