THE *PERFECT FIT.*

PACKAGING AUTOMATION IN *E-COMMERCE*

An expert guide on boosting efficiency and sustainability with right-sized packaging

Henkel

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EDITORIAL

E-commerce packaging solutions have evolved significantly over the past two decades. In the early days of e-commerce, products were often shipped using standardized packaging that was primarily designed to ensure safe transport from A to B. However, driven by technological advances and shifting consumer preferences, e-commerce has experienced rapid growth and packaging is now a key element of the supply chain. Faster, better and more sustainable—both the consumer and industry are placing greater demands on e-commerce packaging. Besides being robust and functional, today's packaging solutions also need to minimize their impact on the environment. As a result, more and more focus is being placed on sustainability, automation and personalization.

Efficient packaging solutions are extremely important for the e-commerce sector as they help optimize logistics processes and compensate for the shortage of skilled workers. During peak periods such as Black Friday, online retailers and fulfillment centers have to handle high order volumes while also meeting customer expectations in terms of swift deliveries. Optimized packaging can drive down transport costs by reducing weight and volume. It can also help to minimize product returns by ensuring that goods reach customers safely and undamaged. As such, efficient packaging not only helps drive production and transport efficiency but also boosts customer satisfaction.

This expert guide takes a close look at the latest trends in the e-commerce packaging industry. In addition to examining the benefits of fully automated packaging processes tailored to the size of the items inside, this guide also shines a light on what companies need to consider when switching to this packaging solution.

Please reach out to our packaging experts should you have any queries.

CHALLENGES IN E-COMMERCE-PACKAGING

Conventional e-commerce packaging methods give rise to numerous challenges that can lead to inefficiencies across the entire supply process.

Overpackaging

Overpackaging is where the packaging is far too big for the product, requiring a lot of void fill. Besides producing an excessive amount of waste, overpackaging also generates unnecessary costs. Firstly, companies have to purchase more materials than they need for the packaging, and secondly, the packages themselves are heavier and take up more space in the truck, which pushes up transport costs. Disposing of the packaging waste can also represent an issue, with customers having to go to greater lengths to recycle it properly and the industry as a whole facing higher disposal costs. Last but not least, overpackaging is also bad for the environment. The fewer packages that fit into a truck, the higher the carbon footprint of an individual order. The large amount of materials used means that resources are wasted and more recycling is needed, placing further strain on the environment.

Underpackaging

The other extreme is **underpackaging**, which is where products are not packaged sufficiently and could therefore become damaged. If safe transport cannot be guaranteed, the end consumers are not the only ones left feeling disappointed after having to send back their products, as this also generates extra costs for both the logistics company and the manufacturer. If this becomes a more regular issue, the reputational damage caused by falling levels of customer satisfaction may, over time, give rise to more serious repercussions for the company.

OVERPACKAGING

- large amount of materials used
- unnecessary costs for packaging materials
- increased transport costs
- excessive waste produced
- more recycling needed

UNDERPACKAGING

- potential product damage
- high risk of more complaints and returns
- brand image tarnished

To ensure efficient shipments that are as sustainable as possible, companies need to steer clear of these two extremes, which result in a suboptimal use of resources and put a strain on logistics operations. However, it's hard to find the happy medium using conventional packaging practices, which usually rely on manual processes. Fortunately, there is a tailored solution to this problem: right-sized packaging.

WHAT IS ***RIGHT-SIZED*** **PACKAGING?**

In the conventional packing process, the packaging is usually pre-assembled so the items can be placed directly inside. Working at around 25 to 30 manual packing stations, staff choose the packaging size (usually S to XL) and the type of adhesive tape simply by looking at the items. They place the ordered products inside and add some extra material to fill out the packaging to ensure the items do not move around or become damaged during shipping. They then seal the box, usually by manually applying adhesive tape.

Too much or too little – right-sized packaging makes all these problems a thing of the past. The size of the items to be packaged is automatically determined using a scanner so that the right-sized shipping boxes and envelopes can be used. The packaging is then sealed using a hot melt adhesive, eliminating the need for tape.

Since the packaging is folded around the product to ensure a perfect fit, there is hardly any unused space that needs to be filled out with extra material. This significantly reduces packaging waste. Using fanfold corrugated cardboard and paper instead of pallets full of envelopes and boxes saves storage space and costs. Compared to the conventional packing process, this solution also offers greater flexibility – not only in terms of packaging sizes, but also in terms of the personnel required. Given the current shortage of skilled workers, coupled with rising order volumes in the logistics sector, this form of automated packaging technology offers an appealing alternative to manual packing.

Benefits of right-sized packaging

PROTECTING THE ENVIRONMENT:
Using the exact amount of packaging material required and eliminating the use of superfluous void fill can **significantly reduce transport volumes**. Reducing the amount of space each package takes up enables **more packages to be shipped per transportation unit**, which in turn **lowers** fuel consumption and **CO_2 emissions per package**.

CUTTING COSTS:
Optimizing the packaging size can generate significant cost savings in multiple areas. For example, **reducing the amount of materials used** leads to lower packaging costs. Paper usage alone can be cut by up to **30%**. On top of that, there's no need for any tape or void fill. In addition, more compact packages mean **lower shipping costs**, since shipping charges are often based on weight and volume.

Reducing the number of returns represents an additional source of potential savings, with right-sized packaging minimizing the risk of product damage during shipping. Together, these factors significantly drive down operating costs. This offers a significant competitive edge, especially in the high-volume e-commerce business.

CUSTOMER SATISFACTION:
End consumers no longer have to rummage around in mountains of void fill to find their order. **Less packaging waste** to dispose of and a lower risk of damaged products result in an improved unboxing experience.

According to the Packaging Report, a Europe-wide study commissioned by the Two Sides initiative on consumer preferences, perceptions and attitudes toward packaging, 73% of consumers prefer packaging that is not too big for the size of the actual product. Clever packaging design can strengthen brand loyalty and boost customer ratings, which in turn can help drive sales.

THE *VITAL* ROLE OF **ADHESIVES** IN **PACKAGING**

Adhesives are a key element in the implementation of right-sized packaging solutions since they play a major role in packaging efficiency. Packaging integrity is a crucial aspect, with high-quality adhesives ensuring that packaging remains safely and securely sealed. Hot melt adhesives also help to optimize packaging processes as they set quickly and increase production throughput.

Various types of hot melt adhesives
A variety of adhesives are used in the packaging industry, with each performing specific functions. The main two categories are pressure-sensitive adhesives (PSAs) and non-PSA hot melt adhesives.

PSAs remain sticky at room temperature and offer immediate adhesion when pressure is applied. This type of adhesive is often used for labels, adhesive tapes and self-seal envelopes as it forms a strong bond without any additional heat or activation.

Non-PSA hot melt adhesives need to be heated before application and set once they have cooled down. They are used in the cardboard industry to seal packaging and ensure a permanent, stable bond.

→ **With right-sized packaging, PSAs are used for right-sized paper envelopes and non-PSA hot melts for cardboard packaging.**

Substrate differences and selecting the right adhesive
Choosing the right adhesive for a certain type of application depends on the properties of the substrate it will be applied to. Paper envelopes and cardboard boxes have different surface properties and levels of thickness, which impacts the requirements for the adhesive. In the case of paper envelopes, the adhesive needs to exhibit strong adhesion to rougher, less even surfaces. This is particularly true when it comes to paper envelopes made using recycled fibers, which are less rigid due to the shorter structure of the recycled fibers.

By comparison, cardboard boxes usually have a smoother, more stable surface, which allows for a stronger bond but also has to withstand flexible stresses. Printed or coated paper presents an additional challenge. Since the surface properties have been altered by the coatings applied, the strength of the adhesive may be impaired. These cases require the use of specialized adhesives that can ensure strong, permanent adhesion despite the smooth, often less porous surfaces.

Besides the substrate properties, additional factors play a key role when selecting the right adhesive. The checklist below provides an overview of what companies need to bear in mind.

Checklist for selecting the right adhesive

- **SUBSTRATE:** Is the packaging made out of paper, cardboard or recycled material, or does it have a special coating? Is the surface smooth, rough, printed or coated? Adhesion varies based on the substrate and surface properties. The adhesive therefore needs to be one that has been specifically developed for the material in question.
- **ENVIRONMENTAL CONDITIONS:** Does the packaging need to withstand extreme temperatures or moisture, e.g., transported in hot or cold environments? The adhesive needs to be suitable for use in the required temperature ranges.
- **SUSTAINABILITY:** Is the adhesive compatible with the paper recycling process? An additional aspect that many companies find important is whether it can help achieve sustainability goals, e.g., by being bio-based.
- **APPLICATION:** The adhesive needs to be suitable for the application method used. The setting time also plays an important role. A faster setting time can speed up production, but companies need to make sure that packaging integrity is not compromised as a result.
- **MECHANICAL REQUIREMENTS:** Does the packaging contain heavy products or need to withstand high mechanical stresses? If that is the case, the adhesive needs to offer high mechanical strength to maintain the stability of the packaging. However, if a high level of flexibility is required, as is the case with reusable packaging, the adhesive needs to be flexible enough to prevent cracking or breaking.
- **CUSTOMER EXPERIENCE:** A good unboxing experience can have a positive impact on customer loyalty. The adhesive therefore has to ensure that, when the time comes, the packaging is easy to open without being damaged.
- **COSTS:** Cost efficiency and value for money are also key factors to consider when selecting the right adhesive. Companies therefore need to take into account the purchase costs as well as the long-term savings arising from reduced material usage and lower shipping costs, for instance.
- **AVAILABILITY:** The adhesive needs to be available for delivery in the desired quantities and at short notice if required.

- **Take advantage of the expertise of your adhesive supplier and listen to their advice** in order to find the optimal adhesive solution that meets your specific requirements.
- **Conduct extensive testing using the selected adhesives under real-world conditions** to validate their performance.
- **Choose the adhesive solution that not only meets your current requirements** but also supports your company's **long-term sustainability goals**.

Benefits of using specific adhesives

The Technomelt E-COM portfolio offers a variety of adhesive solutions that were specially designed to meet the requirements of modern e-commerce packaging. One of the portfolio's USPs is its compatibility with the paper recycling process, which has been **certified by cyclos-HTP**. These adhesives are also certified for use in machines made by all leading original equipment manufacturers (OEMs) and for processing in systems made by all leading application equipment manufacturers (AEMs), and are additionally compatible with the various substrates of the leading original material manufacturers (OMMs).

Which adhesive is suitable for which specific material and application?

CARTON APPLICATIONS

TECHNOMELT E-COM E1	General purpose grade with excellent heat stability and good performance across diverse substrate properties
TECHNOMELT E-COM E2 COOL	Versatile, low-temperature grade enabling significant energy savings
TECHNOMELT E-COM G3	High-adhesion grade for high memory forces, very cohesive and excellent heat stability
TECHNOMELT E-COM G4 ECO	General purpose grade with a reduced carbon footprint (cradle-to-gate, excl. biogenic uptake)
TECHNOMELT E-COM G5 ECO COOL	Low-temperature grade with a reduced carbon footprint (cradle-to-gate) enabling significant energy savings

PAPER ENVELOPE APPLICATIONS

TECHNOMELT E-COM G10	Excellent heat stability, long open time, highly cohesive and white product

Head to head: hot melt versus tape
Hot melt adhesives offer numerous advantages over adhesive tape. To properly recycle packaging sealed by tape, the end consumer has to remove the tape from the box by hand and then recycle the two components separately. This is not only frustrating, as even on the rare occasions when consumers do actually go to all this effort, the end result is not perfect: Some of the fibers from the tape are usually left on the packaging, which complicates the recycling process. Hot melt adhesives also represent a more elegant solution than tapes in terms of handling. As part of the automated packing process, the adhesive is continuously fed into the machine via a hot melt adhesive tank. The tank is filled automatically, with zero interference in the packaging process. By contrast, rolls of tapes need replacing, which usually results in brief periods of machine idle time.

BEST PRACTICE: *HOT MELT* IN ACTION

Not all adhesives are equal, as illustrated by the example of a UK-based e-commerce retailer that banks on right-sized packaging. The company had originally used an EVA hot melt adhesive with an application temperature of 180°C, which had frequently led to downtimes and increased spare part spend due to the high level of char. At 120 kilograms of adhesive per week, material usage was also very high for the level of machine throughput.

In view of these issues, the company decided to switch to a polyolefin-based hot melt adhesive from Henkel, with the goal of ensuring the clean running of its machinery and eliminating stringing. Since Technomelt E-COM E2 COOL is applied at a temperature of 130°C, the retailer was able to save a huge amount of energy. But that wasn't the only area in which the Henkel adhesive excelled. Compared to the previously used EVA, the Henkel solution offered a number of key advantages. The results speak for themselves:

- **42% reduction in energy consumption:**
  from 1.2 kW/h to 0.7 kW/h per tank
- **52% reduction in adhesive consumption:**
  from 120 kg to 62.5 kg per week
- **Improved processing characteristics:**
  high adhesion, clean running, low stringing and elimination of char
- **Extended equipment life** for nozzles, hoses, filters, etc.:
  estimated savings of €24,000
- **Improved worker safety:**
  significantly reduced risk of serious burns plus less irritating fumes in the work environment due to equipment running at lower temperatures
- Significant **reduction in downtimes:**
  weeks of operation with no reported adhesive problems

Henkel conducted the case study in collaboration with machine manufacturer Sealed Air Equipment and Henkel's UK distribution partner Interlock Adhesives.

STRATEGIES FOR IMPLEMENTING *RIGHT-SIZED* PACKAGING

Making the switch from conventional packaging processes to right-sized packaging is usually straightforward. In the case of greenfield halls that are operational yet haven't been planned out, the system can be planned from the outset in such a way that everything can be installed where it needs to go. And in the case of existing logistics centers, manual packaging stations can be replaced with automated packaging machines. However, this is a bigger undertaking if the halls have already been planned out.

The implementation of a system for right-sized packaging varies from customer to customer, and is therefore an individual process. Generally speaking, however, the following steps are involved:

- **Analyze the current situation:**
  how much space is available? What is the throughput of packages per day?
- **Select suitable packaging technologies and machines:**
  contact and consult with system integrators, who act as a link between customers and machine manufacturers, or contact machine manufacturers directly
- **Get adhesive, substrate and equipment suppliers involved:**
  in order to ensure maximum compatibility between the materials to be processed and the selected machines
- **Development phase:**
  machines are developed, followed by factory acceptance test (FAT)
- **Machines and systems implemented on customer premises:**
  including staff training to ensure smooth implementation
- **Monitoring:**
  ongoing monitoring and process optimization performed by resident engineers who are temporarily made available to customers to discuss any errors with the machine operators and adjust settings

→ **While making the switch to right-sized packaging requires systematic planning and implementation, it also offers long-term benefits in terms of cost efficiency, sustainability and customer satisfaction.**

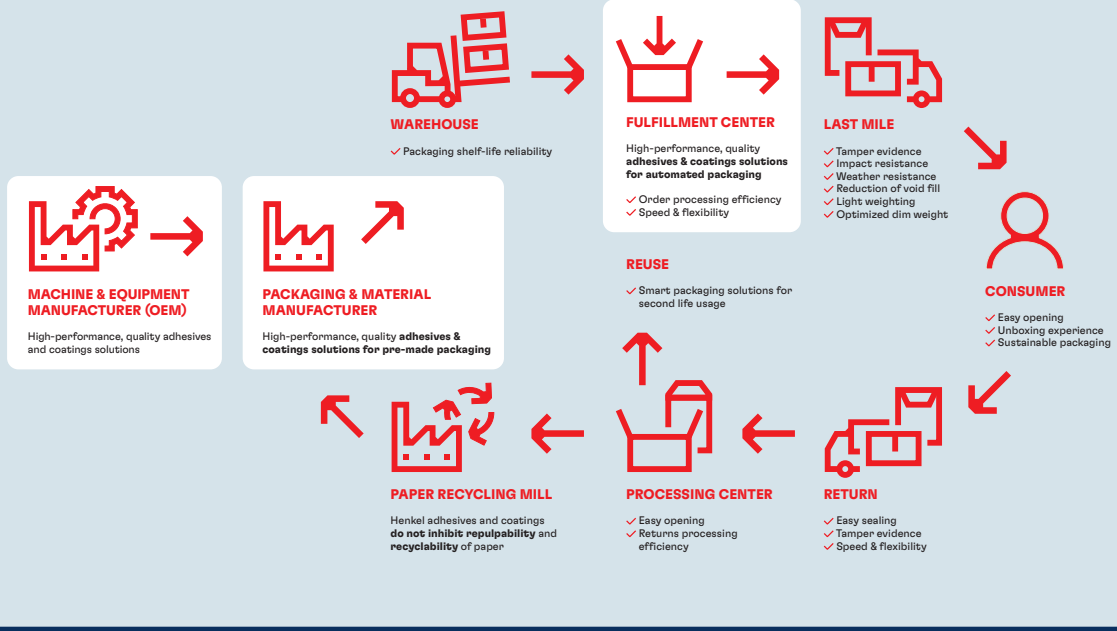
OUTLOOK: *TRENDS* AND DEVELOPMENTS

A whole host of new e-commerce packaging trends emerging today are set to gain traction in the years ahead. Future adhesive innovations will enable ever lower application temperatures while also driving the use of bio-based materials, paving the way for packaging to become even more energy efficient and less resource-intensive. Increasing efficiency and adhesion also means that smaller amounts of hot melt adhesive can be used.

Digitalization will play a key role in shaping a future packaging industry trend, with smart packaging set to communicate important information about its contents. For example, information about storage conditions, such as the temperature and humidity of the respective environment, will help to improve traceability and provide end customers with information. More importantly, however, it will also support quality assurance. Information about the packaging itself, such as the materials used and how to recycle them, can also be communicated in this way.

The packaging and manufacturing industries work together closely. New trends are therefore also born in collaboration with partners, and are shaped by their innovations as well. Active dialog between all parties therefore helps in developing the best packaging solution for different applications. The design of the primary packaging is important for the efficiency of the transport packaging, which is why adhesive and packaging manufacturers need to be involved in the planning process as early as possible.

HOW HENKEL ADHESIVES AND COATINGS SUPPORT EACH STEP OF THE E-COMMERCE VALUE CHAIN



RIGHT-SIZED PACKAGING— THE *KEY TAKEAWAYS*

- **Sustainable packaging options** are becoming increasingly important as they help to reduce environmental impact over a product's entire lifecycle. Selecting the right materials and minimizing transport volumes is a big part of this, as is avoiding oversized packaging that requires void fill.
- **Right-sized packaging** offers a promising solution and a happy medium between under- and overpackaging. Especially when combined with the right hot melt adhesive, this automated packaging solution can reduce packaging waste, costs, energy consumption and CO_2 emissions.
- Using hot melt adhesives to **seal e-commerce packages** offers major advantages over tape, as they are easier to recycle and handle.
- **Choosing the right adhesive** is key to the success of the automated packaging solution, and it needs to be based on the company's specific requirements. The substrate also plays a major role, as do the environmental conditions that the packaging is exposed to.

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