

# Paper Machine Clothing Fabric Design and Production

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## INTRODUCTION

The wire part is the first and foremost part of any paper machine. The first stage of removal of water from the web is taking place and also the sheet web is formed on a wire in this section. The principal of removal of water is by the gravitational force and vacuum is also applied at blow boxes and couch. Hydrofoils are used to create vacuum and ceramic foils are used for smooth surface and for long life. If anything goes wrong at this stage it is very difficult to rectify it in the stage of the paper machine operation. Hence, while selecting the forming fabrics, necessary care and precautions are to be taken. Otherwise

the entire efforts put by the paper makers to produce the paper will go waste. Each machine is unique in nature and the forming fabrics for each machine is tailor made as per the furnish, machine configuration, machine speed and grades of paper manufactured. Hence, the fabrics are manufactured as per the requirement of that particular machine.

### Forming Fabrics

Earlier day's metallic wires like Phosphobronz and Stainless steel are used. After the introduction of synthetic wires the life of the wire, formation, retention and drainage are improved tremendously. Since the machine speeds are touching record levels, the demand

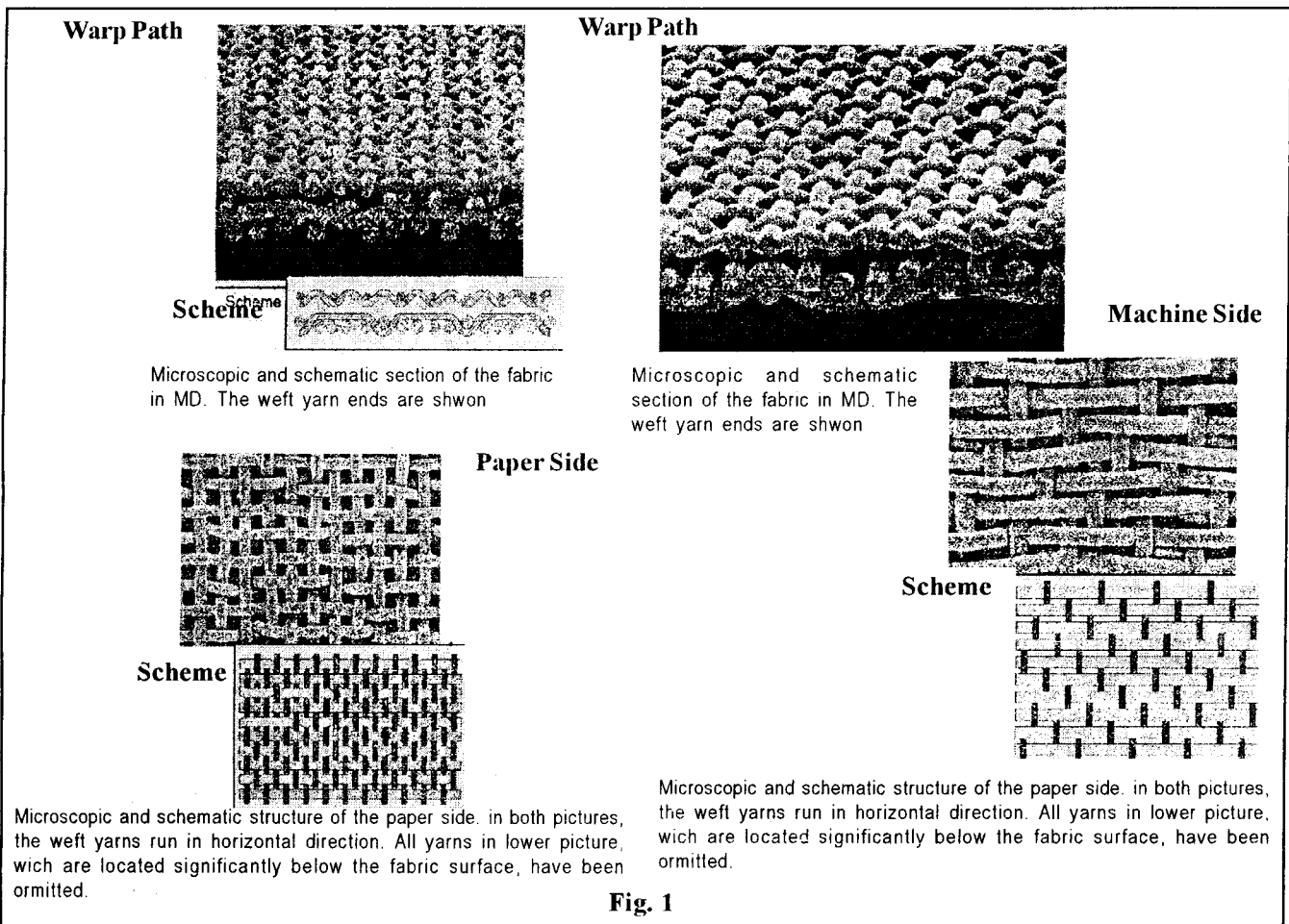


Fig. 1

for high quality wires are also increasing day by day. Wire manufacturers are spending lot of time, money and sleepless nights to cope up with the increasing demand. Now, single, one and half, double and two and half layer wires are produced for different varieties of paper, different speed.

The latest development in the forming fabric is the triple layer wires. The following benefits can be achieved by using triple layer fabrics :

- Higher dewatering
- Higher life time
- Better formation
- Better retention
- Better surface properties
- Reduction in refiner loads
- Better runnability
- High stability

For information one of the latest designs of triple layer fabric from M/s. Andres Kufferath GmbH, Germany is shown:

#### Press Section

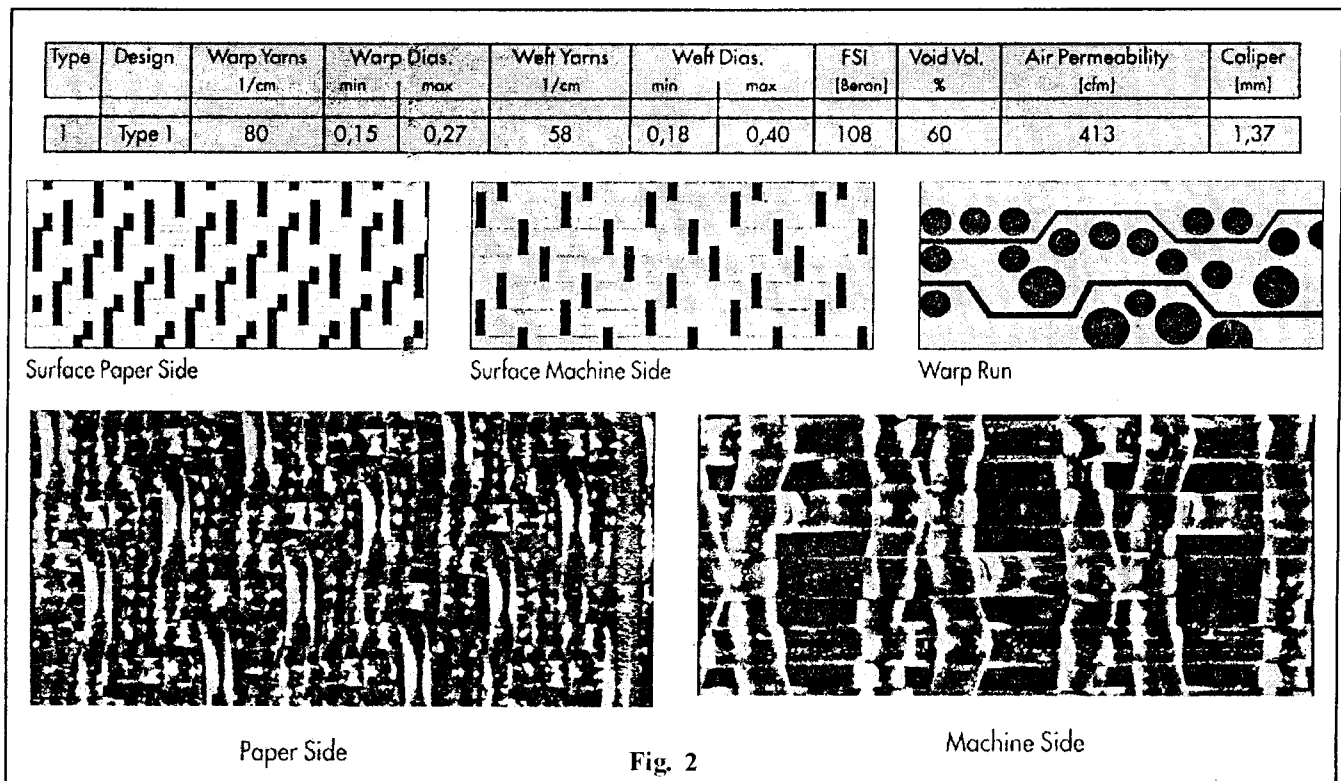
After the wire part next comes the press section. Here the paper web enters with 18-20% solid content. In press section the water is removed by applying mechanical force. The web is pressed hardly between two nips. Vacuum

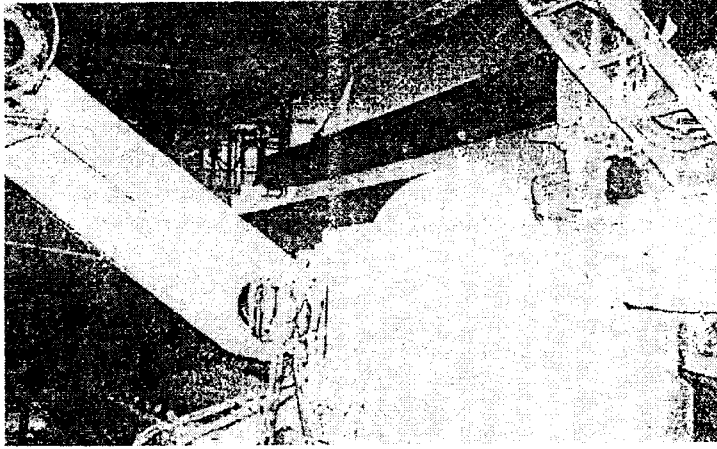
is also applied to remove the water at suction press. In this section we try to remove the water as much as possible so that it will be helpful to remove the water in the next step of water removal at minimum cost. Most of the development in the paper machine in the recent past is happened in this area. Care should be taken so that the paper web not crushed too much due to high nip load. The developments in this section starts from plain presses with the combination of rubber covered and granite or stonite rolls, suction press, blind drill rolls, venta nip press to the latest development of shoe or extended nip press.

#### Press felts

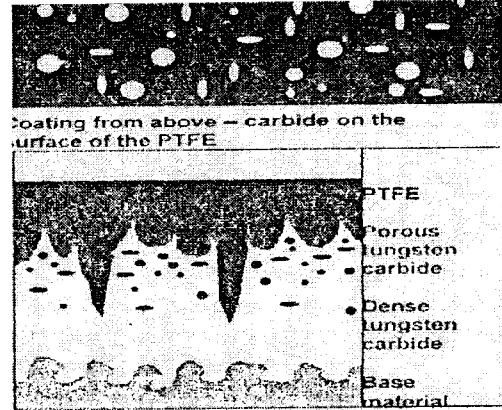
These developments in the press configuration demanded high quality press felts for the fast removal of water from the paper web at a higher speed and shortest time period. The felt carries the water removed by pressing and also prevents the web from any physical damage. Initially woolen felts were used. After the introduction of synthetic needled felts there is a sea change in felt life, water removal, higher void volume, marking on paper and surface properties. The synthetic batt on mesh needled felts are developed with single layer, double layer, laminated and sandwich type. The recent development in this area is seamed felts, which are widely used for all grades of paper without any marking.

The latest development in the press fabric is that it might be possible to further de-water the sheet on a different medium than felt. Kufferath has developed a





The PikoClean - coating



Profile of the new coating

Fig. 3

multi layer fabric made from monofilament synthetic yarns, which is woven and also seamed in a newly developed process.

#### Advantages

This fabric avoids all mechanical problems, which can occur in a press, in a particular the dreaded vibration is definitely eliminated. In addition the fabrics offers big advantage due to its large openness and high permeability with regard to water absorption and cleaning.

This fabric can be used in the turning position on a cylinder mould machine, suction press of a board machine, couch position of the board machine, Pre-Press of the making felt on a board machine and also pick-up position of lower basis weights. Field trials are conducted and the results are more than expectation. The commercial production is already started. More details are available on request either from us or from Kufferath.

#### Dryer Screens

In earlier days, the dryer fabrics are made with cotton and wool. Then people started using, first with synthetic round yarn and recent day's synthetic flat and flat ribbon yarns. This change from cotton to synthetic yarns has not only given long life for the screens but also several advantages for the paper makers and some of them are mentioned below :

- Better evaporation due to different permeability levels.
- Good contact area results uniform drying thereby improvement in the surface properties.
- Long dryer screen life resulting reduction in the cost for machine clothing.
- Reduction in the steam consumption resulting increase in machine speeds, Paper production and more profit.

#### Monotier concept

In the year 1997 M/s. Asten, Belgium developed their new concept of MONOTIER dryer screen. For this innovative monotier concept dryer screen M/s. Asten, during the 50 anniversary of the ATIP in France, got the grand prix del' innovation ATIP 1997, for the best innovation award in paper industry. Monotier concepts of the dryer fabrics are produced from synthetic flat ribbon yarns like other flat yarn fabrics. The specialty of this concept is, unlike conventional dryer fabrics, in monotier concept two separate warp yarns are used, one in top and one in the bottom, which looks like a double layer fabric. This double warp design gives several unique advantages over the conventional flat ribbon yarn screens.

- Reduction in caliper
- More contact area
- Lower CA value
- No damage in the fabric construction (against damage due to hydrolysis)
- Prevention of adherence and penetration of contamination.
- Faster seaming.
- Considerable reduction in the difference of air permeability between the seam area and the dryer screen.
- Less distortion of the loops of the seam.
- Various Fermentation & combination of warp yarns to meet the different needs of the customer.
- Phenomenal increase in the fabric and the seam strength.
- Remarkable improvement of resistance against contamination.

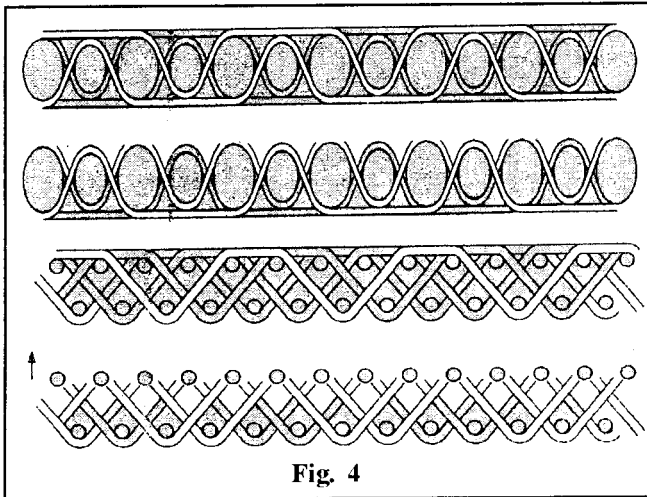


Fig. 4

### Mircotec

This is the latest development in the dryer fabric design with the above said monotier concept. Due to the pressure from Governments around globe and increasing pressure from Ecologist to protect our Earth ecology, environment and forest more and more secondary fibres are used as raw material in recent days. This has caused increased headache for the paper makers, paper mills and the whole industry due to increase of stickies & adhesive from the waste paper and also various chemicals used for coating application to improve surface properties for better printability and resistance to water, liquid and other materials. Keeping this in mind, MICROTEC, the new type of Monotier concept fabric with profiled flat ribbon on paper side is MonoTier Concept Dryer Fabrics are also superior to conventional dryer fabrics in case of hydrolysis thanks to their separate warp layers system.

### MonoTier concept facts

Increased heat transfer thanks a contact area of 58%. Reduced sheet fluttering thanks to reduced air carrying capacity due to the very smooth surface structure of both fabric sides. Reduced paper stretching thanks to low fabric thickness and favorable neutral line. Faster tail threading and improved adherence of the paper sheet thanks to a large contact area and smooth fabric surface.

Even drying of the paper sheet thanks to very steady air permeability values. Increased running time thanks to excellent anti-contamination and cleaning properties due to the smooth flat ribbon surface. Increased running time thanks to slow down of air permeability decrease reached by keeping lateral air canals open. Use of the advantages of the MonoTier Concept in all positions and for all paper grades thanks to the complete air permeability range (60-600 cfm). Well determined fabric types for problematic positions thanks to the combination of different materials, which is possible as the two warp layers are independent one from another F. Fabric tensile strength increased by 50% compared with traditional fabrics of the same thickness thanks to the patented weave pattern with double warp layer. High seam tensile strength thanks to the untwisted flat ribbon seam. Equal contact surface in the seam area thanks to the untwisted flat ribbon seam. Quick and easy seam closing : 10 m in 10 minutes. No humid marking of the seam as fabric and seam have the same air permeability surface. No pressure marking of the seam as fabric and seam have the same thickness and contact surface. Optimum clothing for the whole dryer section : all advantages are kept thanks to the combination of different fabric types and air permeability values of the MonoTier Concept dryer fabric range developed This design has increased the resistance of contamination adherence to the surface of the dryer screen. Some of the

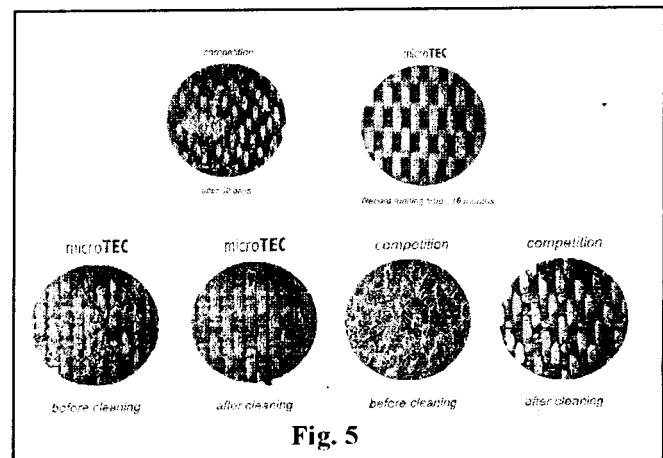


Fig. 5

Table- 1

Air permeability	cfm	100	120	150	180	200	250	300	350	400
Air permeability	m <sup>3</sup> /m <sup>3</sup> /h	1550	1900	2350	2800	3100	3900	4700	550	6200
Ca-value		3	3							
Contact area %				40				28		
Caliper	mm	1,6	1,55	1,5	1,5	1,5	1,5	1,5	1,5	1,5
Weight	g/m <sup>2</sup>	1350	1200	1100	1150	1050	1150	1100	1000	1000
Tensile strength MD	daN/10cm			1950					1650	
MD materials				PET					PET	
CMD materials				PET					PET	
Percentage PET	%			100					100	

**Table-2**

Air permeability	cfm	70	90	12	150
Air permeability	(m <sup>3</sup> /m <sup>3</sup> /h)	1100	1400	1900	2350
Ca-value		3	3		
Caliper	mm		2, 1		
Weight	g/m <sup>2</sup>	1300	1250	1200	1150
Tensile strength MD	(daN/10cm)		1250		
MD materials			PET		
CMD materials			PET		
Percentage PET	%		100		

successful stories of this type of design on different machines are shown below:

**Micro Top**

This fabric is a flock yarn Monofil/Round wire fabric developed to avoid the formation of lenses and to restrict the contamination to spread over the paper web or external rolls. The flock yarns on the paper side of the dryer screen act like a brush, catches the contamination like latex, which are in the molten form while entering the first and second dryer groups, without making any marking on the paper web.

**Application**

Monotier concept dryer screens are preferred for most of the high speed new and rebuilt paper machine worldwide for the last 4 years. Monotier concept dryer screens are produced from 70-600 CFM airpermeability ranges for all types of paper grades. The price difference between a conventional flat ribbon yarn dier fabric and the MONOTIER concept dryer screen is negligible.

Both Microtec and Microtop type dryer screens are a bit expensive compared to monotier concept dryer screens.

**Case study I**

During 2001 at ITC Bhadrachalam Paperboards 15 dryer cylinders was ground in-situ within 6 days time in their PM-I. This grinding was done due to the reason that they have installed on-line coating in their existing machine. Since some of the dryer cylinder surfaces are not uniform in-site grinding was carried out.

**Result**

They have achieved the desired result of getting uniform sheet drying and sheet surface before the sheet enters the on-line coating stage. Another important problem in the dryer part is fluff generation at the pre dryers and stick of coating solution after size press and after coater. The best solution to reduce the fluff generation is to coat the dryer surface with Teflon and tungsten carbide. Till now Chromium coating and Teflon sleeves are used on the dryer cylinders. However, due to the soft nature of Teflon any sharp material can cause damage to the Teflon sleeve and another important disadvantage is doctor blades cannot be used.

Now new technology is available to coat the dryer cylinder first with Tungsten Carbide and then with Teflon and it is called as pikoclean. This coating was done by combining the hardness of Tungsten carbide and the non-sticky properties of PTFE. This coating thickness is around 60-80 microns and it can be done in-situ at site. Doctor blades can be used after coating. This coating process consist of grinding of dryer cylinder, if necessary, to prepare uniform surface for coating, sand blast it to remove the dirt, coating with Tungsten carbide by HVOC method, coating of PTFE Teflon and baking of Teflon with gas fired IR heaters. It will take approx. 36 six hours for one dryer cylinder and the approx. Cost is EURO 1000/sq. mtr. for coating job. If grinding is necessary before coating it involves extra cost.

**Case study II**

During the recent rebuilt of PM-I in M/s. Tamil Nadu Newsprint and Papers Limited one lead roll and one dryer cylinder after the new Speed Sizer was coated with Teflon., In all new Voith Paper machines the first two dryer cylinders are coated with Teflon to reduce the fluff. By doing coating with Teflon the dryer cylinder surface temp. can go upto 150°C. Above 93 °C the fluff generation tendency will reduced.

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**CONCLUSION**

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Even though the dryer part of the machine is very import due to the reason that this is the area at which most of the energy is consumed in the paper making process. Unfortunately the mills give less importance and focus on this area. The total cost of the machine clothing is 1.5% of the production of paper. Still it plays very important role in the economics of the paper production.

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