<u>CUT AND DRIED</u>

Tips on Increasing Veneer Dryer Energy Efficiency

by Patrick Dronsky

Several types and configurations of veneer dryers exist in the plywood industry. Typical would be a 6-level, 108-feet-long, 17-feet-wide heated section. Veneer dryers are typically heated via natural gas burners or via steam heated radiators; a small number are heated via thermal oil radiators or forced hot air (from boiler emissions).

In order to dry the sapwood of Douglas-fir, a common West Coast species, typical heating requirement would be approximately 21,600,00 Btu/hr on a commercial veneer dryer that produces 15,000 sq. ft. 3/8 inch thick per hour. On a per unit basis, this equals approximately 1450 Btu/ sq ft 3/8 inch thick energy requirement.

The above energy figures are for a new dryer running at optimum efficiency and well maintained. Because many dryers in the industry are old, leaky, and not regularly maintained, actual energy consumption requirements can be much higher than those listed above.

Common Dryer Inefficiencies

Partly because the veneer industry has been in existence for so long and partly because investment capital is not always available, the service life of veneer dryers seems to be getting longer. Many mills are forced to "make-do" with older dryers that become less energy efficient over time. The dryers, typically made from mild steel and mounted atop a concrete slab, degrade in several ways as time passes.

For example, the mild steel insulated housing often falls victim to corrosion. The housing can corrode from the inside-out, due either to moisture migrating from inside of the dryer and into panel cracks or missed welds, or to moisture being trapped in seal-welded panels.

A solution is installation of a "minimum-heat-transfer" insulated dryer housing that is corrosion resistant by design. The inner skin of the housing is seal welded to prevent any moist air ingress into the panel. As an added benefit, the seal welding prevents in-plant fugitive emissions from escaping the dryer altogether and polluting the mill air. Between the skins is placed minteral wood insulation, helping to keep the dryer's heat loss as small as is practically possible. The outer skin is a corrugated steel cladding, which allows the interior of the housing to "breathe." Any moisture that could ever get into the housing is allowed to evaporate out.

Another innovation in housing design is assembly construction. Before the top corrugated skin is fastened down, a strip of insulating "seam-tape" is laid down. Thus, the only metal-to-metal thermal conduction is through a sheet meal screw.

Another dryer problem is that the most common types of doors and seals are fundamentally flawed in design. While they operate well in a new dryer, over time they fail to keep the dryer airtight. Most dryers feature sheet-metal strips which act as gaskets, but these strips will bend, either due to normal service or impact damage, and the air-tight seal is lost. In addition, the dryer door frames may change shape over time, due to thermal expansion, which exaggerates the lost seal problem.

The problem can be solved with a quick-install door cartridge and quick-change seal system that keeps dryer doors airtight. Prefabricated and assembled door cartridges allow a mill to simply cut out their old door frame and weld the new cartridge in its place. This system can be done on a door-by-door basis, or to an entire dryer at one time. The door cartridges come complete with pre-mounted door seals that simply pop into place, allowing the seal to be changed in minutes.

Still another dryer problem is that most dryers do not feature a floor, but rather are "bottomless" and have their steel frame sealed against steel embeds in the concrete. Because of different thermal expansion rates of steel and concrete, the seal which once existed between the dryer and the concrete erodes and large cracks in the concrete can form. The erosion of the concrete, also due to high heat and moisture levels, allows hot air from inside the dryer to escape.

The solution: a quick-install, retrofit insulated floor system that can be installed under any make and model of dryer. The floor is insulated with 3-4 inches of mineral wool insulation to minimize heat loss. The floor is seal welded in construction in order to remain impervious to moisture and corrosion damage.

Mills can realize energy savings due to elimination of heat loss at a fraction of the cost of concrete foundation repair or replacement. Expansion roller assemblies, which permit the dryer to expand thermally rather than fighting against a rigid concrete slab, also are available.

Single to Two Zone Conversions

Veneer dryers also can be converted from single-zone dryers to two-zone dryers. In a single-zone longitudinal dryer, two large fans circulate air along an upper duct, into the dryer and through many sections of dryer rolls, framework, and veneer, and finally back into the return fan manifold for recirculation in the dryer.

The design of a two-zone dryer allows for control of static pressure at each end of the dryer and the capability of maintaining high temperatures over the entire dryer's length. Increased temperatures and the control over emissions from the dryer are due to the two separate heating zones and the two completely separate and opposing air circulation systems.

In a two-zone system, there are four fans—two at each end of the dryer. The air circulates from each end towards the middle, where a partition wall directs the air down into the manifold doors and into the dryer itself. An additional heat source (gas burners or steam/oil radiators) is also incorporated into the dryer's upper duct to provide uniform heat to the new zone of the dryer.

In a standard single-zone dryer it is almost impossible to control or stop air from escaping into the dead-air space and cooler sections of the dryer's “positive pressure” end. To offset this, “make-up” air is pulled through the “negative pressure” (fan-end) baffles or through any poorly sealed panels and doors. This ingested cool air causes a considerable amount of wasted heat energy and severe pitch build-up inside the dryer. In a single-zone dryer, the high temperature air enters at one end of the dryer, and cools as it passes through the length of the dryer.

A typical single-zone dryer sees a drop of 10° F per door section which equals a 150° to 200° F drop in temperature from the delivery manifold to the return manifold (depending on a dryer's length). Two zoning provides two separate control zones, which provide increased and uniform heating from one end of the dryer to the other, and the large heat loss common to single-zone upper ducts is not observed.

As the volume of air moves through a dryer, every drying section adds a degree of resistance to the air stream. In a single-zone dryer, the air must flow through twice the sections of resistance than in a two-zone dryer. A two-zone dryer offers far less restricted airflow because there are fewer drying sections through which the air must travel before being recirculated. Better airflow results in improved quality and faster drying.

Mills that have installed a two-zone conversion typically see a production increase of at least 25 percent.

Dryer Controls

Many dryers still operate via manual control, relying on the operator to set and maintain the operating conditions of the dryer—temperature, humidity levels, speed, etc. In many cases, operating conditions for the same dryer and veneer product can differ greatly, based on operator preferences. A dryer control system helps a mill maintain the same operating conditions regardless of operator. A predetermined set of operating parameters (a "recipe") can be set by the mill's quality control supervisor to ensure product consistency and maximum dryer efficiency.

Variable Frequency Drive Controllers

Vintage dryers feature manual dryer speed control. The ability to modulate the dryer conveyor speed is not automatic and typically the dryer runs at a set speed, which may not be optimum for the wood species and thickness being dried.

An individual motor and Variable Frequency Drive (VFD) controller for each deck of the dryer addresses this problem. This allows the speed of the dryer's conveyor to be set to any speed to optimize the drying process. By setting the correct speed, the amount of usable dry veneer is optimized. Without running at the optimum dryer speed, the wood may be too dry or not wet enough, and both have disadvantages, especially with respect to energy consumption. Wood that is too dry cannot be used for manufacturing as it may be too brittle and break. Wood that is too wet after drying requires a second pass through the dryer (called "redrying"), effectively doubling the amount of heat energy that was required to dry a particular sheet of veneer.

Chain drive VFDs also can be linked to an industrial dry-end moisture detector, which can automatically drive the dryer conveyor at the optimum speed by modulating the dryer speed based on the final moisture content of dry wood veneer sheets in real time. ■

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