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Use of ceramics on the forming section: diagnosing and preventing forming fabric wear

Scope

The most important function of a forming fabric is to produce a quality sheet at the wet end of the paper machine. The next fabric priority is to maintain the optimum performance for an economic lifespan.

This TIP brings together information from several sources to show how a detailed analysis of the used fabric sample can identify machine conditions that cause a reduction in forming fabric life and help prioritize maintenance efforts to minimize those conditions.

Forming fabrics are subject to many varied destructive forces whilst making paper and the more common ones, as listed below, will be discussed with an emphasis on practical pointers to reducing their effect on fabric life.

- General abrasion
- Localized scoring
- Abrasive fillers
- Fabric melting
- High pressure needle shower damage

Safety precautions

Worn ceramics may be very sharp. Handle units with gloves to prevent cuts.

Used fabric analysis

In order to effectively hunt down reasons for short fabric life, the most important first step is the used fabric analysis performed by most clothing suppliers. It is remarkable how often this critical first step is overlooked in favor of guessing which blades or rolls to change. It is most important that a full width cross machine sample is cut from the used fabric and clearly marked with the fabric and machine identity. This sample along with relevant comments should be sent to the clothing supplier for a detailed analysis.

The direction of fabric run as well as the front and back edges should be clearly marked on the sample strips because the direction of the wear burrs on the fabric strands will often determine if the problem is roll related or due to stationary elements. A more complete description of the fabric wear analysis has been published (1) but a few examples will be given here.

It is often useful for the mill to also cut and keep their own reference full width strip. This material can be used as a simple template to locate the source of wear streaks and gouges by directly laying it on the various machine components.

Fabric abrasion

Abrasion is by far the dominant reason for fabric removal. Even after all forming section problems are solved, the fabric will still ultimately wear out. Abrasive wear is inevitable because of the repetitive frictional rubbing of the fabric against a multitude of abrasive surfaces for several million cycles.

A fabric running today on the fastest newsprint machine is transmitting over a thousand horsepower (745 KW) at speeds close to 60 mph (60 kph). If that fabric runs 24 hours a day for a 100 day life, it travels an astonishing 144 thousand miles (232,000 kilometers).

The fabric wear profiles that are done on returned fabric strips are like the fingerprint of a machine and they will clearly show if changes are occurring from one fabric run to another. The units of these profiles are usually thickness, or caliper of the fabric. Also, as shown by the example in Figure 1, they can clearly identify problem areas requiring attention and provide an anomaly's exact location across the fabric width if the sample edges are identified.

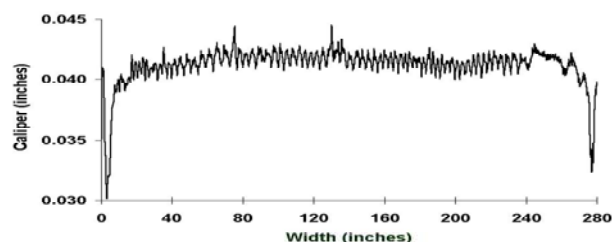


Fig. 1. Used fabric wear profile illustrating both edge and periodic wear.

This example clearly shows a severe deckle region wear problem very close to both fabric edges and a regularly spaced wear problem across most of the fabric width. In this example the condition of all suction box deckle strips should be examined. If no problems are detected, the deckle positions can be staggered. Ultimately, changing to lubricated deckles would reduce the wear rate at the edges. When given an exact measurement of the periodic spacing of the lines of wear across the machine width, the mill can readily identify the offending component(s) that have the same spacing and rectify the problem. This is most likely caused by shifting ceramic tiles. Regrinding the ceramic blade to a flat profile can rectify this.

Creep wear burrs as shown in Figure 2, are forward facing burrs, where the wear debris from the fabric strands is sticking to the front or leading edge of the strands. These creep burrs can only be caused by a surface that is moving faster than the fabric and sweeping its wear debris ahead of the fabric run. Creep wear is most often caused by rolls with an abrasive surface and a useful technique has been published (2) for identifying poor roll surfaces.

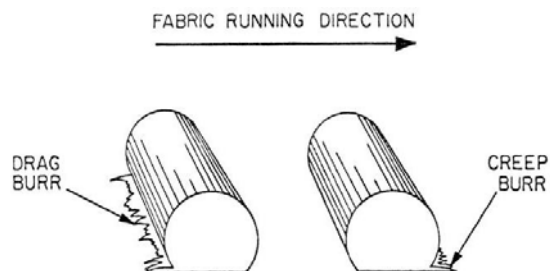


Fig. 2. Diagrammatic sketch of cross machine direction strands with creep and drag wear burring.

The most frequent causes of creep wear are:

- under or over-crowning of a roll

- deflection of weak rolls causing a reduction in fabric path length in the middle of the machine
- random bands of dirt build-up on poorly doctored rolls.

Fabric wear due to roll problems can occur on both the machine and paper sides of the fabric and it should be noted that the wear often extends right out to the very outside edges of the fabric.

One special cause of creep wear across the full fabric width can be at the driven rolls (3). Because fabrics are elastic they will be stretched by the cumulative drag load to the highest tension ahead of the first drive roll and then they will shrink back on the drive roll surfaces as they relax to their lowest tension after the drive rolls. If any drive roll surface is abrasive then severe creep wear will occur as the fabric continually creeps or moves backwards on the drive roll surface.

In rare instances, a full width cross machine band of creep burrs can occur when there is a complete loss of traction by a driven roll and the roll spins out of control inside the fabric.

Drag or trailing wear burrs in the opposite direction to the creep burrs are frequently caused by abrasive stationary drainage elements which drag the wear debris backwards against the run direction. In typical drag wear cases the wear frequently does not run to the extreme edges of the fabric but stops in the sheet deckle region. The edges of the stationary ceramic drainage elements can become rough or sharp with time as wear removes the original polished radius that was supplied. Fabric life can often be improved by restoring the original edge quality or even replacing severely worn elements with a better quality ceramic.

It should be remembered, however, that drag wear can also be caused by roll surfaces that are traveling slightly slower than the fabric. This occurs when there are roll bearing problems or the roll diameter is locally reduced by wear, corrosion and all the same problems that cause other regions of the roll surface to run faster. When the drag wear is caused by roll problems, the wear frequently runs out to the extreme edges of the fabric.

The surface quality of the worn strand surfaces provides excellent clues to the coarseness of the wearing surface. A very smooth worn surface points to a fine but severe abrasive such as mineral fillers added to the furnish for opacity. This condition should not be confused with the deliberate surfacing of the fabric that clothing suppliers sometimes perform to improve the fabric topography on the machine side for better guiding or to reduce undesirable sheet marking by out-of-plane paper side strands.

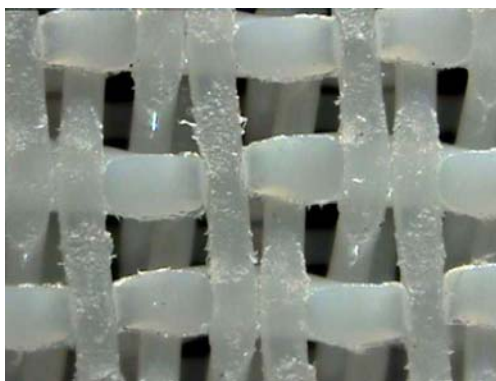


Fig. 3. Roughly worn fabric surface typical of abrasive roll problems

An almost random but roughly worn surface, as shown in Figure 3, is more typical for roll surface problems such as corrosion or a deteriorated roll covering.

The more uniformly rough surfaces shown in Figure 4 resembling scratching action are symptomatic of uneven drainage surfaces.

Localized drag scoring is distinguished by narrow bands of wear or gouging around the fabric length which can sometimes be so narrow, they cut into part of an individual wear strand surface leaving a line of wear around the full length of the fabric. The damage is similar to that shown in Figure 4 but the gouging is more localized and severe. Often the natural oscillation of the fabric between the guide palms will produce an even wider band of wear than the actual width of the offending edge.

Scoring sources can be as simple as a single grain of sand or rust stuck in a foil blade surface. Another common cause of scoring damage is unevenly segmented ceramic surfaces that have shifted position or a chipped ceramic edge such as on a lead forming board blade.