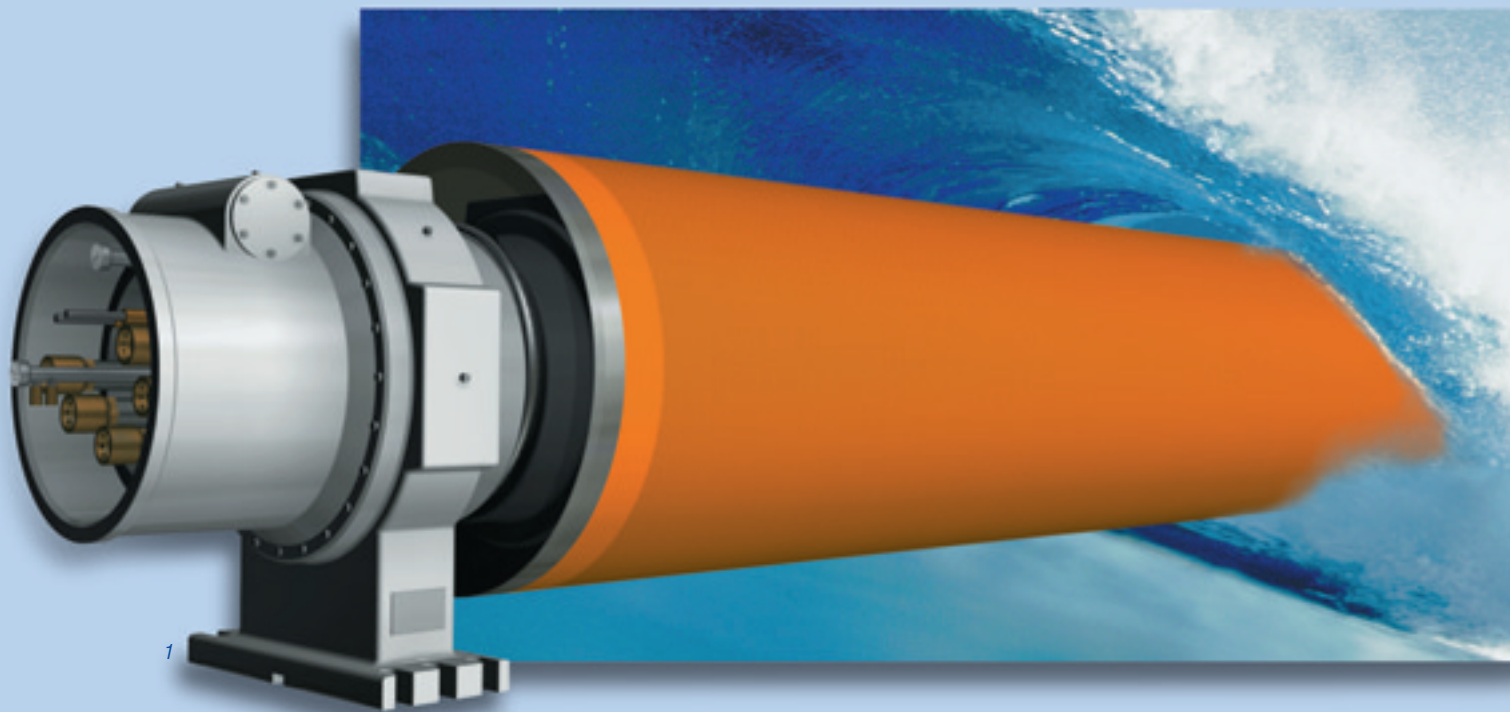


## Polyurethane Roll Covers – a technological overview



There are two basic product groups of Voith Paper polyurethane roll covers:

- **Aqualis, (PolyDyneSR), PolyDyne and G2000**, for use in paper machine press sections
- **PolyMate**, for dry applications, mainly reel and support roll covers.

A special-purpose product for marking presses in cigarette paper production is the ultra-hard HTP-1100 roll cover (Fig. 2).

### Aqualis – PolyDyne – G2000 design

With few exceptions, all roll covers used in the wet end are designed for the press section. They all have a very similar multi-layer construction comprised of a composite fibre-plastic base layer, the unique AST bonding layer and the polyurethane surface layer (Fig. 3).

The reinforced base layer provides outstanding bonding to the metal core, high strength, and excellent resistance to water and chemicals even at high temperatures. This exceptionally sturdy design ensures optimally reliable operation and minimizes accidental damage in case of mishaps.

One of the worst examples of such damage experienced so far was a suction press roll core fracture, which was only



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Fig. 1: Suction press roll.

Fig. 2: Product overview.

Fig. 3: Cover structure.

Fig. 4: Peeling resistance test.

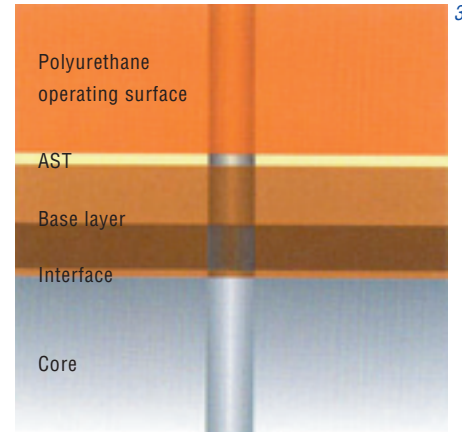
Fig. 5: Fracture section through polyurethane/ base layer.

Fig. 6: Cover damage caused by steam box.

Fig. 7: AST bonding in damage zone.

Product	Operating environment	Loading	Hardness (P+J)	Surface design	Applications
<b>Aqualis</b>	wet	high	5, 10, 15	S, BD, G, P	Suction press rolls
<b>PolyDyne</b>	wet	high	5, 10, 15	BD, G, P	Press rolls
<b>G2000</b>	wet	very high	4	BD, G, P	Press rolls
<b>HT 1100</b>	dry	medium	0 (82 ShD)	P	Filigree press rolls
<b>PolyMate</b>	dry	low	5...50	P	Reels, support rolls, rewinders, ...

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apparent from extreme eccentricity and confirmed by inspecting the roll interior: the cover surface remained unaffected.

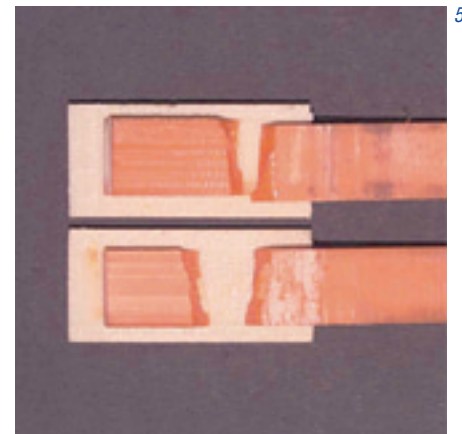
The unique AST bonding layer is much stronger and hydrolysis-resistant than any other adhesion system (Fig. 12). This is attributable to powerful chemical binding, phase mixing between the base and surface layers and waterproofing with special fillers.

The strength and water resistance of the AST bonding system is even higher than those of the individual layers, as shown by the complete absence of adhesion ruptures in destructive testing (Figs. 4 and 5).

Impressive proof of the AST bonding layer strength was provided by a case of cover damage due to badly adjusted suction press roll steam boxes. Although the polyurethane surface was completely



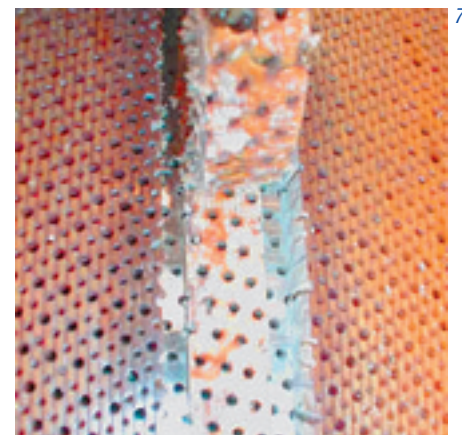
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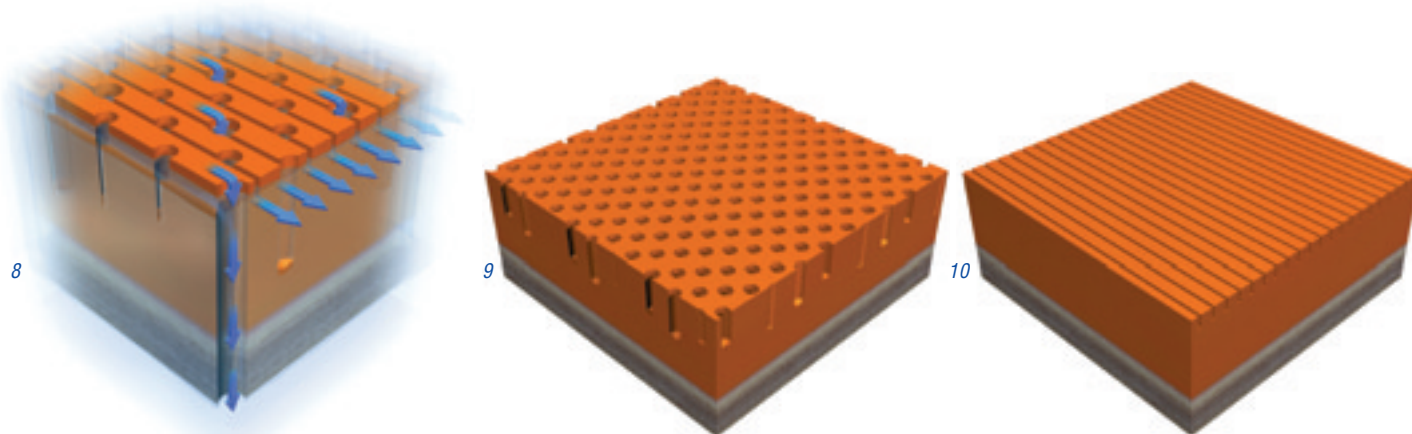


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Fig. 8: Drainage paths.

Fig. 9: Surface with blind holes.

Fig. 10: Fluted surface.



destroyed by hydrolysis, the bonding to the base layer remained virtually intact (Figs. 6 and 7).

The surface layer normally comprises polyurethane materials on a poly-THF (PTMEG) basis. These PU materials uniquely combine high strength with outstanding elasticity, exceptionally good wear resistance and excellent resistance to hydrolysis. They are the best polyurethane materials available for this purpose at the present time.

### The Aqualis – PolyDyne – G2000 drainage concept

Nowadays, optimal computer-aided surfacing design saves up to 50% of the drainage ducting previously required (Fig. 8). This significantly reduces surface flow resistance in all directions, so that

web drainage is far more homogeneous. Furthermore, this innovative surface design optimally utilizes the effective water storage capacity of the blind holes without building up additional hydraulic pressure. This reduction also delays cover compaction and thus improves mean flow resistance.

The advantages of the new Aqualis drainage concept are proven in practice, as reflected by the more cost-effective operation of Aqualis roll covers.

Compared with rubber coatings, the high material strength enables practically unlimited combinations of holes and grooving with up to 45% free surface area (Figs. 9 to 11), as well as outstanding durability. In many cases the optimized surface design has solved perforation imprint problems and also increased dry content. The advantage of the latter is either lower drying costs, or higher output

with the same drying capacity. Further benefits of polyurethane roll covers include significantly longer felt life and conditioning advantages, when compared with an uncovered operation. In general the softer nip always has a positive effect on drainage and paper quality. The result is extremely gentle drainage, with less tendency to marking and crushing.

### G2000 – the tough press roll cover

The G2000 press roll cover is even tougher than the standard covers Aqualis (PolyDyne SR, for suction press rolls) and PolyDyne (for press rolls). The main advantage of the G2000 polyurethane material is its far lower heat development under fluctuating loads (less flexing friction). This enables its use in presses with extremely high dynamic loading, where so far only grooved steel rolls were possible. These usually comprise high-speed

Fig. 11: Surface fluted and with blind holes

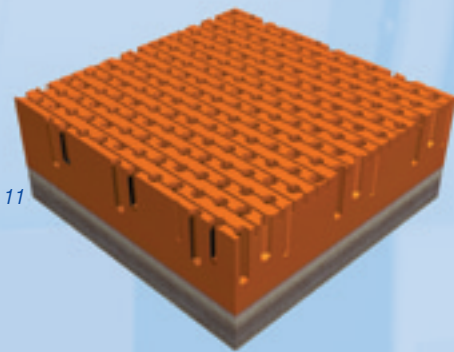
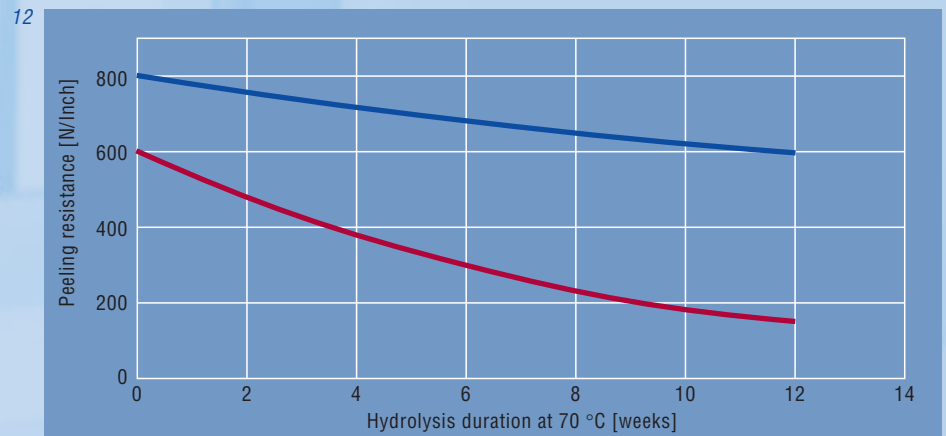


Fig. 12: Hydrolysis resistance of binding systems.

— HT 990 (BKU binding)  
— PolyDyne 5 (AST binding)



third or fourth stage presses with small roll diameters and high line forces. The primary advantages here are much longer felt life, less vibration and less crushing. This material is also much more heat resistant than the standard covers, i.e. its melting point is higher. This is very important in the case of felt failures, because melting of the cover material is delayed long enough to prevent serious damage. The G2000 is also ideal for use in felted shoe presses.

### Press optimization

Due to the high complexity and interdependence of the various drainage processes in the press nip, neither perfect roll cover design nor optimal felting alone guarantees the best possible drainage. Only optimal balancing of the two elements ensures the highest drainage efficiency in the press nip. Any

felting or roll cover changes must therefore be carried out jointly by both product specialists.

### Future potential and prospects

Several other promising applications for polyurethane covers are currently under development or in the field trial phase. This particularly includes the application of Aqualis and PolyDyne roll covers for tissue machines, requiring the development of **softer** covers with very high resistance to hydrolysis and heat.

Further potential lies in the development of polyurethane covers for sizing rolls, mainly requiring high surface quality, homogeneity, and resistance to damage and melting.

Development work is also underway on polyurethane covers for paper-rolls in the wet end. The special challenge here is to produce a high quality yet cost-effective roll cover, meeting the respective requirements for corrosion protection, water and heat resistance and doctoring.

