Web Handling Terminology

Article

Web

Web is a material that is thin, flexible and continuous in nature. Web materials are transported within a machinery to convert them into finished products. A wide variety of consumer products are made from web materials such as paper, plastics, films, foils and metals, into finished products such as diapers, female hygiene products, labels, tapes, magazines, aluminum cans, and even some electronics.

Web Handling

Web handling is the process of controlling and transporting the web within the process machinery with the goal of minimizing the defects due to the transport.

Converting

Converting is the process of transforming the web from its continuous flexible form, into another permanent form. Some examples of converting processes include, printing, coating and lamination where the raw web is converted into finished products.

Roll-to-Roll Processing

Since the term “web” is often confused with the “World Wide Web” the terms “Roll-to-Roll’ is becoming predominant. Roll-to-Roll processing is synonymous to converting or web processing where the term is derived from the fact that the web materials goes from a roll to another roll.

Rolls

When the flexible web is wound on a core of material it is called a roll of web or wound roll.

Rollers

Rollers are part of the processing machinery that support the web while they are transported within the machinery. The rollers may be made from materials such as steel, stainless steel, aluminum or carbon fiber.

Idler Rollers

Some rollers are intended only for support and these types of rollers are called idle rollers or idler rollers. These rollers have low friction bearings that allow them to spin at the same speed as the web.

Dead Shaft Rollers

Some of the idler rollers might have a dead shaft with bearings supporting the spinning outer roller surface. The dead shaft is fixed to the machine frame and the outer shell spins while the shaft is stationary. These rollers are most common for application where the roller function is purely for support of the web.

Live Shaft Rollers

Live shaft rollers have the shaft and the outer roller surface rigidly connected while the whole assembly is supported on bearing mounted on the machine frame. Both the shaft and the shell rotates. Live shaft rollers are common with driven rollers, heating and cooling rollers and other process rollers.

Driven Rollers

These are usually live shaft rollers, that are connected to a torquing device such as a motor, to transfer the torque or force to the web.

Web Span or Free Span

The unsupported portion of the web between two rollers is called a web span or a free span or simply a span.

Span Length

The length of the unsupported portion of the web between two rollers is the span length.

Web Speed or Transport Velocity

The speed at which the web is transported within a processing machinery is called the web speed or transport velocity. The web speed is usually expressed in feet-per-minute (fpm) or meters-per-minute (mpm). The web speed is typically measured or inferred from the driven rollers.

Machine Direction or Transport Direction

Machine direction (MD) is the direction in which the web is transported. This is also along the length of the web. Web speed and web tension are measured along the machine direction.

Web Tension

The force in the web or the force applied to the web in the machine direction is called the web tension. The unit of tension is pound (lb) or Kilogram (Kg). It is also common to express this force normalized with respect to the width of the web as pounds-per-linear-inch (PLI).

Longitudinal Control

The machine direction control of web speed and web tension is called longitudinal control. This is an integral part of web handling. Good longitudinal control can increase the efficiency of the overall machine by increasing the web transport speed while delivering the web with minimum defects through the process machinery.

Tension Control

Tension control involves the active control or regulation of tension within the processing machinery using a closed loop control system. Tension is controlled by either speeding up or slowing down two rollers (using driven rollers or breaks) or by directly applying a tensile force with a mechanism such as a dancer. A force feedback device such as a load cell may also be used to close the loop.

Draw Control

The open loop control of tension by maintaining predefined velocity ratios between driven rollers is called draw control.

Dancer

A device that is typically made of one or more free moving idle roller(s) that imparts force on the web. Dancer rollers may have linear motion or rotary motion (with a pivot arm) to move or change the span length upstream and downstream of the dancer roller.

Load Cell

A transducer, typically made of strain gauges, that is used to measure the tension force on the web.

Tension Zone

The spans or regions of the machine where the tension is regulated or controlled is called a tension zone. Roll-to-roll processing machinery might have multiple tension zones that are controlled by multiple tension control systems. Driven rollers and brakes (to slow the web down) are typically used to control tension based on tension measurement from transducers.

Nip Roller(s)

Nip is usually a rubber covered roller or a roller with a flexible surface that is used to squeeze the web onto another roller. The nip roller(s) apply force on the web for various reasons. Processes such as lamination, embossing and printing may need the force applied by the nip for the converting process. Nips are also used to increase friction between the web and the roller and for isolating tension zones in general web handling applications.

Traction

Traction is the adhesive friction force between the web and a roller. High traction implies a high friction force or grip between them. When there is enough traction between the web and the roller, the surface velocity of the roller and the linear web speed will be the same. Web traction can be increased by increasing the coefficient of friction (COF) of the web surface, the COF of the roller surface, increasing the web tension or by increasing the nip pressure.

Web Slip

When there is not enough traction between the web and the roller, the web speed may be more or less than the surface velocity of the roller; the web slips on the roller. When the web slips on the roller the web is sliding on the roller surface thereby having a relative velocity between the web and the roller surface. When there is enough traction, the web grips the roller and thus have zero relative velocity between the two.

Air Entrainment

The phenomenon of air trapping between the web and a roller as soon as the web (or the roller) starts moving is called air entrainment. Depending on the surface roughness of the roller, the surface roughness of the web, the web speed and the porosity of the web material, the increase in speed of the roller rotation can increase the volume of air entrained between the two surfaces. This entrained air acts as a lubricant and reduces the traction between the web and the roller.

Cross Machine Direction

Cross machine direction is perpendicular to the machine direction and parallel to the width of the web.

Web Guiding

Web guiding is the process of regulating the cross machine position of the web while the web is transported. Other terms for web guiding include lateral control or lateral alignment or CD alignment or lateral registration or CD registration.

Web Guide

The device used to control the lateral position of the web is called a web guide or simply a guide.

In the next article we discuss more terminologies specific to web guiding.