

Spraying Water On Dryers

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EXECUTIVE SUMMARY

The object of this review is to create a sense of awareness, understanding, caution, and moderation in regard to spraying water around dryers. It can be difficult to achieve adequate awareness of the difference between applying large quantities of cold water to a single spot on a hot stationary dryer surface and indirect application of a warm stream of water over the entire dryer surface. Emphasis must be placed on the correct practice during regular operator and safety training.

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INTRODUCTION

Water is sprayed on paper dryers for several reasons:

- To remove broke, wads, and paper wraps
- To cool the dryer cylinders for maintenance
- For fabric and dryer cleaning
- During fire-fighting

Water is an excellent cooling medium, particularly when it flashes to steam. Water can be very effective in lowering the temperature of a dryer. Dryer cylinders are made from cast iron. Cast iron is a strong, but brittle material and the thermal stresses produced by the injudicious use of water around dryer cylinders can cause dryer cracking or even instantaneous, catastrophic failures. Because of the potential for failures, dryer manufacturers discourage spraying water on hot dryer cylinders.

Although water can be safely applied to dryer cylinders, if applied with care, the practice may be observed and followed by untrained personnel without an adequate level of understanding and caution. For this reason, a clear, consistent, and safe policy is to simply avoid spraying water on hot dryers. Any deviation from this simple position requires that mill management and its safety organization provide thorough training and safety instruction to its operating personnel. The following review was prepared to support these efforts and help to reduce the risks.

BROKE REMOVAL FROM DRYERS

It is preferable to use air hoses and broke spears, rather than a water hose, to remove paper broke, wads and paper wraps. There are a number of reasons for this:

- An air hose or broke spear can be more effective than a water spray in clearing small, thin dryer wraps and broke from low grammage paper.
- Air hoses or remote mechanical fingers are a much easier and cleaner way to remove small tailings and threading broke. Water hoses are not very effective for this purpose.
- On dryer sections with no bottom fabrics, it is generally easier to cut the sheet, with a blade on the bottom dryer or a broke pole on the top dryer. This is done with the dryer stopped. The broke will then drop into the basement when the dryer is slowly rotated.
- For heavy wraps, the use of water can make such a mess that it takes longer to clean up the mess than it would have taken to clear the broke without water. Wet paper cannot be cut off a dryer and wet paper wads can damage the dryer fabrics.
- Dryer bearing housings have labyrinth seals. These seals are not watertight. If the water is aggressively sprayed on the dryer, water can splash past the labyrinth seals and into the bearing lubrication system (grease or circulating oil), resulting in damage to the dryer bearings.
- Sheet break detectors and sheet slashers should be used to reduce the number of wraps on a dryer cylinder following a sheet break, perhaps to the point that a water hose is never required for clearing broke. This should be the first priority.



Note: When using broke spears, the dryer must be stopped, to prevent personnel injury and dryer fabric damage.

General Guidelines

If a water hose is used to clear broke from the dryers, the following guidelines should be followed:

- Before using water, shut off the steam pressure to the dryer cylinders and allow the dryer pressure to vent.
- Whenever possible, the dryer should be rotating, at crawl speed or above, to prevent the water spray from hitting only one spot on the dryer.
- Use warm water rather than cold water in order to keep the temperature difference between the water and the dryer shell and the resulting thermal stresses as low as possible.
- Limit the amount of water sprayed onto the dryer to what can be supplied through a normal mill water hose (which typically has a 25 mm (1") inside diameter).
- A water spray is preferred over a water jet, provided there is sufficient pressure available to clear the broke.
- Do not direct the water at one point on the cylinder surface. The water spray should be worked back and forth across the dryer, to avoid cooling one area too quickly.
- Avoid spraying water directly on the dryer heads. Surface cracks have been found in dryer heads where the heads have been sprayed with water. Also, it is more likely that the water will be deflected past the bearing housing labyrinth seals if water is being sprayed on the dryer heads.



Note: It is important that these precautions be explained to machine operators during regularly scheduled safety and operator training.



Note: When spraying water, do not stand too close to a hot dryer, or on footwalks above a dryer, or on cross-machine walkways between dryers. If water is sprayed on a hot dryer surface, the water can quickly flash into hot steam. The steam can flash back and burn the operator and cause an immediate fog making it difficult to get out of the area.

DRYER COOLING

Dryer manufacturers advise against using water sprays to cool hot dryers, because of the potential for developing high thermal stress in pressure containing parts. There are, however, ways of cooling the dryers other than using water sprays:

- For accelerated cooling, the steam pressure can be turned down (or off) prior to the end of production. This allows the natural cooling effect of the wet web to accelerate the cooling of the shell.
- The dryer can be vented to atmosphere to reduce its steam pressure, or to a vacuum condenser to reduce the steam temperature even further.
- The shell can also be cooled by showering warm water (minimum temperature of 25 °C, preferred 50 °C) onto the dryer fabric, in the return run prior to a fabric carrier roll, while running the dryer section on crawl. The water in the dryer fabric then cools the dryers indirectly, without spraying water directly onto the dryer surfaces.
- Once the dryer cylinders have been completely de-pressurized, the manhole covers can be removed. If necessary, room temperature water can then be pumped into the dryer and the dryer rotated slowly, to remove additional heat from the shell and heads. This water should then be drained from the dryer.
- Ventilation fans can be used to blow room temperature air into the dryer cylinders through the manhole openings, after the dryers have been stopped and the pressure relieved. Blowing air into the dryer for several hours will cool and ventilate the inside of the dryer prior to entry and also help to evaporate any remaining condensate from inside the dryer.
- The ventilation air can be cooled by package air chillers, to further accelerate cooling the dryers for entry.



Caution: When air is first blown into a hot dryer cylinder, hot water vapor will spill out of the manhole opening. This can cause serious burn injury and produce an immediate fog in the area. All personnel should be safely away from the dryer manhole opening before the ventilation air is turned on.

General Guidelines

If water sprays are used to cool the dryers, the following guidelines should be followed:

- Before using water, shut off the steam pressure to the dryer cylinders.
- The dryer should be rotating, at crawl speed or slightly above, to prevent the water spray from hitting only one spot on the dryer.
- Use warm water rather than cold water in order to keep the temperature difference between the water and the dryer shell and the resulting thermal stresses as low as possible.
- Limit the amount of water sprayed onto the dryer to what can be supplied through a typical mill water hose (which typically has a 25 mm (1") inside diameter).
- Do not direct the water at one point on the cylinder surface. The water spray should be worked back and forth across the dryer, to avoid cooling one area too quickly. It is best to spray the water through the fabric, to minimize the thermal impact of the water on the shell.
- The dryer fabric tension should be monitored when applying water. Fabrics can absorb water and stretch. If the fabric tension drops too much, the fabric guide may become ineffective and the fabric could run off the machine.
- Avoid spraying water directly on the dryer heads. Surface cracks have been found in dryer heads in mills where the dryers are sprayed with water. If water is to be sprayed on the heads, the dryer must be rotating and a fine mist (only) should be directed towards the heads.



Note: It is important that these precautions be explained to machine operators at regular intervals during safety and operator training.

DRYER AND FABRIC CLEANING

Water is used to clean dryer fabrics and occasionally dryer surfaces. Since these operations are carried out with a machine shut down, the steam pressure will have been removed from the dryers, and the dryers will have been cooled. Water can then be safely applied to the dryers and fabrics for cleaning them.

Dryer fabric cleaning systems are normally more effective if the water is heated and applied uniformly across the full width of the fabric.

General Guidelines

If water is used to clean the dryer fabrics or dryer surfaces, the following guidelines should be followed:

- Be sure that the steam pressure to the dryer cylinders has been shut off and the dryers are no longer hot (they can be cool or warm, but not hot).
- Fabric cleaning is usually more effective if the dryers are rotating, at crawl speed or slightly above.
- Warm water is usually more effective in cleaning than cold water.
- The water should be applied uniformly, in order to uniformly clean the entire surfaces.
- Take care not to direct the water toward the dryer in such a way that the water is forced through the bearing cover labyrinth grooves and into the bearing cavities.
- The dryer fabric tension should be monitored when applying water. Fabrics can absorb water and stretch. If the fabric tension drops too much, the guide may become ineffective and the fabric could run off the machine.
- Flooding the nip between the dryer fabric and a return run felt roll can be a very effective way to use water to clean the dryer fabric. This will minimize the amount of water that reaches the dryer cylinders.

FIRE-FIGHTING

Fire hoses and dryer hood sprinkler systems have the ability to supply large quantities of water very quickly. Some of this water may spray onto the dryer surfaces in during fire fighting. Small amounts of water and typical water fan jets should not cause high stresses or damage, provided the dryers are rotating and the dryer fabrics are on the machine. The hazard of an active fire normally outweighs the risk of damage to the dryers from using water to help extinguish the fire.

General Guidelines

The guidelines listed below should be followed in the event of a fire:



If outside fire departments are called to assist in fighting fires in the mill, it is essential that they be informed of the dangers inherent in direct hosing of dryer cylinders. This should be done in advance of any potential emergency situation.

- Immediately close off steam supply to all cylinders and allow the dryer condensate system to vent to atmosphere.
- Break the sheet immediately, to prevent it from continuing to run into the dryer section.
- Interlocks should cause the ventilation system to be shut off when the Emergency Stop is activated. Ensure that this does, in fact, occur.
- Continue to rotate the cylinders, if possible. Rotating cylinders are less likely to be damaged from water application than stationary ones (the rotation has the same effect as moving the spray around).
- When it is necessary to direct a fire hose toward a cylinder, move the spray around.
- Do not direct it continuously on one location. Attempt to maintain a uniform coverage of the cylinder surface.
- Use a hose equipped with a nozzle, and adjust the nozzle to achieve a spray, rather than a heavy stream. Use of dry chemical fire extinguishers is recommended where possible.
- Sprinkler systems must be adjusted so that they do not impinge directly on stationary dryer cylinder surfaces.
- If excessive heat from the fire or cooling from the fire-fighting operation is believed to have occurred, the dryer manufacturer should be contacted for recommendations concerning the safety of the dryer cylinders.
- Non-destructive examination, such as magnetic particle and run-out inspection, may be required to establish whether structural damage to the dryers has resulted.

Kadant Johnson is a global leader in the design, manufacture, and service of dryer drainage systems, rotary joints, syphon systems, and related equipment for the dryer section of the paper machine. For more information about Kadant Johnson products and services, email info@kadant.com or visit www.kadant.com.

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