3 Easy to place on shelf – stable, maintains shape when opened;
4 Easy shopper interaction – clear link between primary and secondary packaging, easy product removal from the secondary packaging.
5 Easy disposal – tool free, minimum interaction, space saving.

26.3 Flow wrap machinery and sealing

Flow wrapping is carried out as follows: The flow wrapper operates as a horizontal form-fill-seal machine. It forms a continuous tube of packaging film by producing a longitudinal seal (often referred to as a fin seal) along the base of the pack. Product is pushed into the tubes for a set distance. The tube containing the product is then sealed (end seals) and cut to a predetermined length. The key to an effective flow wrap operation at high speed is a well designed and built "folding box" or "folding plate" (figure 26.13).

The end seals may be heat sealed by the application of pressure and heat from rotating predominantly metal jaws for a pre-determined time. For heat sealing the main wrapper typically consists of a lamination such as 10–12 µm ($0.39–0.47 \times 10^{-3}$ in) PET and 25–30 µm ($0.98–0.1.18 \times 10^{-3}$ in) cast polypropylene (CPP; metallised or non-metallised), with the CPP as the heat seal layer. In addition mono-web co-extruded BOPP film can be used on its own for heat seal applications. However the available sealing layer thickness is often only ≈ 1 µm (0.039×10^{-3} in) thick and, therefore, the sealing jaw set-up and maintenance must be perfect to produce consistently tight seals. The end seals may be cold sealed by the application of pressure alone when cold seal adhesive is employed. The sealing surface of the rotating jaws may now be a softer material such as Kevlar or rubber. The softer surfaces of these materials even-out any irregularities in the film to produce improved seal integrity.

Where higher barriers are required (e.g. to oxygen, moisture or odours) or high visual impact, several layers of different films are laminated together (usually by the printer) with adhesive. The lamination process typically involves solvent-based adhesives. However, there has been a gradual move towards solvent-less adhesives, which produce a weaker bond in the lamination but also

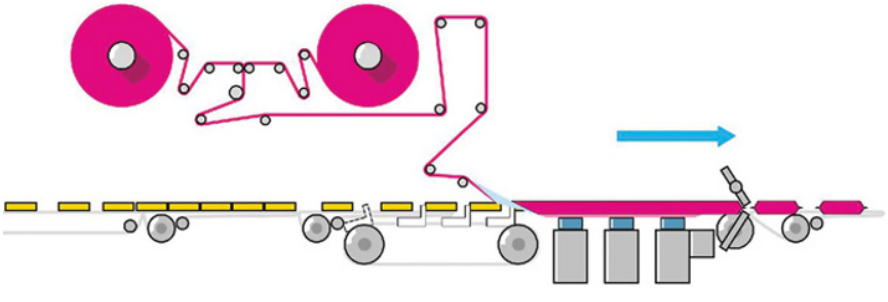

Figure 26.12 Schematic illustration of a flow wrapping line.

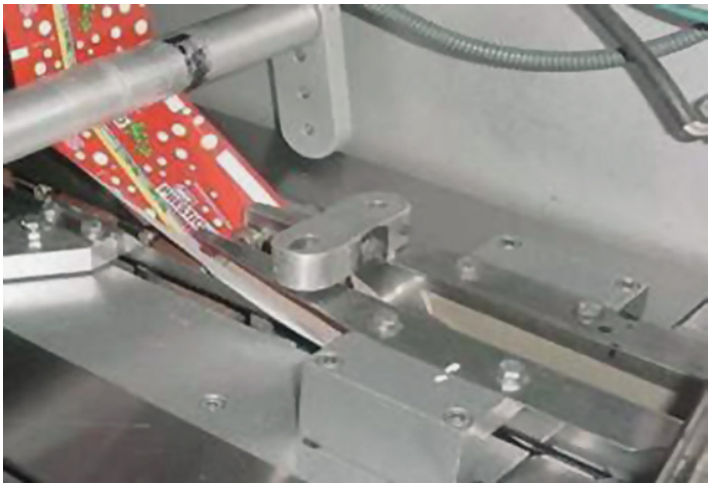

Figure 26.13 Flow wrap folding box.

produce a softer feel to the finished pack. Extrusion lamination using LDPE as the adhesive is also used; however, these structures are more commonly found in the cereal bar category providing a little added puncture resistance.

As discussed, a typical structure for a high-quality impact laminate film could be BOPET/adhesive/CPP whereby the print is sandwiched between the adhesive and PET, giving a high gloss surface. In this structure, the heat seal is provided by the internal layer of CPP that has a lower melting point than the external layer of PET. In addition, a thicker sealing layer is used compared to a coated film or mono-web BOPP to guarantee maximum seal integrity and high sealing bond strength.

Standard heat seal films on horizontal flow wrap machines run at up to 30 m/min (98 ft/min). Low temperature sealing (LTS) or broad sealing range (BSR) films are proven to run at 70–80 m/min (230–262 ft/min). However, some suppliers state their films run at up to 100 m/min (328 ft/min). LTS/BSR films attract a premium price and have therefore found limited use compared with cold seal adhesive films. LTS/BRS films are not recommended for vertical pillow pack machines due to their initial weak bond strength (seal required to carry a load immediately after sealing and before the seal has cooled).

Cold seal films work by applying a blend of natural rubber latex and synthetic polymer-based adhesive onto the internal edges of the film to be sealed. These are then pressed together on the wrapping machine at high speed (see Section 26.4.5). Cold seal films are typically used for horizontal flow wrap operations where high-speed wrapping is required. Vertical pillow-pack operations rarely use cold seal films due to the low-speed equipment and the premium price incurred for cold seal structures. Although synthetic cold seal adhesives have been developed and proven over recent years, their use in replacing natural rubber latex has proven slow due to additional on-costs.