woven*FFS®

The innovative opportunity for your high quality industrial sacks
A New Technology is Born

THIS TECHNOLOGY PACKAGE OFFERS YOU

- Downgauging
- High quality printing
- Fast filling
- High mechanical properties
- Clean packaging environment
- Improved product packaging performance: barrier to moisture, aromas, vermin infestation
- Hermetic bag

PURPOSES

The woven*FFS® technology is suitable for sugar, rice, fertilizers, chemicals, pet food and numerous other end applications.

For the very first time, this new concept combines woven fabric with FFS packaging line technology (see picture below), offering an innovative solution to the industry. Traditionally, woven plastic bags stand for toughness, impact, and tear resistance, and are used in the fertilizer, building and food/pet food industry.

The latest innovation by Dow, Haver & Boecker and Starlinger now makes it possible to apply an ELITE™ resin coating from Dow, to the woven fabric, rendering it sealable. This technology can therefore be used on the cost effective Form, Fill and Seal packaging lines in replacement of incumbent paper bags, polyethylene (PE) film bags or even stitched bags.

The state of the art woven*FFS® bags can provide a high toughness packaging solution with lower weight. Depending on the specific application, it has shown a weight reduction of up to 50% compared to incumbent solutions. It also allows for excellent printing and ease of recycling.
Coated Woven Characteristics

As the following charts show, the innovative woven*FFS technology can provide the required high toughness, impact and tear resistance, while sealability properties provide improved moisture resistance.

**SEAL STRENGTH VS. TEMPERATURE**

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>woven*FFS®</th>
<th>PLASTICS FFS 80µμ</th>
<th>PLASTICS FFS 140µμ</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>10</td>
<td>15</td>
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<td>180</td>
<td>180</td>
<td>190</td>
<td>200</td>
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</table>

**BARRIER TO MOISTURE**

<table>
<thead>
<tr>
<th>Material</th>
<th>Water Permeability (g/m²·d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular 2 ply used in Cement Packaging (150g/m²)</td>
<td>3500</td>
</tr>
<tr>
<td>woven*FFS®</td>
<td>&gt; 2000</td>
</tr>
</tbody>
</table>

**INTERLAYER ADHESION**

<table>
<thead>
<tr>
<th>Material</th>
<th>Interlayer Adhesion (N/15mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woven PP (50g/m²) / Coated with RC® (25g/m²)</td>
<td>5</td>
</tr>
<tr>
<td>woven*FFS®</td>
<td>&gt; 15</td>
</tr>
</tbody>
</table>

Dow has been a leader in the packaging industry for decades. Working with Dow, gives you access to a broad portfolio of technology solutions combined with years of experience and expertise in the packaging industry. With our broad portfolio of resin solutions, Dow has dedicated its team of technical experts and leading-class research and development (R&D) resources to work towards the sustainable packaging solutions of tomorrow to help converters meet consumer demand today.

**Benefits for Brand Owners**

In line with this, Dow recognizes the importance of packaging as a marketing tool in and of itself. Having targeted its solutions to offer enhanced properties, Dow solutions are ready to overcome this challenge. With resins that integrate excellent aesthetics and printability, Dow solutions help brand owners separate their products from the crowd as well as offer strength and high performance to ensure it stays that way for a while.

**Benefits for Converters**

Dow offers a variety of film substrates and resins for flexible packaging for heavy-duty shipping sacks (HDSS) applications. ELITE™ Enhanced Polyethylene Resins from Dow can provide a material solution that goes beyond the traditional combination of performance attributes. With increased lightweighting capabilities and enhanced processability, converters can benefit from improved sustainability benefits while ensuring that performance is maintained.

**ELITE™ Enhanced Polyethylene Resin and woven*FFS®**

- Excellent processability on Starlinger extrusion coating / laminating line stacoTEC
- Low neck in reducing edge trims
- High performance packaging sealant with:
  - Low hot tack initiation temperature to help avoid tape damage and for faster FFS line speed up to 2000 bags/hr (25 kg)
  - High seal strength for demanding field applications like cement, fertilizers, food packaging, etc.
THE 3 ENABLERS:

STARLINGER Woven Plastic Fabric Lines

Starlinger – The synonym for woven packaging
Starlinger, world market leader in machinery and process technology for woven plastic sack production, develops innovative high-performance products and new technologies with the aim to generate the maximum benefit for the customer. With the development of woven*FFS®, we – the driving force behind woven fabric packaging – have teamed up with the specialists in their respective fields to once more give our customers the decisive edge over their competition by making unique products possible.

A complete portfolio
The Starlinger product range covers all types of machinery for the production of modern woven fabric applications. But we offer not only the widest range of woven sack plant machinery, we also provide the most comprehensive scope of processes in connection with woven fabric production.

Technological leadership
Investing with Starlinger means drawing upon leadership in quality and technology – from the raw material to the finished end product and back to recycled pellets. Be it tape extrusion, circular weaving, laminating / coating, printing, tubing or converting – our machinery is characterized by highest production outputs, unmatched availability and flexibility that offers unequalled opportunities. Each machine a singular masterpiece of its own, the optimally synchronized process steps all add to your profit!

High return on investment
Raw material costs are on the rise, but so is the savings potential through improved technology and materials. The quality of the end product determines the strength achievable from a given material. Lower sack weight at equal quality means more profitability. Our technological advantage gives you the ability to down-gauge your products to a level that your competition will hardly be able to reach. This not only makes you happy, but also the environment! And the profit potential more than offsets the cost difference between a plant from Starlinger and one from a competitor.

** PP PRICE VS. BAG WEIGHT **

Bag weight (g/m²) vs. PP price (US$/T) from 1995 to 2011.

** 45 MIO. STANDARD BAG PROJECT **

- Payback period Starlinger: 2.8 years, competitor: 2.65 years
- 6 % calculatory interest rate considered
- Asset depreciation range: technical equipment 10 years, buildings 20 years
- After approx. 6 to 8 years reinvestment required for looms (Competitor) new investment of approx. €450,000 - €500,000
HAVER & BOECKER, known as a global technology leader for packaging equipment and processing technology, develops innovative high performance products to ensure smooth packaging processes. Our goal is to generate the maximum benefit for our customers.

Haver FFS – The technology
Knowing the difficulties of loose material handling, the combination of FFS technology and woven fabric has been based on a blend of well proven packaging equipment and innovative solutions in bag sealing. The FFS process with its fully automated packaging system is a combination of weighing and filling. It provides clear advantages in respect of accuracy and filling capacity to the customer. The system allows to work with different bag materials as regular PE film and woven FFS® fabric. In addition it can handle a wide range of bag formats and sizes. The easy changeover of film wheels offers maximum productivity. Woven fabric as a packaging material increases the strength of the bag. The bag handling due to the nice square shaped filled bag design results in an easier and more accurate manual and automatic bag handling. The improved bag durability allows for an extended logistic chain with less waste material and bag breakage.

HAVER FFS Technology – Your benefits
- Cutting edge and innovate technology
- Automated and precise bag handling
- Cost savings in packaging material of up to 20%
- Proven bag handling and bag sealing technology
- Compact and tight bag design results in easier handling and good stackability
- Variety of products can be packed in different packaging materials
- Your solution provider

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