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Sheet handling devices

Scope

The purpose of this Technical Information Paper is to describe equipment that is used to enhance web runnability in the dryer section of papermaking machinery.

Safety precautions

There are no specific safety precautions for the use or application of this TIP, however normal safety precautions should be taken when working around sheet handling devices on operating papermaking machines.

Utility

As paper machine speeds increase, efficient paper web runnability through the dryer section is normally more difficult to achieve. This is particularly true where machine speeds are increased above original design speeds.

The most common runnability problems are loose sheet edges, threading tail drop-off in the press-to-dryer and dryer-to-dryer transfer areas, blowing of the web around the bottom cylinders in single-fabric two-tier dryer sections, edge fluttering, and sheet stealing in open draws. The first step in solving windage-induced runnability problems is to document where the problem starts and the airflows around the problem areas. Many times dryer runnability can be improved by:

- Changing dryer fabric design to reduce air movement
- Proper balancing of hood and pocket ventilation systems
- Setting up proper geometry in fabric runs between dryers

Web runnability generally improves as web solids increase. Problems can therefore be reduced by maximizing solids out of the press section. Problems can also be reduced by properly ramping up dryer section steam pressures to begin drying the web early in the dryer section. Too slow an increase will result in reduced drying, but too large an increase in pressure between different steam groups in a common mechanical group can hurt runnability, as can steam pressures that are so high that picking and sticking occur.

If runnability problems still occur after existing sheet handling and ventilation equipment is optimized, special air handling devices should be considered to improve runnability. Several of these devices are covered in this TIP.

Press-to-dryer transfer

In a common press-to-dryer transfer arrangement, the web travels on the underside of a dryer fabric from the last press roll to the first dryer cylinder. Common problems include separation of the tail from the dryer fabric during threading and widening, and edge separation during normal running. The separation is a result of the formation of an air

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wedge between the paper web and fabric when they first converge. Sheet edge flipping on the outgoing side of the dryer can also be a problem, causing wrinkles, creases, and sheet breaks.

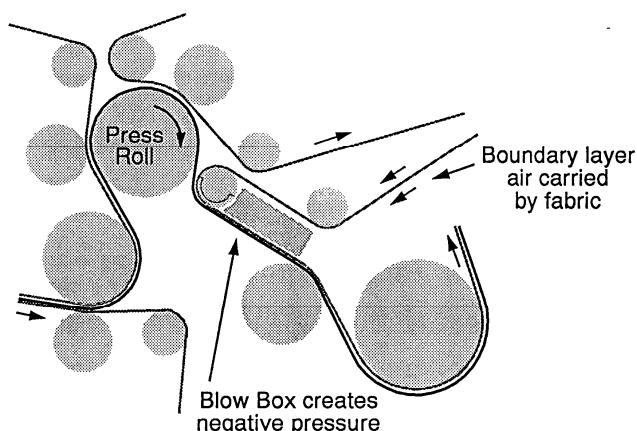


Fig. 1. Blow box helps stabilize press-to-dryer transfer

For long unsupported fabric lengths, blow boxes may be installed above the fabric in the press-to-dryer transfer, to help alleviate blowing and drop-off problems (Fig. 1). These boxes are custom designed for mounting in relationship to the deflection of the dryer fabric caused by the induced vacuum.

Blow-boxes are designed to induce a slight vacuum to hold the web onto the adjacent fabric. The vacuum can be formed by two mechanisms (Fig. 2):

- The foil effect
- The coanda effect

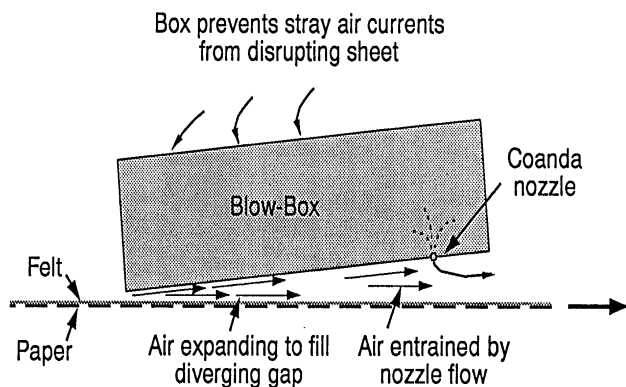


Fig. 2. Foil effect and coanda nozzle create vacuum under blow box

The foil effect is created by a diverging angle between the dryer fabric and box. As the dryer fabric travels under the box, air in the space between the two must expand to fill the increasing gap. This expansion causes a slight vacuum to form.

The vacuum from the foil effect can be augmented by a coanda type nozzle. Air jets leaving a coanda nozzle entrain and eject air located in the region between the dryer fabric and blow box. This method creates a more stable vacuum level and it has proven to be more successful in many applications than applying vacuum directly to the stabilizer box.

With the direct vacuum method, the closer the dryer fabric is to the stabilizer box, the higher the resulting vacuum under the stabilizer box. This creates an unstable geometry in which the fabric tends to get pulled into the box. With the coanda nozzle, the fabric maintains an equilibrium gap with the blow box.

The vacuum levels induced by foil are on the order of 2-6 millimeters of water column (40-60 Pa). Blow boxes that use coanda type nozzles will generate vacuum levels of 6-25 millimeters of water column (60- 250 Pa). Edge seals are also used on the blow box to maximize vacuum. These seals can be either mechanical type or coanda nozzles. With the low blow box vacuums, blocking stray air currents is important. The blow box that is positioned behind the dryer fabric not only generates the vacuum, but also prevents stray air currents from passing through the fabric and disrupting the web.

To induce required vacuum levels, two or four coanda nozzles are often used. The first one is on the leading (ingoing) edge. It blows opposite the web direction and establishes the initial vacuum level. The second nozzle is on the trailing (outgoing) edge. It blows in the web direction to maintain vacuum along the length of the blow box. The trailing edge nozzle would typically be positioned over the ingoing nip of the lead-in ("baby") dryer to prevent sheet blowing. The other two nozzles would help to seal the front and back edges of the box.

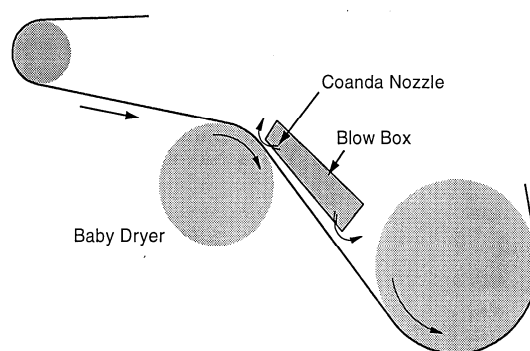


Fig. 3. Blow box to control sheet after baby dryer

Similar blow boxes can also be used after the lead-in dryer cylinder, as shown in Figure 3. When using a blow-box after a baby dryer, the leading edge nozzle would be positioned over the outgoing dryer/fabric nip to urge the web to follow the dryer fabric rather than the dryer. These blow boxes have their second coanda nozzle located on the trailing edge to help maintain vacuum along the box's length by blowing against the dryer or roll surface.

The second nozzle also induces a vacuum at the ingoing nip between the dryer fabric and bottom dryer. This second nozzle, in conjunction with the foil effect of the box, prevents boundary layer air on the fabric's backside and the roll's surface from forming a pressure wedge at the converging fabric/dryer nip.

See caveat at end of this TIP for advice on application of press transfer blow boxes.

Single-fabric dryer section

The single-fabric two-tier dryer was originally used to support the web in initial dryer sections, thereby improving runnability at higher speeds. In this configuration, a single fabric serpentine through a two-tier dryer section to support the wet, and therefore weak, web. As speeds increased, the web would detach from the fabric in the down-runs and tend to separate, or bag away, from the dryer fabric as it passes around the bottom dryers, where the fabric is located between the web and dryer (Fig. 4).

A blow box is used in the down run between top and bottom dryers to help alleviate this problem (Fig. 5). As with the transfer box, these blow boxes also use two or four nozzles. The first nozzle is located near the point where the felt separates from the top dryer. The second nozzle induces a vacuum at the ingoing nip between the dryer fabric and bottom dryer.

Web separation from the dryer fabric can occur either in the down-run after the web separates from the top dryer and wraps the bottom dryer, or in the up-run between the bottom and top dryers. A blow box can also be installed in the up-run position to help keep the web on the dryer fabric before it contacts the next dryer, as shown in Figure 6. This can further help to prevent wrinkles in the web.