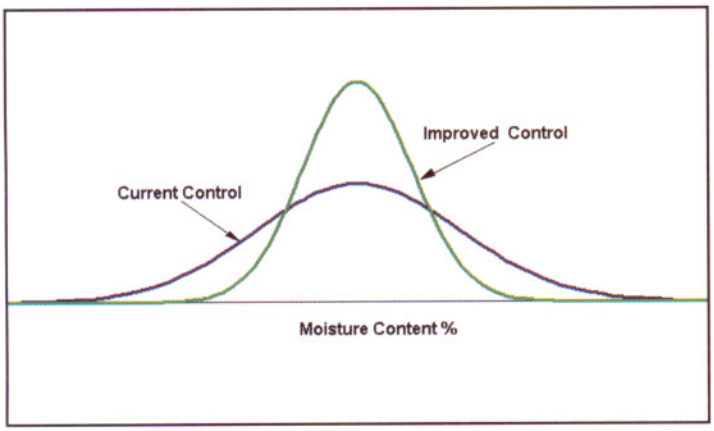
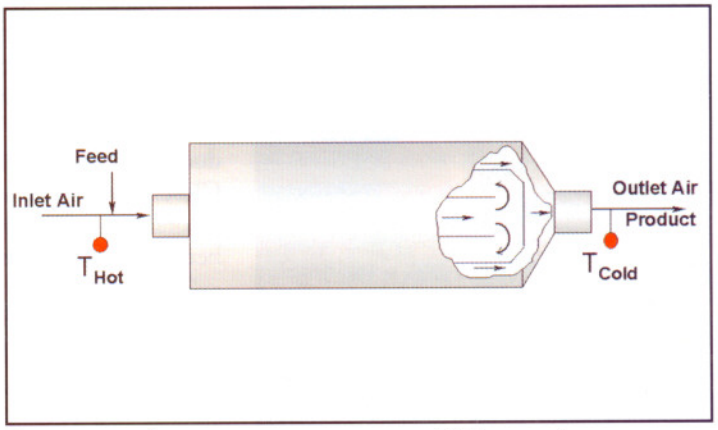
Control Moisture For Profit

By John Robinson, Drying Technology, Inc.



Current vs improved moisture control using the temperature drop method.



Temperature drop measurement across an OSB rotary dryer.

Introduction

Drying is costly; poor moisture control makes it more costly through lost production, lowered product quality, and increased energy consumption. A highly significant factor affecting moisture control is location of the moisture sensor; if not located inside the dryer, the control system has one chance in three of making the correct control decision.

Moisture Sensing Problem

The panel industry commonly uses two sensing methods as the basis for moisture control: conventional moisture sensors (Infra-red, Near Infra-red, Radio Frequency, Capacitance, Resistance, etc.), and dryer exhaust temperature as a surrogate for moisture content. Both methods are generally ineffective because conventional sensors use relatively small sample sizes, must be frequently calibrated, are unable to operate satisfactorily inside or around the dryers, and the exhaust temperature method provides no automatic means for setpoint adjustment when water load to the dryer changes.

Sensor Selection Criteria

The moisture content of a product exiting a dryer is either wet, dry or on target. If the commonly used "after-the-fact" (feedback) control system is in auto mode, its control decisions will be based on the moisture content of the product at the downstream moisture sensor. For example, if the moisture content at the sensor is on target and water load changes enter the dryer, the control system must assume that no control action is necessary until the change reaches the sensor. In general, this type of control system has only one chance in three of making the right control decision; in fact, its chance for success varies inversely with the time required for an entering change to be detected (dead time). For this reason, a control system with its moisture sensor located downstream is prone to cycle and produce poor moisture distribution; this can lead to a reduction in the production rate, an increase in unit energy consumption, and poorer product quality. Obviously, the most important criterion for selecting a moisture control system is to *install the moisture sensor inside the dryer* so that it will make the correct control decision 100% of the time.

Conventional sensors sample only a fraction of the total production rate, usually a small spot on the product surface, therefore, a second moisture control selection criterion should be to *select a sensor that uses as large a sample-size as possible*. Some conventional sensors require frequent calibration; therefore, the third selection criterion is to *select a sensor that requires no calibration*.

The exhaust temperature moisture sensing method, although an "inside-the-dryer" sensor, is incapable of maintaining the target moisture when water load changes enter the dryer. The operator must continually search for the correct setpoint value in an "after-the-fact" manner, therefore, the fourth criterion for selecting a control system is to *select a control system capable of automatically and continuously re-adjusting the temperature setpoint to maintain the target moisture content*.

The Control Solution

A moisture sensor is available that meets the recommended criteria for selection of a moisture control system. It is based on a patented mathematical model relating the moisture of the product leaving the dryer to the temperature drop (delta t) of hot air after contact with the wet product, and the dryer production rate. This "inside-the-dryer" type moisture sensor does not need calibration, uses total production for the sample, is based on rugged temperature sensors, and applies to most products and dryer-types. It is superior to the exhaust temperature sensor because its setpoint can be automatically and continuously adjusted to maintain target moisture content.

Improved Moisture Control In Panel Manufacture

OSB Moisture Control

Figure 1 shows distributions of strand moistures from a rotary dryer before and after installation of a Temperature Drop control system. The standard deviation of the moistures was reduced by 50%. The minimum reduction achievable is normally 30% for either rotary or conveyor dryers.

Figure 2 depicts the temperature drop measurement across a rotary dryer and figure 3 shows the temperature drop measurement for a conveyor dryer. The control system uses these temperature drops to calculate

an output signal that is proportional to the moisture of the strands. This output signal is used to manipulate the feedrate and/or the heat input to the dryer. In addition, the control system has the unique capability of constantly adjusting the temperature setpoint to maintain target moisture content when the water load is constantly changing.

MDF Moisture Control

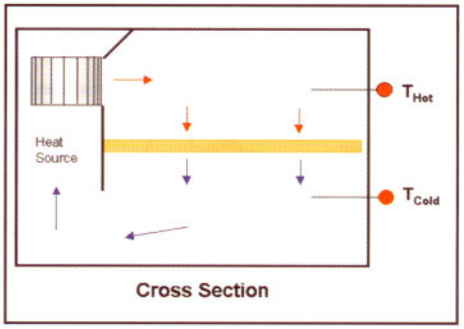
The Temperature Drop method was recently installed on three MDF flash dryers; figure 4 shows the measurement of the temperature drop. Figure 5 describes the narrowing of the moisture distribution as a result of using a moisture sensor installed inside the dryer. The control system is also capable of continuously adjusting the temperature setpoint to maintain the target moisture content. Results indicate a minimum 30% and a maximum of 50% reduction in moisture variation can be achieved in this type application.

Veneer

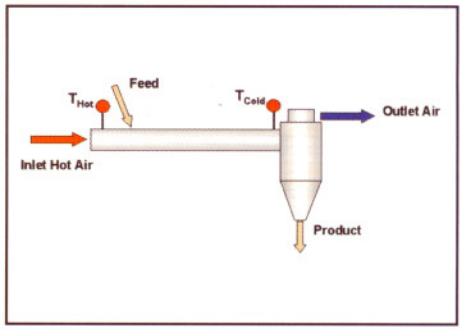
The Temperature Drop method for controlling veneer dryers was first installed on a veneer jet dryer at the Bon Wier, Texas, plywood mill of Kirby Forest Industries in the early 1980's. The existing control system was the usual brush-type moisture sensor at the end of the dryer that detected and marked wet sheets for re-drying. The dryer speed tended to cycle because it operated on "after-the-fact" moisture information. It was, at best, an automated re-dry inventory control system.

The Temperature Drop control method infers average veneer moisture content inside the dryer by taking a temperature drop across a dryer section (Figure 6), and processing it through the model to generate an output signal proportional to the veneer moisture at the control section. In this way, the entire veneer production is sampled for moisture determination.

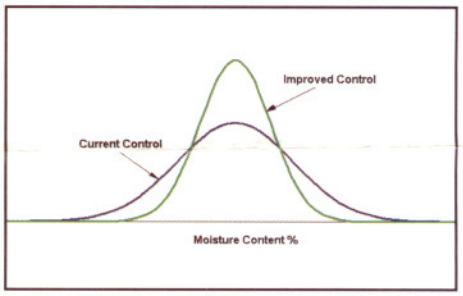
The Temperature Drop control system converts about one-third to one-half of the normally produced redry sheets directly into acceptable veneer by minimizing the cycling effect of the "after-the-fact" type control. The veneer lies flatter, has better color, and glues better; fewer blows occur, and less over and under-dried veneer is produced. The average production rate is increased by about 7.5%. It was first commercially installed in 1986 at Boise Cascade's mill in Florien, Louisiana, where three systems are presently in operation. Figure 7 shows the production rate increase (15%) resulting from progressively installing Temperature Drop control systems on eight veneer dryers at Kirby Forest Industries' three Texas mills, from January 1983 through July 1986.



Temperature drop measurement across an OSB conveyor dryer.



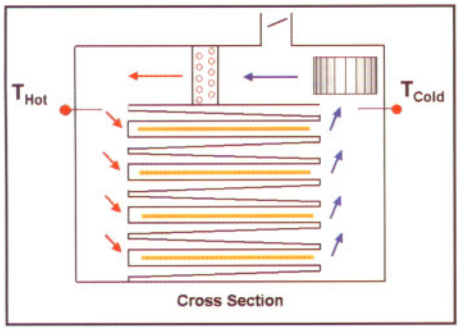
Temperature drop measurement across an MDF flash dryer.



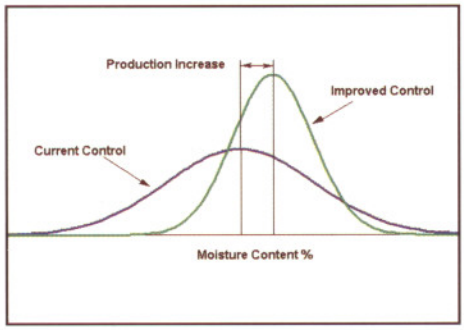
Current vs improved moisture control of an MDF dryer using temperature drop method.

Summary And Conclusions

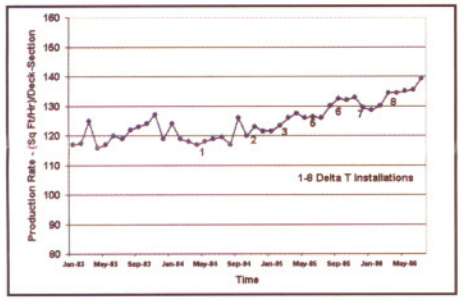
You can expect a 30% to 50% reduction in product moisture variation by including in your moisture control system a moisture sensor that operates inside a dryer, uses the largest sample-size possible, requires



Cross section of a veneer jet dryer temperature drop measurement.



Shifting average moisture content.



Effect of temperature drop control method on corporate veneer production.

no calibration, is essentially universally applicable, and can be automatically and continuously re-adjusting to maintain the target moisture content. The overall results are an improvement in quality, a reduction in unit energy costs, and corporate standardization of moisture control systems for all dryers. Additionally, if production is dryer-limited, it can be increased by shifting the average moisture content upward as shown by Figure 8. ■

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Product Information

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The new BMS3000 from LIMAB uses long range, ultra-precise laser sensors to measure board thickness without touching the surface. The system measures on OSB, MDF, HDF, particleboard, plywood, hardboard and any other hard or soft panel surface.

The BMS3000 includes 1 to 10 measurement tracks with sensors, PC, cabinet and software. The software provides real time graphics, trend graphs, numerical data display, data logging, two levels of alarms with outputs and network communications.

The system employs our newly developed PreciCura sensor that uses the latest digital

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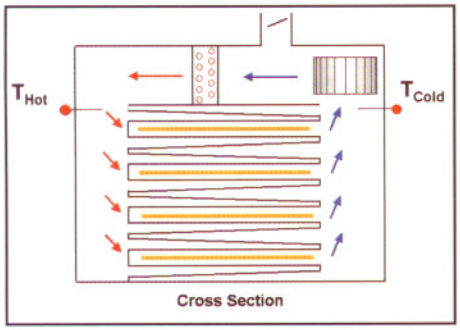

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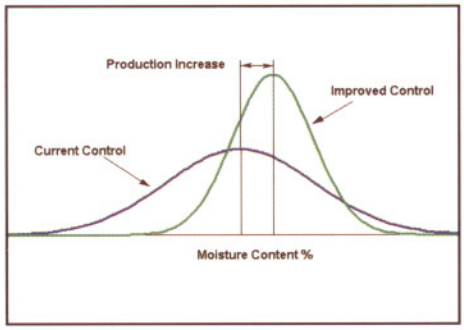

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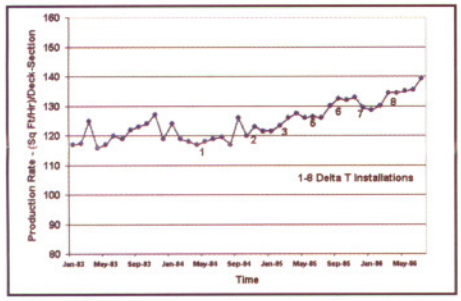

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Continued on page 28 …