Delta T Moisture/Dryer Control System

Drying Technology, Inc., Silsbee, TX

The Delta T Moisture/Dryer Control System is model-based control system that senses moisture inside the dryer and provides early and precise control response.

Inside the Dryer Moisture Sensing

The Delta T Moisture Control system consist of a model based control algorithm that allows moisture sensing of the product inside the dryer. The Delta T uses two temperature sensors inside the dryer to sense the moisture content of the product and make control changes to correct the moisture while it is still in the dryer.

The patented Delta T Moisture Control System is based on a model that relates the moisture content of the product leaving a dryer to the temperature drop (ΔT) and production rate. The temperature is measured before and after contact with the product during drying and the difference (ΔT) between the two is used in the model to calculate the change in moisture and make a control response. Figure 1 illustrates the Delta T method. The Delta T model can be considered a soft sensor for measuring moisture of the product inside the dryer. Figure 2 shows the product moisture calculated by a Delta T soft sensor versus a NIR moisture meter.

Figure 1: Delta T Model

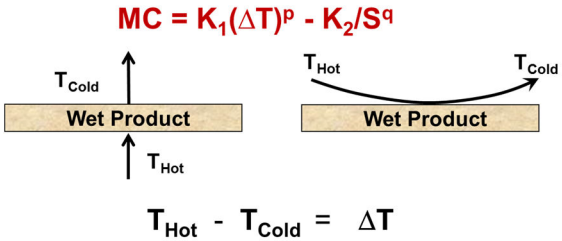
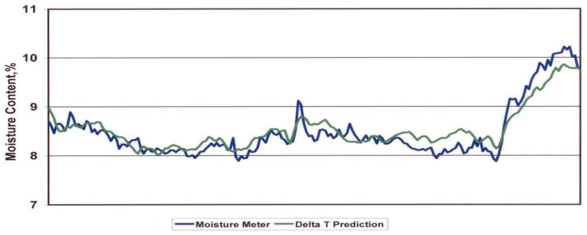


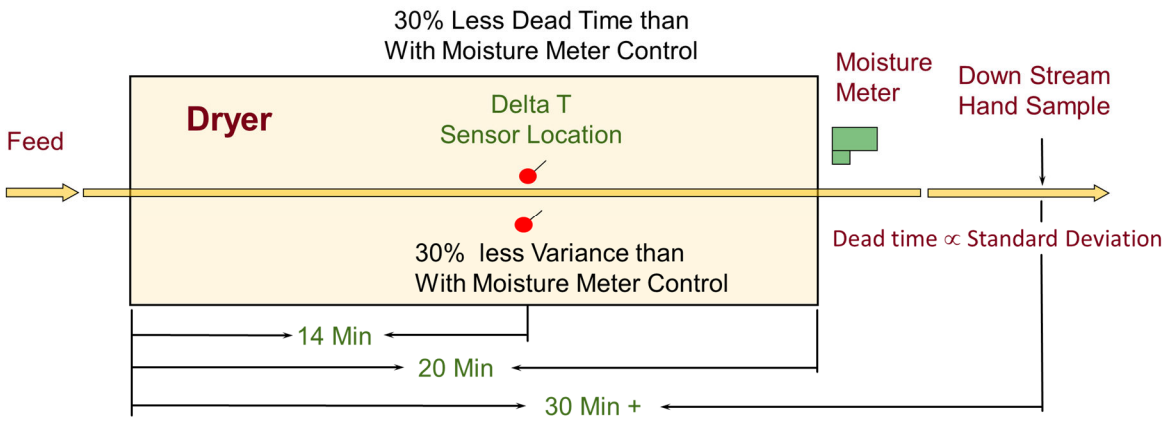
Figure 2: Delta T Predicts Moisture



Reduces Dead Time

The proper location of the temperature probes in the dryer allows the Delta T to become an 'inside the dryer' moisture sensor. By sensing the changes in moisture at a point inside the dryer and making control responses, the dead time is greatly reduced. As seen in the diagram above, the Delta T will detect the change in moisture and respond to the change in less time than systems using conventional methods, such as moisture meter/sensor or hand sampling. The moisture variance caused by process upsets is proportional to the dead time between the time of the upset and the time of detection and response. Therefore, by reducing the dead time with early detection and response the moisture variance is also reduced. Normally, the reduction of variance realized with the Delta T system is 30% or more. Figure 3 illustrates the location and dead time reduction of the Delta T method.

Figure 3: Delta T Sensor Location Reduces Dead Time



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Delta T Applicable to Many Dryer Types

The Delta T control system can be used with many dryer types.

Flow Through Dryers: Conveyor and many fluid bed dryers are examples of continuous flow-through dryers where the Delta T soft sensor is located in the dryer. The moisture and dryer load are monitored for changes and the control response is made while the product is still in the dryer. This early response reduces the dead time, thus reduces moisture variance.

Suspension Dryers: The Delta T systems uses the inlet and exhaust air temperatures to sense the changes in moisture and dryer load. The traditional method for controlling spray, flash, and rotary dryers is to control to an exhaust temperature set point. This method results in immediate control in the right direction, however the exhaust temperature set point must be changed to maintain the target moisture after a load change. This traditional method is not theoretically sound. The Delta T method being model based calculates its new set points and maintains the target moisture.

Batch Drying: The Delta T method has been used on batch dryers with good results. The same Delta T principal is used to determine the final Delta T value that relates to the desired final moisture content.

Benefits

Most often the average moisture content of dried product is low due to lack of good control and the product is over-dried to be safe. The Delta T system will reduce the moisture variation, thus allowing the moisture content to be increased and safely stay below the upper control limits. This increase in mean moisture will give a better quality product, a production increase, and an energy savings. Figures 4 shows the reduction in overall moisture variance and Figure 5 illustrates safely increasing average moisture content, thus providing a production increase.

Moisture Variation Reduced

Production Increased

Quality Improved

Energy Conserved

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Drying Technology, Inc.

Conveyor Fluid Bed

Spray Rotary

Flash Ring

Continuous & Batch Drying

Figure 4: Reduction in Moisture Variation

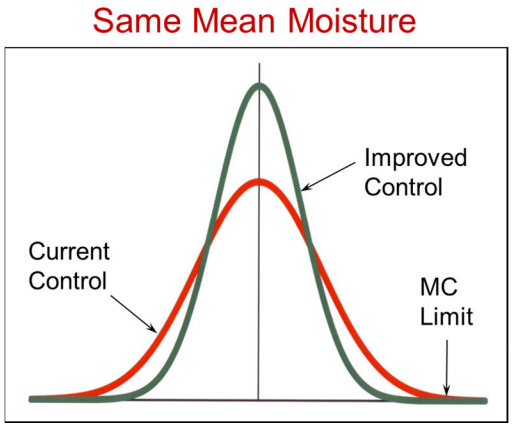

Figure 5: Possible Shift in Average Moisture with Improved Control