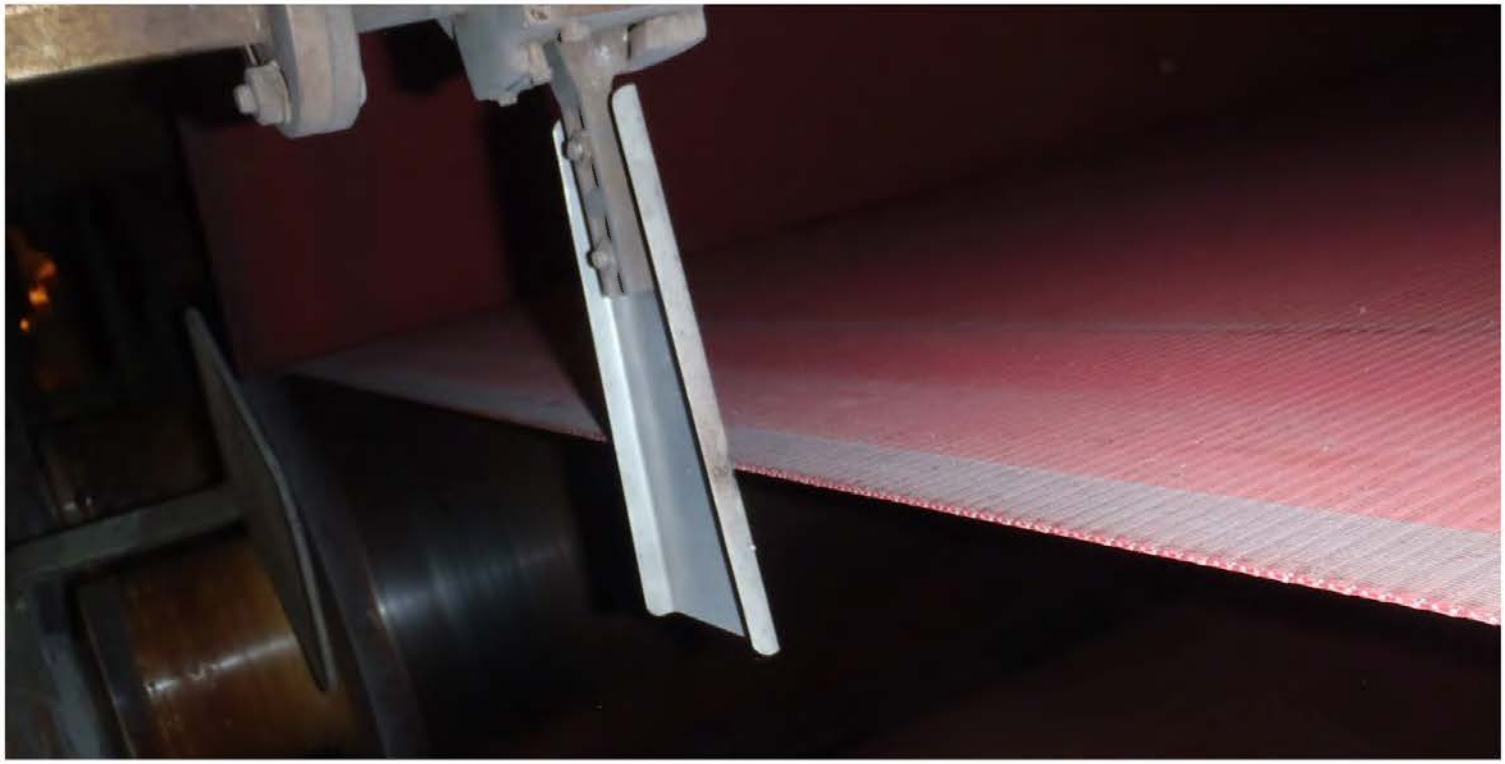
Why guide palm setting is important for dryer fabrics and what you need to know



There are a number of factors that can affect or reduce runnability in the dryer section, but the cause is not always obvious and easy to correct. A smooth run of the fabric without commuting, waviness or even wrinkles is one of the prerequisites for a trouble-free transport of the web through the final section of the paper machine. Correctly positioned and adjusted guiding control devices in correspondance with the guiding roll, ensure that the dryer fabrics are running „straight" and the production process is not disturbed. Damage to the fabric due to misguiding or increased edge wear is avoided and prolongs the fabric life.

Types of guiding control devices

There are three types of guide control: optical, pneumatic and electrical. When using an optical guide control, the fabric guiding is controlled by a sensor via light reflection. This kind of control is contactless. With pneumatic regulators, the guidance of the dryer fabric is controlled by a guide palm. Electric regulators also have a guide palm, which triggers the signal to the guide roll on contact with the dryer fabric. Opposite to the pneumatic regulator, the guide palm in this case has no direct contact to the dryer fabric edge as long as the dryer fabric runs straight.

In this article, we concentrate on the pneumatic guiding system and its setting. Despite permanent contact of the guide palm with the fabric edge, damage to the dryer fabric can be avoided and lifetime of the clothing can be extended.

Operating principle of the pneumatic guiding system

Actuating cylinder (2) and guide palm (3) of the pneumatic regulator are pressurized with compressed air (1) on both sides. The guide palm is in (permanent) contact with the dryer fabric edge for scanning. Here, a pressure spring with spring preload ensures that the guide palm is in contact with the dryer fabric edge at a defined contact force.

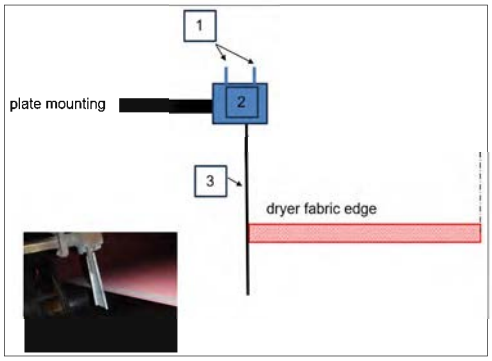


Fig. 1 Pneumatic guiding system

If the fabric runs straight, the guide palm is in centre position and the air valves are closed. If the dryer moves off track, the guide palm „follows" the fabric and is pushed out of its centre position. This opens the valves and the pressure in the actuating cylinder changes. The change in pressure triggers a stroke movement of a piston and initiates the „counter-movement" of the guide roll. By tilting the guide roll accordingly, the dryer fabric is pushed back into its initial straight position and the guide palm returns to its centre position.

Why is a correct guide palm setting important?

The guide palm is in direct contact with the dryer fabric edge. An incorrectly positioned or adjusted guide palm can lead to various problems:

- Abraded edges of the dryer fabric (Fig. 2-5)
- Dirty machine frame due to dryer fabric dust (wear)
- Deposits of the dryer fabric on the guide palm (Fig. 6+7)
- Swing up of the guide palm due to unevenly worn edges
- „Grooved" or cracked guide palm (Fig. 8+9)
- „Migrated" MD yarns at the dryer fabric edges (Fig. 10)
- Reduction of dryer fabric width
- Fabric run off track into the machine frame
- Wrinkling of dryer fabric
- Waviness in the edge area
- Continuous fabric movement due to „unsteady" guide roll
- Prematurely change of dryer fabric

Fig. 2-5 Abraded dryer fabric edges

Fig. 6+7 Dryer fabric deposits at the guide palm

Fig. 8 Damaged guide palm

Fig. 9 „Grooved" guide palm

Fig. 10 Migrated dryer fabric MD yarns

General information on regulation

Before going into more detail about the guide palm setting, let us have a quick look at the following points:

- Where is the correct position of the guide roll?
- Which is the ideal distance of the leading rolls to each other?
- At which angle should the dryer fabric be in contact with the guide roll?

Tension control and guiding control influence each other. The control loops must be separated from each other to prevent a swing up of the system. Due to this, for the **positioning of the guide roll** with guide palm, following rule has been considered a long time: In running direction after the tension roll, with at least one leading roll between tension roll and guide roll, and another leading roll following the guide roll at short distance (Fig. 11).
Nowadays, modern paper machines operate without the leading roll between the guide roll and the tension roll (Fig. 12).

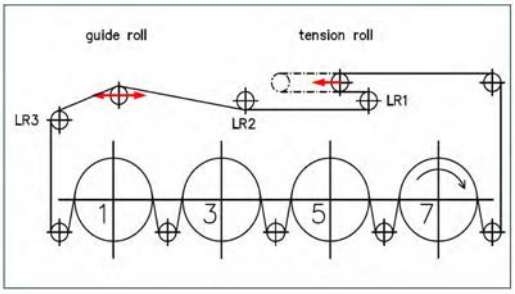


Fig. 11 Traditional roll set-up

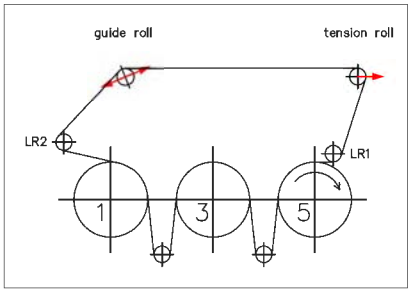


Fig. 12 Modern roll set-up

Further, the **distance between the rolls** is important to prevent guiding problems. The rule of thumb is:

Example 1 (with a leading roll between tension roll and guide roll):
The distance between leading rolls 2 + 3 should be approx. 1.5 times the fabric width - but at least the single fabric width. On narrow machines, it can also be 2 times the fabric width. The distance between leading roll 2 and the guide roll should be higher than the distance between the guide roll and leading roll 3 and amount to approx. 2/3 of the total distance. The distance between the guide roll and leading roll 3 is therefore approx. 1/3 of the total distance (Fig. 13).

Example 2 (tension and guide roll positioned directly each other):
A common distance between tension roll and leading roll 2 is approx. 1.5 times the fabric width (but at least the single fabric width). The distance between tension roll and guide roll should be higher than the distance between the guide roll and leading roll 2 and amount to approx. 2/3 of the total distance. The distance between the guide roll and leading roll 2 is therefore approx. 1/3 of the total distance (Fig. 14).

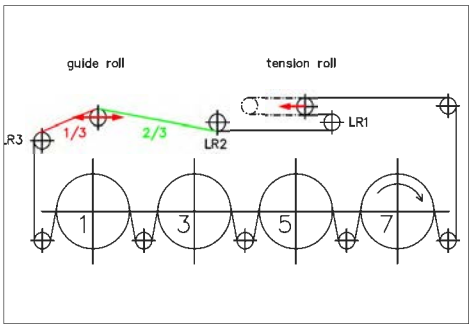


Fig. 13 Roll distances - Example 1

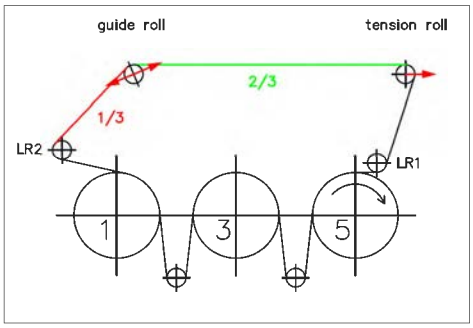


Fig. 14 Roll distances - Example 2

Ingoing and outgoing angle

Basically, guiding is achieved by adhesive friction. On the one hand between dryer fabric and rolls and on the other hand by tension differences between front and drive side. These differences can be caused by misaligned rolls or by the paper sheet (moisture cross profile = e.g. wetter edge on the drive side => cooler edge => longer fabric on the drive side).
In order to use the adhesive friction optimally for the guiding of the dryer fabric, the ingoing and outgoing angle of the fabric contact with the guide roll should fulfil certain criteria.

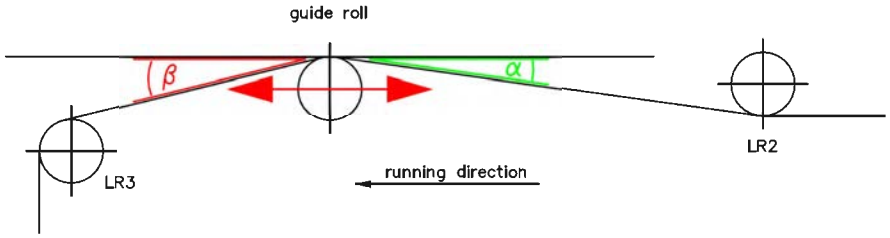


Fig. 15 Ingoing and outgoing angle

The ingoing angle α should be the same or smaller than the outgoing angle β. The larger outgoing angle „holds" the dryer fabric in position after the guide roll. This leads to less internal fabric tension and ensures a stable, smooth guiding control.

Ingoing angle α = 0° - 20°	**Outgoing angle β = 10° - 50°**

Which parameters are important for a correct guide palm setting?

- Position of the guide palm in the paper machine
- Conctact pressure to the dryer fabric
- Contact point of guide palm/dryer fabric

The correct position of the guide palm
The guide palm should always be positioned shortly after the guide roll (approx. 50 cm). Doing this, the effect of the guide roll is transmitted to the guide palm without any delay. If the guide palm is positioned in front of the guide roll, it takes almost the entire dryer fabric cycle until the signal of the guide roll is transmitted to the guide palm.

Contact pressure of the guide palm to the dryer fabric
For a smooth dryer fabric run, the contact pressure should not be set too high, but also not too low. If the pressure is **set too high,** higher wear of the dryer fabric edge occurs and the internal fabric tension increases. Excessive contact pressure can also leave marks on the guide palm. An abraded dryer fabric edge can cause grooves in the guide palm itself (see p. 3 Fig. 9).

If the pressure on the guide palm is set too low, the internal fabric tension is significantly lower, but the fabric does not run smoothly. This sensitive setting results in constant guiding work, which causes a wobbling of the dryer fabric (the fabric „dances"). The constant friction between paper sheet and fabric or roll and fabric can cause increased fabric wear.

Both, a too high or too low pressure can lead to increased wear of the dryer fabric and cause a premature fabric change.

Recommended guide palm pressure: 130 g = approx. 1.3 N

The pressure on the dryer fabric edge can be measured quickly and easily using a spring balance (Fig. 16).

Fig. 16 Spring balance

Contact point of guide palm/dryer fabric

The correct contact point is as important as the pressure of the guide palm. A good guiding control is reached when the position of the contact point guide palm/dryer fabric is adjusted at minimum 2/3 of the length of the guide palm plate (Fig. 17). The contact pressure at this point should be approx. 1.3 N.

Recommended position of contact point:

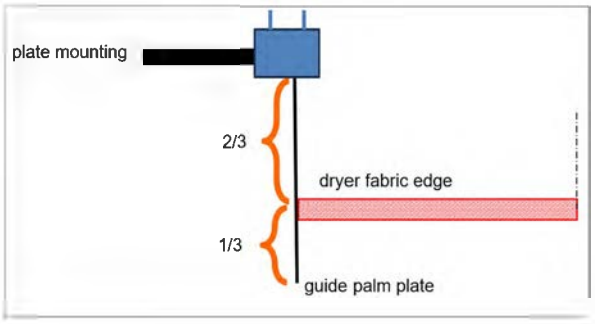


Fig. 17 Recommended position of guide palm at dryer fabric

If the contact point is too high up on the guide palm plate (towards the plate mounting), the contact pressure of the guide palm increases. This leads to increased wear at the fabric edge and groove marks on the metal. Strong internal fabric tension and folded edges can also be the result of a too high contact point which results in increased contact pressure.

If the contact point is too close to the lower edge of the guide plam plate, the contact pressure of the guide palm against the dryer fabric is reduced. This can lead to a premature counter-guiding by the guide roll and results in an unsteady fabric run. The dryer fabric oscillates. If the rolls are dirty, these movements can lead to wear on fabric roll side. A too low contact point increases the risk that the dryer fabric pushes through under the guide palm plate and is no longer caught by the guiding process.

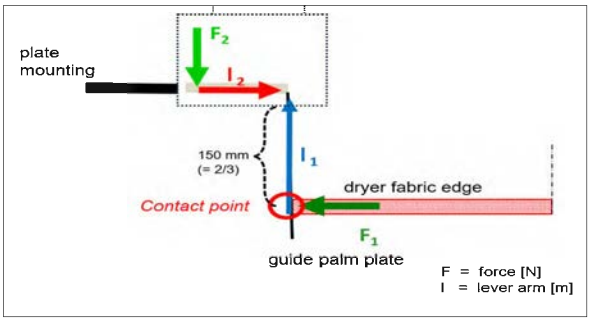
Contact pressure of the guide palm and contact point to the dryer fabric ...

... two apparently small parameters which can have a huge effect. The following example based on **the priciple of the lever** illustrates the change of contact pressure when the contact point guide palm/dryer fabric is adjusted.

A lever is in balance when the product of force and lever arm on one side of the pivot point is equal to the product of force and lever arm on the other side of the pivot point.

$$F_1 \times l_1 = F_2 \times l_2$$

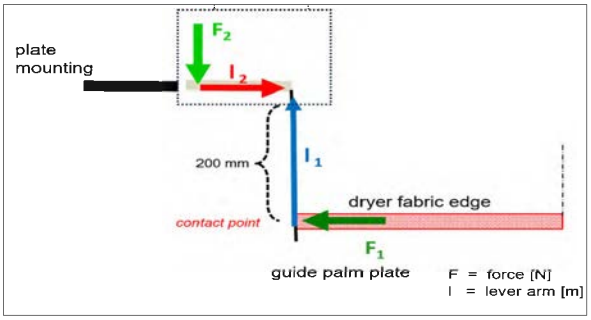
Initial situation (correct guide palm setting):
Plate length = 220 mm (2/3 = 150 mm)
Lever arm l_2 = 50 mm



Example calculation:
F_2 = 4 N
l_2 = 50mm
l_1 = 150mm → F_1 = ?
F_1 = (4Nx50mm)/150mm
F_1 = 1.33 N

The input force F_2 = 4N, results in the recommended actuating force of approx. 1.3 N (F_1) at the contact point (2/3 of the plate length (l_1) = 150 mm). If the contact point is moved upwards (towards the mounting) or downwards, the actuating force F_1 changes. In some cases, it deviates significantly from the recommended 1.3 N!

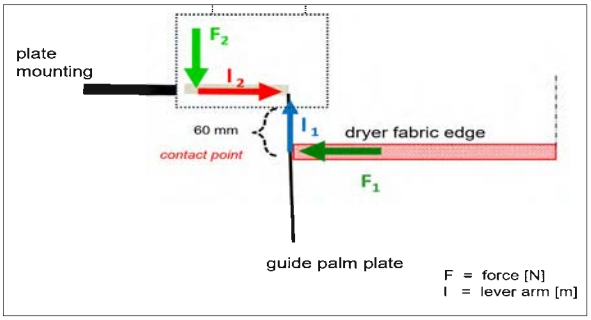
Example 1: Moving the contact point downwards l_1 = 200 mm



Example calculation:
F_2 = 4 N
l_2 = 50mm
l_1 = 200mm → F_1 = ?
F_1 = (4Nx50mm)/200mm
F_1 = 1 N

The contact point guide palm/dryer fabric in example 1 touches the plate at the lower edge (l_1 = 200 mm from the lever arm). This results in a contact point force of F_1 = 1 N.

Example 2: Moving the contact point upwards l_1 = 60 mm



Example calculation:

F_2 = 4 N

l_2 = 50mm

l_1 = 60mm → F_1 = ?

F_1 = (4Nx50mm)/60mm

F_1 = 3.33 N

In example 2, the contact point of the guide palm/dryer is closer to the mounting (l_1 = 60 mm). This results in a significantly higher contact point force of F_1 = 3.33 N. These two examples clearly show the influence of the contact point guide palm/dryer fabric on the actuating force and how important a correct positioning is.

Summary

Choosing the appropriate dryer fabric design can make a big difference to productivity. Not just in terms of energy balance, but also in terms of contamination behaviour, wear potential and much more. In this article we would like to point out that a small machinery part like a guide palm can have a big impact on the overall result. Dryer fabrics are tailor-made and must be designed for the individual demand of the paper machine, position and grade. Good edge sealing and welding protects the dryer fabrics from damage and supports efficiently working guide palms. At Heimbach, we focus on an abrasion-resistant, but also flexible edge sealing. Thanks to the flexible material properties, wavy edges - e.g. due to overstretching as a result of wrapping - can revert back to their original shape without damaging the edge sealing.