SAVING ENERGY

Maximizing Veneer Dryer Efficiency with Today's Top Performers

by Alan Knokey

The cost of energy for any wood processing operation is a significant component of the cost of doing business. It is therefore important for any plant to implement effective measures that will help to control its energy consumption. This was the impetus for the development of several advancements that, when used alone or in combination, can greatly improve the thermal energy efficiency for drying veneer and other such panel products.

Background

In the 1970s it was discovered that exhausting panel board dryers at the lowest temperature point in the process dramatically improved the thermal efficiency of the dryer. This concept was patented in 1980, and by the early 1990s the concept was implemented in jet veneer dryers as well. The lowest temperature point in a jet veneer dryer is at the wet end. A wet end seal section was added ahead of the main dryer section, where all of the dryer's process air could be pulled from and then exhausted. This *single point exhaust system* process application for veneer dryers was patented in 1997.

One of the early issues that resulted from the single point exhaust system was the buildup of pitch on the interior walls of the wet end seal section. Without adequate cleaning and maintenance there was danger of fire. So it was time to go back to the drawing board and come up with a way to alleviate this problem.

Finding the solution

The solution lay in increasing the height of the wet end seal section, and then heating the air ahead of the exhaust fan to ensure that the volatile organic compound-laden gases (VOCs) remained in gaseous form as they were exhausted out of the dryer. Flow control devices were added to control the mixture of ambient air from the plant and heated air from the dryer section into the wet end seal section, and temperature probes were added to monitor the temperature of the air at several points. This was key to maximizing thermal efficiency in the drying process. The system for controlling flow and monitoring temperature has been coined *ADEC* for automatic dryer exhaust control, and was patented in 2011.

Today, a flow control fan in the wet end seal section and a main exhaust damper at the dryer section work together to pull heated air from the dryer. A secondary heating system maintains a high temperature as the gasses are mixed, thus alleviating pitch build up. Temperature data gathered via probes at the top of the wet end seal section, the point of air ingress from the dryer section and the point of ambient air ingress from the plant, allows the ADEC system to precisely control the amount of heating of the air mixture that is done inside the wet end seal section prior to exhaust.

The purpose of ADEC is to allow automatic control of the total dryer exhaust volume under all dryer operating conditions and maximize the thermal efficiency of the drying process. Based on set values during dryer operation, ADEC uses the temperature signal differentials to adjust the main exhaust damper accordingly, which in turn exhausts more or less air volume from the dryer section. The exhausted air is then directed through a duct to the plant’s pollution abatement equipment.

How ADEC works, in detail

A nominal 4'-0" wet end seal section located on the feed end of the dryer is fitted with a stainless centrifugal exhaust fan. The purpose of this fan is to precisely meter exhaust flow from the seal section. The wet end seal section is equipped with special entry and discharge-end stop-offs.

The wet end exhaust duct is designed to match the height of the dryer's recirculating duct and is fitted with heaters on both the operator and chain sides of the dryer. The duct includes a man access door for cleaning. The heaters provide a temperature boost to the wet end seal exhaust flow, which minimizes pitch buildup in the exhaust treatment duct.

The ADEC system fan is located adjacent to the wet end seal section. The dryer exhaust flow is modulated by an actuated inlet vane damper. A control loop is established between the ADEC fan damper and two thermocouples that compare ambient air and wet end seal temperatures. ADEC uses the wet end seal section as a blend chamber mixing blowout from the first dryer section with air from the feed section, and uses the difference between these two temperatures multiplied by a scaling factor as the process variable, or PV (see Figure 1). If the PV rises above the set point the control opens the dryer main exhaust damper, reducing the blowout into the wet seal section which then brings the PV back to the set point temperature. Conversely, if the PV falls below the set point the control closes the dryer main exhaust damper, increasing blowout into the wet end seal section to bring the PV back to set point temperature.

The numeric difference between these thermocouples provides a true indication of the exhaust requirement of the dryer. When the wet end seal temperature rises above a control set point, it is an indication that pressure is increasing in the dryer. When the wet end seal temperature falls below the control set point it is an indication that pressure is decreasing in the dryer. The ADEC continually adjusts the exhaust flow to prevent fugitive emissions and over-exhausting the dryer.

This control automatically senses the dryer air volume increase caused by the evaporation of water from the veneer and adjusts the exhaust damper so that no dryer fugitives flow from the dryer into the feed section and no feed section air is allowed to enter the drying process. The ADEC control thus maximizes the absolute humidity within the dryer under all load conditions.

Modulating the main exhaust damper maintains a uniform pressure in the dryer. The addition of the heater in the wet end seal section minimizes hydrocarbon condensing in the seal section. In most dryers in North America today, the exhaust air from the dryer is reincinerated via a pollution abatement system to ensure any existing hydrocarbons that are in the exhaust are not discharged into the atmosphere.

The ADEC system works in tandem with two other control methods to ensure the maximum efficiency of the complete drying process, and the highest quality of dried veneer.

Cooler pressure balance control

An automatic cooler pressure balance system controls the cooler exhaust volume under all operating conditions, minimizing the flow of heated process air from the dryer into the cooler section, or cooler air into the hot dryer. This system also helps to maximize thermal efficiency, minimizes pitch buildup which reduces maintenance and cleaning, and allows for automatic veneer temperature control into the dry stacking process.

Mechanical stop-offs are located between the last heated section and the first cooling section. In addition to the main cooling fan, the first cooling section's discharge vent is fitted with an exhaust fan. Pressure sensing manifolds located on both sides of the stop-offs accurately measure the pressure in the last heated section and first cooling section. Any pressure difference commands a change in the cooling section exhaust fan speed. The effect is a near zero pressure differential between the enclosed dryer and the first cooler seal section under all operating conditions (see Figures 2 and 3).

Veneer temperature compensation

Uniform temperature control of the veneer exiting the dryer can be maintained independently of the first cooling section by modulating the rotation speed of the cooling fans. If the temperature of the veneer exiting the dryer is too high, the fans speed up. Conversely, if the temperature of the veneer exiting the dryer is too low, the fans slow down. The first cooler fan will always run with a minimum speed setting to maintain pressure control (see Figure 3).

Patents are pending on the automatic cooler pressure balance and the veneer temperature compensation systems.

Results

Instrumentation downstream from the dryer monitoring moisture content indicates a very tight moisture content component in the finished dried veneer. This is attributable to not only the systems described here, but also to the quality of the design and construction of the dryer itself.

Practical applications

The first implementation of the ADEC system was in 2005 in a plant at Kamloops, BC. To date, eight ADEC systems are installed and operating in North America. The improvements described herein are relatively new technology to many plants, but they can be applied to new or existing jet or longitudinal dryers with single zone reverse air systems, and utilizing virtually any heat source.

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