

HOW IMPORTANT IS DRYER WARMUP?

THOMAS K. GRUNDER

TAKING THE NECESSARY TIME TO FOLLOW A CONTROLLED DRYER WARMUP CAN PREVENT EQUIPMENT DAMAGE, BEARING FAILURE, AND INJURIES.

ESSENTIAL TO A WINNING PERFORMANCE BY AN ATHLETIC team is the warmup before the game. It slowly raises players' heart rates, loosens their muscles, and reduces the risk of injury. Like an athletic team, the dryer section of a paper machine also needs a warmup to perform at its peak. The warmup slowly raises temperature and pressure levels to decrease the risk of component failures.

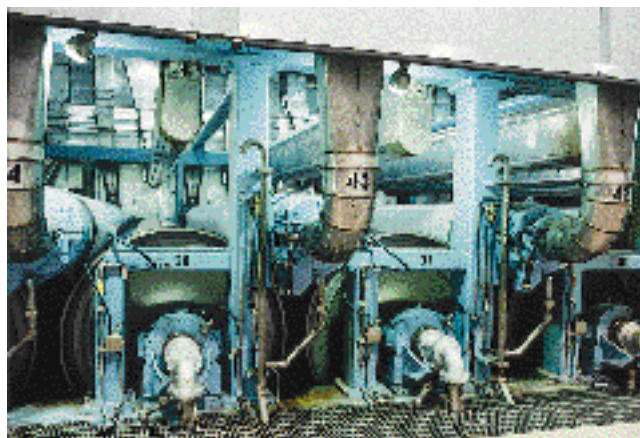
There is a common tendency to rush the dryer warmup. The advantage to decreasing the amount of time spent on dryer warmup is obvious. Since each hour of production time costs thousands of dollars, the argument for cutting the warmup time in half is very persuasive financially.

However, the long-term risks far outweigh the short-term financial gains. Rapid warmup of a dryer can lead to broken bearings and even catastrophic failure. This can cost considerably more than the few hours of lost production. Perhaps the strongest argument for taking the necessary time may be the reduction in the risk of serious personal injury.

COMPONENT FAILURES

By failing to devote the proper time to the dryer warmup, an operator exposes the dryer to a host of heat-related problems that can be costly and catastrophic. Heating a dryer at an accelerated rate creates excessive thermal stresses within its cast-iron components. In simple terms, heating something causes it to expand. When a dryer containing components that vary in size and thickness undergoes rapid heating, portions of it will expand faster than others. A 1-in. thick component will heat faster than a 5-in. component, causing it to crack due to thermal stress.

Bearings are usually the first component to crack. The dryer rotates on bearings that have an inner race, an



Photograph courtesy of Beloit Corp. showing typical paper machine dryers with warmup systems

outer race, and a set of rollers. The inner race is pressed onto the journal through which steam passes. If a journal undergoes very rapid heating, it expands before the bearings. This stretches the inner race excessively and causes the bearing to crack.

Avoiding a catastrophic failure may be the most important reason for adhering to a gradual, controlled warmup. Cracks in components can considerably weaken a dryer. When increased to operating pressure, a weakened dryer unable to contain the pressure can fail. The failure can damage equipment and possibly injure personnel.

PROPER PROCEDURE

The key to avoiding dryer equipment failure is a controlled warmup that prevents the buildup of thermal stresses within the dryer. This allows all components sufficient time to warm up completely at an even rate.

Although it may require individualization for machine operating conditions, the following procedure provides a general guideline for proper dryer warmup:

- A. Admit low pressure steam (5 psig at 230–250°F, i.e., superheated 20°F) or open steam supply control valve 10–15%. Then open manual shutoff valve (gate type) 2 or 3 turns.
- B. When the inlet steamfit body starts to warm up as determined by touch, begin dryer rotation at “crawl” speed.
- C. When the dryer surfaces begin to warm up, adjust the manual valve opening to maintain a dryer shell warmup rate of 1–1.5°F/min. It will take approximately 1.5 h for shells to obtain surface temperatures of 200–220°F.
- D. Slowly increase the steam pressure in the dryers until sufficient differential pressure develops to evacuate condensate accumulated in the dryers. The pressure should not exceed 15 psig. Operate no higher than 15 psig for approximately 1 h to remove condensate and equalize temperatures. Increase the dryer speed to the operating speed—if less than 2000 ft/min—or to the lowest controllable speed not to exceed 2500 ft/min.
- E. If operating pressures are 50 psig or less, adjust pressures to desired values to prepare for sheet threading. Total warmup time is 2.5–3 h. Increase the speed to the operating value.

If the dryers have been down for 4–8 h and are still warm (greater than 140°F), it is possible to reduce the time indicated in step C, but the rate of temperature rise should remain 1–1.5°F/min.

If the dryers have been down for 4 h or less and remain at 200–220°F, omit steps A, B, and C and reduce the time for step D to 0.5–0.75 h.

- F. If operating pressures range from 50–75 psig, slowly increase pressures to 30–40 psig after step D during

the next 0.5–0.75 h. After this period, adjust pressures to desired values to prepare for sheet threading. Total warmup is 3–4.5 h. Increase speed to operating value.

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If the dryers have been down for 4 h or less and remain at 200–220°F, omit steps A, B, and C and reduce the time for step D to 0.5–0.75 h.

If the dryers are at 250°F or higher, use 0.75–1 h to build pressures slowly to the desired values for sheet threading.

- G. If operating pressures range from 125–160 psig, slowly increase pressures from 30–40 psig to 75–80 psig after step F during the next 0.5–0.75 h. After this time, adjust pressures to desired values to prepare for sheet threading. Total warmup is 3.5–5 h. Set dryers at operating speed.

If the dryers have been down for 4–8 h and are still warm (greater than 140°F), it is possible to reduce the time shown in step C. The rate of temperature rise should remain 1–1.5°F/min.

If the dryers have been down for 4 h or less and remain at 200–220°F, omit steps A, B, and C and reduce the time for step D to 0.5–0.75 h.

If the dryers are at 250°F or higher, use 1–1.25 h to build pressures slowly to the desired values for sheet threading.

Taking the time to follow a controlled warmup procedure provides a safer work environment and reduces the risk of bearing and equipment failures. **TJ**

Grunder is product line manager, dryers and drying systems, at Beloit Corp., One St. Lawrence Ave., Beloit, WI 53511-6270.