

Packaging and Shipping Best Practices for Sheet Metal Fabricated Parts



Section 1: How to determine the best shipping and packaging

A lot of work goes into partnering with a custom fabricator to manufacture your sheet metal parts. So, you want to be sure that once the parts are finished, they arrive as expected. A reputable fabricator wants the part to arrive in perfect condition as much as you do and should be able to accommodate your shipping needs. They should help you find cost-effective ways to protect your product from logistics damage while also supporting your end-user needs.

Package design is an important part of the engineering process and should consider the entire logistics cycle and the shipping requirements. There are several things you need to consider during this part of your planning process.

Step 1: Define The best packaging method

You'll want to consider several different factors, including the intended use of the product, the industry, the end user, and the destination. Here are some of the use cases, pros, and cons of bulk shipments, knock down shipments, and assembled products.

	Bulk	Knock Down	Assembled
When	<ul style="list-style-type: none"> • Components or sub assembly sent to another facility for assembly and integration • Product is made of modular components • Too bulky to be shipped assembled / knock down 	<ul style="list-style-type: none"> • Too bulky to be shipped assembled • Easy for end-user to assemble • Some products can't be package in a single carton due to geometry, shape, size or weight 	<ul style="list-style-type: none"> • Finish products can be package and shipped economically allowing for good protection
Pros	<ul style="list-style-type: none"> • Inventory reduction • Logistic cost savings 	<ul style="list-style-type: none"> • All cartons shipped in complete kits • Logistic cost savings • Good packaging quality with limited damage risk during logistic 	<ul style="list-style-type: none"> • Simplified quality control during assembly because finished products are easier to quality check • Risk reduction of components missing at end-user
Cons	<ul style="list-style-type: none"> • Can't be shipped in bulk to an end-user as it sometimes requires skills to assemble 	<ul style="list-style-type: none"> • Sometimes require skills to assemble, not suitable for all product categories 	<ul style="list-style-type: none"> • In some case, logistic costs are too high due to shape, size and weight

BULK SHIPPING

- It's possible to package similar parts together in bulk if the parts will not tangle and potential surface damage from contact will not impact their usability.
- Extra steps are necessary when the parts shouldn't be in contact during shipment. Using spacers or padding made of foam, paper, wood, or other materials is necessary to prevent any scratching or finish damage. Parts that nest together may only require paper between them while stacking parts need cardboard or plastic to separate them.
- Parts with hardware may require additional padding to protect the hardware and adjacent parts in a package. Sharp edges may also require additional protection.

KNOCK-DOWN KITS

- A knock-down or knock-down kit is a form of shipping that packages all the parts together to be assembled elsewhere.
- This is a common option for automotive, rail, electronics, and furniture and is sometimes used as part of import tax strategies.
- Semi-knock-down kits are also possible where some components are already assembled but not all.
- Parts can be efficiently shipped in flat sheets if they are being assembled elsewhere.

ASSEMBLED PARTS

- How you package assembled parts will vary based on their destination. They may or may not require end-user packaging depending on the next stage in your logistics cycle.
- End-user packaging should support your brand and meet all destination labelling requirements in addition to fully protecting the product during transport. Your marketing and legal team should be important partners in this process.
- End-user packaging of assembled parts should also include any instructions or other printed inserts for the customer.
- Custom containers are the only option for some products based on size, weight, or dimensions.

Step 2 : Calculate Preliminary logistic costs

Once you've determined the best shipping option for your product, you can determine some of the key factors that impact your logistics costs. There are several things to consider.

Shipping needs	What to consider
Factory to Distribution Warehouse (3PL)	<ul style="list-style-type: none"> • Ocean Shipment: Factor in the loadability of the container you plan to use. Typical sizes are 20 feet standard, 40 feet standard, or 40 feet high cube • FCL: There are truck load costs when no ocean shipment is required • Confirm the 3PL warehousing charges if you sell on an E-commerce platform such as Amazon or you're using Shopify <p><i>*For door to door shipping cost, consider requesting a quote from 3 forwarders</i></p>
Distribution Center (3PL) to End User OR ----- Distribution Center to Shop / Dealer / Retailer	<ul style="list-style-type: none"> • Check with FedEx, UPS, DHL, or Post Office to set up a corporate account and negotiated favorable rates for your e-commerce business • Express companies charge based on 3 factors: weight, size, or a combination of both <hr style="border-top: 1px dashed black;"/> <ul style="list-style-type: none"> • Check rates with freight trucking companies who specialize either in LCL (Less than a Truck Load) or in FCL (Full Truck Load) depending on your situation

WHAT IMPACTS YOUR FREIGHT COST?

How much you pay for freight will depend on several factors. Work with your fabricator to find ways to minimize or reduce your costs if necessary.

- **Distance of travel:** the further a part travels, the more it will cost. Consider how you plan your logistics to optimize the distances between manufacturing, distribution centers, and your end user.
- **Weight:** the weight of the part directly impacts the shipping costs and determines how many parts can be shipped together and hence the number of packages. When possible, the use of lighter-weight materials for manufacturing and eliminating unnecessary or excessive packaging can help you control these costs. While the weight of your packaging material should be a factor in how you choose to package and ship your parts, it's not a best practice to choose a low-cost option that exposes your parts to unnecessary risk of damage.
- **Number of shipments:** combining or consolidating shipments will help you reduce your costs. This can apply to end-user shipments in some cases as well as shipments to distribution facilities.
- **Mode of shipment:** there are different ways to send your shipment from your fabricator and the costs vary. Faster methods come at a premium which makes your logistics planning an important part of managing freight costs.

Step 3: engineer the right packaging

Only once you've confirmed your best option for product logistics do you move into the package design and engineering. Here are 5 rules you should apply in the process.

Rules When Engineering Packaging	
Rule # 1 2 types of packaging options	There are 2 type of packaging options you should consider: Type 1: The product supports the packaging. In this case, the carton is solely to protect the product surface during shipping Type 2: The packaging supports itself
Rule # 2 Geometry is continuous and the product must not move inside	Type 1 Packaging: The product must be strong enough to support other cartons to be palletized Type 2 Packaging: Product must not move once packaged and the carton or insert must be strong enough to support multiple cartons when products are palletized <i>*See section 2 of this chapter to see different method of protecting the product inside the carton</i>
Rule # 3 Loadability inside truck or containers	Determine how you'll palletize the products and how it will be loaded inside the container or truck It's best to design packaging so it is easy to load and unload by forklift <i>*Keep in mind that the container door height is lower than the container internal height.</i>
Rule # 4 Logistic cost validation	Once you finish designing the packaging concept, you should confirm 3 things prior to producing packaging samples: 1. Validate container loadability 2. Validate logistic cost 3. Validate packing cost
Rule # 5 Drop test validation	Test your packaging with samples Work with your freight forwarder or carrier to drop test your packaging and ensure the product will not be damage across the logistic journey <i>*Your ultimate goal should be for the end-user to receive the carton in perfect condition</i>

WHO IS RECEIVING THE PRODUCT AT THE FINAL DESTINATION?

Fabricators can package and ship your parts directly to the end-user or to the next stage in your logistics cycle such as a distribution warehouse.

- Some fabricators offer drop-shipping services and will send your product directly to your customer. Sometimes this is handled by the fabricator and other times by a third party they have contracted. End-user shipping involves precise logistics, warehousing, and tracking so confirm their standards and best practices.
- The condition of the product when it arrives to an end-user reflects on your company so be sure the fabricator can meet your company standards.
- When shipping to a warehouse for further distribution, your packaging must accommodate the additional steps in your logistics cycle. Packaging should be such that the part is protected during deliveries from a warehouse to an end-user or retail location.
- Reusable packaging isn't an option if the part is shipped to the end-user but is a possibility for regular shipments to distribution centers.

Section 2: Packaging options

There are a lot of decisions to make around choosing a carton for your product. Ultimately it needs to protect your goods during shipping, but your choice also has an impact on your shipping costs and brand.

Carton choices

Boxes are available as brown, white, or custom printed – each with its distinct advantages and disadvantages.

Brown boxes

- 60-100% recycled cardboard
- Less expensive than white or printed
- Easily available in a wide variety of standard sizes and strengths

White boxes

- Preferred for branding by some and allows for more printing options
- Shows dirt and damage more than brown boxes
- Can also contain recycled material

Custom printed boxes

- Most costly option
- Can be customized inside and out to support your brand
- Can include instructions for the product
- Requires additional lead time and minimum quantities may be required
- Artwork and setup charges for each size of box and for any changes will be required

Carton strength

Your fabricator should help you determine which box offers the structure needed to ship your product. Factor in the dimensions of the box relative to the weight of the contents and consider the strength requirements during shipping and when palletized. Double and triple wall corrugated containers offer better strength and protection than single wall

Boxes are made of corrugated paper which uses s-shaped paper flutes between linerboard paper to create its strength and structure. The thickness and number of flutes per foot impacts the strength of the box.

- A flute is ¼" thick with 33 flutes per linear foot, provides best cushioning properties
- B flute is 1/8" thick with 42-50 flutes per foot, can resist crushing and has good stacking strength
- C flute is 3/16" thick with 39-43 flutes per foot, common choice for shipping

The industry uses the Mullen bursting tests and edge crush tests to establish guides for boxes. The Mullen burst test standard is often used by those who are concerned about damage during handling throughout the logistics chain. The edge crush test helps understand how the box will hold up when stacked or palletized.

To understand how to interpret these standards, an edge crush test of 26 ECT means it can withstand 26 pounds of pressure on the edge of the carton. A Mullen burst test score of 150# means it can withstand 150 pounds per square inch of force applied to the face of the carton.

Single wall corrugated boxes

Maximum load per box	Minimum edge crush test	Mullen burst test
35 lbs	26 ECT	150#
50 lbs	29 ECT	175#
65 lbs	32 ECT	200#
95 lbs	44 ECT	275#
120 lbs	55 ECT	350#

Packaging materials

There are a lot of different options when it comes to packaging materials. Consider what your part may be exposed to when choosing packaging material. Physical damage can occur during different stages of transport, loading, and unloading. However, your package may also be exposed to moisture, the elements, and different chemicals which can all impact your packaging material choices.

EPE (EXPANDED POLYETHYLENE) FOAM

EPE foam (expanded polyethylene foam) has a low density and is semi-rigid with closed cells. It's commonly used for cushioning and impact absorption.



Advantages

- No odour or taste, food safe
- Light weight with a high weight to strength ratio
- Very flexible
- Good shock absorption, cushioning, and insulation
- Resistant to water, oil, static, and some chemicals
- Recyclable and reusable



Disadvantages

- More fragile than traditional foam
- Deforms easily
- Recycling facilities may be limited for end user



CUSTOMIZED EPS (EXPANDED POLYSTYRENE) FOAM

EPS foam (expanded polystyrene) is a white, rigid foam that can be custom formed to suit the needs of a part. It's produced from small, solid polystyrene beads and has a closed cell structure.



Advantages

- Can be formed or molded into a custom shape to protect a part offering a tight fit for sensitive items
- Custom shapes to contain part or molded corners are possible
- Lightweight and stackable
- Very good impact strength and shock absorption
- Low moisture absorption, chemically inert, bacterial resistant, and food safe
- Good insulation and cushioning
- Does not contain CFCs or HCFCs and is recyclable



Disadvantages

- Requires lead time for customization
- Additional costs to develop custom design and mould
- Any changes to product or packaging will require changes to EPS mould which will impact budget and timing
- Brittle and can break into multiple small pieces
- Flammable and can degrade when exposed to UV light
- Recycling facilities may be limited for end user
- Not biodegradable



MOLDED PAPER PULP

Typically made of recycled paper, molded paper packaging is available in different thicknesses and can be molded to fit a specific part.



Advantages

- Can be formed or molded into a custom shape to protect a part offering a tight fit for sensitive items
- Custom shapes to contain part or molded corners are possible
- Very strong with good shock absorption and cushioning
- Less expensive than many other foam and plastic packaging
- Water resistant, electrically neutral, resistant to temperature changes
- Made from recycled materials, is recyclable, biodegradable, and compostable



Disadvantages

- Requires lead time and additional costs for customization and mould design
- Changes to product or packaging will require changes to mould and impact budget and timing
- May be heavier than other options, increasing shipping costs
- Treatment required to make it completely waterproof and not just water resistant



PLASTIC BUBBLE WRAP

Plastic bubble wrap is made from rows of cells with air between layers of polyethylene. Bubble sizes can vary based on the needs of the product, including larger "air pillows" to fill large voids.



Advantages

- Used to wrap parts or fill voids
- Flexible and suitable for a wide variety of products
- Good shock, vibration, and surface protection
- Inexpensive, lightweight, and anti-static
- Some are more environmentally friendly with pre- and post-consumer waste incorporated
- Reusable



Disadvantages

- Air seals can be punctured compromising the cushioning ability
- Recycling facilities may be limited for end user
- Not biodegradable

PAPER VOID FILL

Packing paper, like bubble wrap, can be used to fill voids. It's typically used on the top and bottom of boxes to provide cushioning to the product inside.



Advantages

- Good cushioning and surface protection
- Inexpensive
- Recyclable
- Can be branded if required



Disadvantages

- Compresses so a lot of material is required to provide appropriate cushioning
- Adds weight to package
- Doesn't protect against moisture, chemicals, oils etc

Corrosion protection during shipping

Proper packaging can help prevent corrosion should your sheet metal fabricated parts be exposed to any corrosive elements. It's a good investment for parts that are sensitive to corrosion and will be transported in conditions that expose them to moisture, chemicals, or significant changes in temperature or humidity. There are several options:

BAGS AND DESICCANTS

Bags can be used to act as a barrier to stop moisture exposure for the parts. The bag material will vary based on the parts and the shipment exposure and can include antistatic bags to protect from electrostatic discharge. Silica gel or activated clay are common choices for desiccants to control humidity levels. For large containers, desiccant strips are often hung inside.

FOIL VAPOR BARRIERS

Parts that are prone to surface damage can be packaged using a water vapor proof foil barrier that is vacuum sealed. Prior to being placed into the foil package, material is often used to cushion the part, and a desiccant is enclosed. It's also possible to include a humidity indicator card inside a component of the packaging that can be opened and checked for humidity levels periodically during shipment without exposing the part itself. This form of packaging is a best practice for parts that require very low humidity during shipment and is often used for ocean transport.

Package and Product Labeling

How you label your product will vary based on several factors, including the type of product and the geographical markets you're shipping into.

- Sheet metal can be marked or labeled with different methods including electrochemical marking, lasers, or screen printing to identify part numbers or add branding or other identifying information
- Your labeling and packaging should support your brand, including boxes, on-product labeling, and possibly other shipping materials
- Knock down kits should be labeled for easy handling and assembly at their destination
- When multiple products are boxed and shipped together for additional distribution, the external boxes should be labeled to support logistics and inventory management at warehouses
- Different jurisdictions have different requirements for labeling standards so confirm what's required and work with the expertise of your fabricator
- Some products require permanent markings on the product themselves including products for small children
- Labels shall include traceability # to track design change and enable inventory control according to good practices