EXPERTIP

Category	PRESS
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Understanding Press Fabric Air Permeability (CFM)

As a papermaker, trying to understand what makes a press fabric succeed or fail can be extremely challenging, especially since , to this day, there is not a single property you can rely on to predict press fabric efficiency. Most of the parameters currently being tracked and reported by felt manufacturers were developed to monitor and verify the consistency of their own processes. This ExperTip aims to help your understanding of this popular "Quality Specification" and to put it in its proper perspective as a predictor of performance.

Here are some facts to consider when using CFM as a predictor of press fabric performance.

1) There are many ways to arrive at the same CFM reading

Among others things, the batt fineness, batt quantity, base fabric weight and stacking of the weave, density of needling, external treatments, and compaction levels all affect fabric permeability. Several different combinations of those factors may yield the same CFM measurement but produce vastly different operations.

The most obvious illustration of this fact is that a press fabric has the same permeability when tested upside down. The vast majority of press fabrics' roll and sheet sides (top and bottom) have very distinct characteristics serving very different purposes. The sheet side typically has finer batt designed for sheet handling and pressure uniformity while the roll side is normally coarser for durability and ease of cleaning. In most applications, running the felt inside out would result in poor runnability, despite the CFM being unaffected.

2) CFM is not measured the same way by all vendors

The standard device within the industry used to be the Frazier Air Permeability Tester. This was a standard textile industry measure not specifically designed for press fabrics. The tester measures the volume of air (Cubic Feet/Minute) which passes through the fabric at a pressure of 0.5" of water column pressure while the fabric is held with a clamp to prevent air leakage. These are not conditions encountered anywhere in felt operation. This tester has the disadvantage of requiring pressure on both sides of the fabric, which makes it difficult to measure away from the very edges of a fabric.

Since it has become crucial in modern press fabric manufacturing to measure more points in the felt to confirm and maximize uniformity, press fabric suppliers had to develop alternative devices to collect more permeability data points. The advantage of this type of system is that an air perm profile can be generated, which provides much more insight into the uniformity and repeatability of the process. For this reason, most felt manufacturers have developed new devices that may or may not replicate the old standard. Who knows?

3 Fabrics with the same 60 CFM permeability			
Base Type	Triple-layer cabled yarn	Four-layer coarse single monofilament yarn	Light double-layer base fine single monofilament yarn
Batt Applied	All 33 dTex	17 dTex over 44 dTex	17 dTex over 33 dTex
Weight	5.5 oz/ft^2 (1682 g/m^2)	7.8 oz/ft^2 (2386 g/m^2)	5 oz/ft^2 (1531 g/m^2)
Caliper	0.126 in (3.2 mm)	0.174 in (4.4 mm)	0.123 in (3.1 mm)

Table 1 - shows various combinations of base fabrics and batt fiber deniers that were actually used to obtain an air perm of 60. The table clearly shows the same air perm can be reached in many different ways.

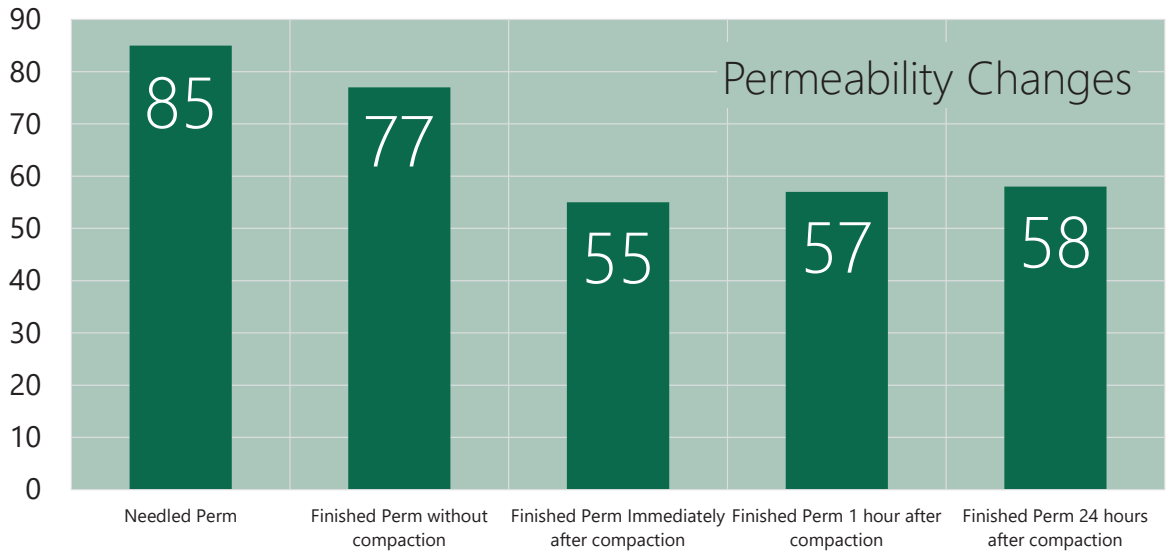
FIGURE 1. Traditional Permeability Tester uses a goose neck to reach inside the edges of a fabric.

FIGURE 2. Portair Profiling Tester
Hand held unit can be used to collect permeability profiles.

3) It is hard for the buyer to tell under what conditions the fabric was tested

In addition to the variation in testing equipment and protocol, the conditions at the time of testing are not known to the buyer. What was the level of pre-compaction? How long did the fabric rest after compaction. What was the ambient humidity? Knowing how difficult it is in a press fabric plant to match pre-compaction levels from one finishing frame to the next, it is easy to imagine that pre-compaction between competitors is highly unlikely to be the same.

One very important note about pre-compaction. Originally, press fabrics were made of sheep's wool. Those fabrics were very compressible and reached running CFM very quickly. In the 1970's, when polyamide fabrics were introduced, they were dogged by slow break-in due to their superior resilience. Pre-compaction was developed to increase polyamide fabrics' initial density and thus reduce the time to reach operating permeability on the paper machine. There is much debate about the effectiveness of that process when one considers the operating conditions on modern machines which compress today's press fabrics very aggressively. Another concern about pre-compaction is that it hides the true permeability of a fabric. History has shown that the fabric in graph 1 would perform essentially the same at all those various points of measurement, yet it may be reported as any number between 55 and 77 CFM depending on pre-compaction level. This is why most press applications engineers pay much closer attention to the needled permeability when gauging repeatability.



GRAPH 1. Permeability at various stages of manufacturing

AstenJohnson is a global manufacturer for the paper industry, supplying paper machine clothing like press fabrics, forming fabrics, dryer fabrics, and other advanced filtration fabrics to paper mills and pulp mills around the world.

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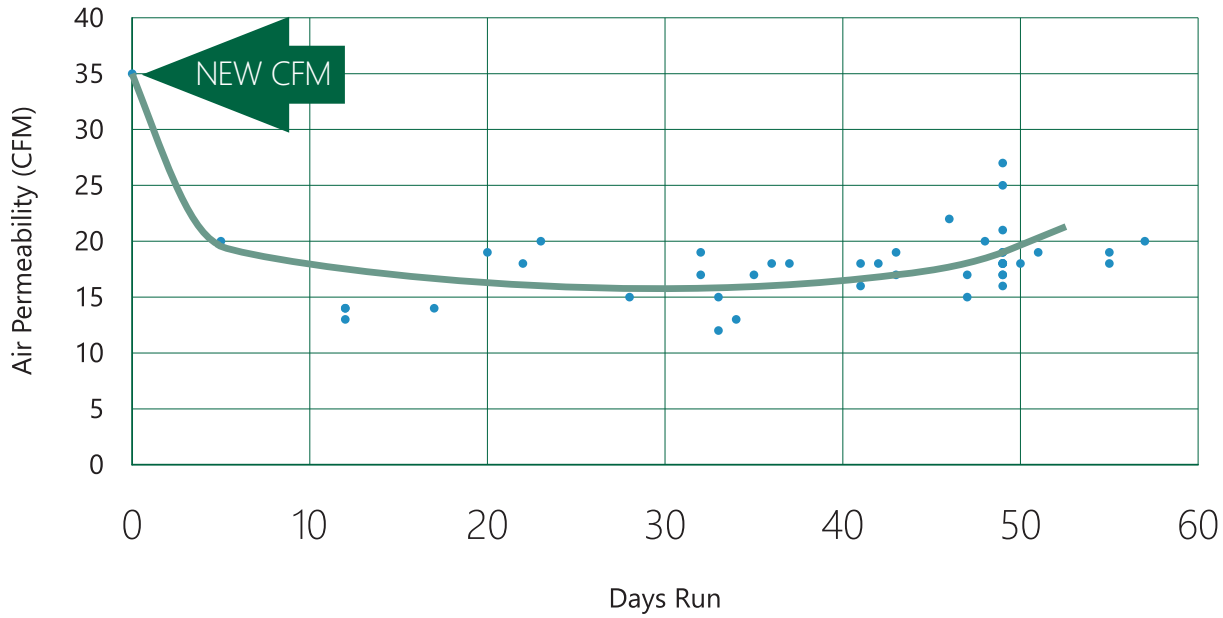
4) CFM changes significantly over the useful life of a felt

Press fabrics are a very compressible media right out of the box. This causes the permeability of the fabric, by any measure, to change drastically during its first hours of operation. This means your 60 CFM fabric may well be operating at 20 CFM from very early on and throughout its useful life. Moreover, different constructions will settle at different operating permeabilities. For instance, a high batt-to-base ratio construction will likely settle and operate at a significantly lower permeability than a style with a low batt-to-base ratio. This means the optimal CFM for one design may not apply to a different style.



GRAPH 2. New vs. used perms.

Practical use

Looking at the range of CFM of used samples for a given press position does seem to shed some light on what range of permeability is currently being used successfully on a given press position. Successful fabrics removed for a given position tend to have a consistent range of "operating" CFM. Knowing the effective perm range for a given position and designing a fabric to settle there is a more useful aim than attempting to match the initial CFM of what is currently running successfully. For instance, the position in graph 2 seems to operate well in the 12-22 CFM range. Anyone planning to design a fabric that would settle outside this range should be able to justify her course of action. Of course, CFM is only one of many other parameters that one must consider for a fabric to run successfully.

Conclusions

Data shows that there are several good reasons to be skeptical of permeability as a performance predictor. It continues to be a critical quality and repeatability parameter for press fabric manufacturers, if measured with modern tools and sampling is done in a professional manner.

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