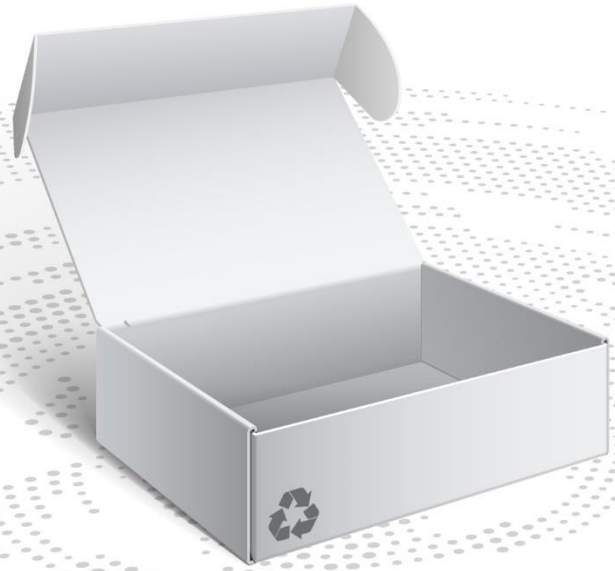
LOCKHEED MARTIN



# Sustainable Packaging Guidelines for Suppliers

## BUYING TOMORROW . . . TODAY

*Signaling Our Values in Supply Chain*

Disclaimer: The contents of this document are intended to serve as supplier guidance and specific packaging requirements are set forth in contracts issued by Lockheed Martin.

# 1.0 Introduction

Packaging and packaging products are important for the protection and delivery of Lockheed Martin branded products and supplies, as well as packaged products supplied by others. Increased global pressure on the quantity, composition and stewardship of packaging and packaging products has prompted Lockheed Martin to develop these guidelines ("the Guidelines") to ensure that the packaging and packaging products that are procured by Lockheed Martin are compliant with global requirements.

Additionally, packaging and packaging products have been identified as a large component of Lockheed Martin's waste stream going to landfill. In 2008, we established the Go Green initiative against a 2007 baseline to track our environmental performance and measure progress toward the target of 25 percent in absolute reductions in carbon emissions, water and waste sent to landfills by the end of 2012. Through employee initiatives, innovative projects and strong leadership support, we met or exceeded each of these goals nearly a year ahead of schedule. In 2012, we launched new environmental sustainability goals to reduce our carbon emissions, facility energy use, waste-to-landfill and water use by 2020, from a 2010 baseline. In 2014, we realigned our waste goal in favor of a total waste reduction goal. Our goals by 2020 are to:

- Reduce carbon emissions by 35 percent.
- Reduce facility energy by 25 percent.
- Reduce water use by 30 percent.
- Reduce waste generated by seven percent.

Our goals strengthen our industry leadership in the sustainability arena and align with the goals of U.S. federal agencies to meet energy, water and waste reduction targets by 2020. We are encouraging our suppliers to use the Guidelines to improve their packaging solutions.

Being cognizant of what potential impact packaging has on waste generation and product protection is necessary to understanding what can be reduced or eliminated. While product integrity cannot be compromised due to logistical, legal and safety reasons, using the latest technologies coupled with the required amount of material necessary to safely package and transport the product will reduce the overall impact on the environment. Following the Guidelines and using sound judgment will help to achieve the goals of sustainable packaging and reduced waste to landfill.

Suppliers to Lockheed Martin should consider working with their design engineers, planners, packaging and other groups to develop packaging that, to the maximum extent possible, eliminates unnecessary packaging and/or allows for packaging that can be reused, recycled or composted.

## Purpose

The purpose of the Guidelines is to communicate Lockheed Martin product expectations to suppliers of products that contain packaging as well as individual packaging products. Lockheed Martin expects that all packaging and packaging products supplied to Lockheed Martin will conform to this specification to meet all applicable global requirements where products and supplies are sold and/or distributed into the marketplace.

## Scope

The Guidelines apply to the packaging of all products supplied to Lockheed Martin and its subsidiaries, and packaging products sold to Lockheed Martin and its subsidiaries for purposes of packaging all products, that are procured, sold and distributed globally.

# 2.0 Definitions

**Terminology used in packaging and packing:**

## Package and Packing

**Packaging:** Any material intended to be used for the containment, protection, handling, delivery and presentation of goods from raw materials to processed goods from the producer to the user or consumer. Packaging may be classified as primary packaging, grouped or secondary packaging, and transport or tertiary packaging. Examples of packaging include: cartons, crates, pails, trays, bags, pallets, pallet collars, drums, load boards, skids, dunnage, interior or exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, stretch wrapping, coatings, closures, inks, adhesives, interleaving paper and labels.

**Primary Packaging*:** An interior container or bag which is in contact with the contents. It is also known as the **unit** package. It may be used as the shipping container if it meets transportation requirements.

**Secondary Packaging*:** A container which encloses one or more primary containers. It is also known as an intermediate package. It may be used as the shipping container if it meets transportation requirements.

**Transport (Tertiary) Packaging*:** An exterior package used to protect goods during the process of distribution, handling, storage and transportation. It includes shipping containers and pallets with shrink wrapping or banding, for example.

**ASTM D996 Standard Terminology of Packaging and Distribution Environments*

**Packaging Products:** Refers to the materials that are used to build or construct the packaging of Lockheed Martin products and supplies. Packaging products include, but are not limited to, paper, corrugate, stretch wrap, cushioning media (such as polymeric peanuts), wood products (such as plywood and sawn lumber), fasteners (such as nails and screws), adhesives and inks.

**Recycled Content:** The concentration of materials (i.e., plastic resins, wood fiber) that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (post-industrial) or after the consumer use (post-consumer) and have been reused in the production of another (including the same) packaging product.

**Threshold Level:** Concentration level which defines the limit above which the presence of a substance or substance category is restricted or declarable.

**Substances of Very High Concern (SVHCs):** Substance of Very High Concern identified by European Economic Area via candidate list.

**Intentionally added:** Deliberate use in the formulation or fabrication of a product where its continued presence is desired to provide a specific characteristic, appearance or quality.

**ISPM – 15:** International Phytosanitary Measures No. 15 directly addresses the need to treat wood materials of a thickness greater than six millimeters used to ship products between countries.

## Military Levels of Packing

There are different levels of packaging depending on the environmental conditions, the storage duration and degree of protection required. Contractual packaging requirements will also determine the level of packaging.

- **Level A** – Military (MIL-STD-2073) Level of Preservation: Indeterminate storage preservation and packaging which will protect against corrosion, deterioration and physical damage during the most severe world-wide shipment, handling and storage conditions. A Level A Pack must be capable of protecting material from the effects of direct exposure to extremes of climate, terrain and operational and transportation environments.
- **Level B** – Military (MIL-STD-2073) Level of Packing: Indeterminate storage preservation and packaging which will protect against corrosion, deterioration and physical damage during the most moderate world-wide shipment, handling and storage conditions. A Level B Pack must be capable of protecting material not directly exposed to the extremes of climate, terrain and operational and transportation environments.

## Commercial (ASTM-D3951) Packaging

Commercial packaging provides requirements for commercial preservation, packaging, unitization and marking. Such packaging affords adequate protection against mechanical and physical damage during shipment and is intended for a minimum storage period of one year.

## Shock

Shock refers to the blunt forces encountered in distribution environments. Shocks can be mild or severe and, for example, can be the result of cartons dropping off conveyor belts, drivers tossing cartons into trucks or forklifts banging into palletized loads. Typically, this blunt force - the shock - causes the most product damage.

## Vibration

Vibrations are the mild, but continuous, forces encountered in distribution environments. Vibration is experienced when cartons are moving down conveyor belts or when packages are riding down highways in trucks. Typically, damage from vibration occurs when an item can shift to the side of a carton and it rides there through distribution.

## Sustainable Packaging

While there are many ideas and definitions of sustainable packaging, it can be defined as follows[**]

- Is beneficial, safe and healthy for individuals and communities throughout its life cycle.
- Meets market criteria for performance and cost.
- Is sourced, manufactured, transported and recycled using renewable energy.

- Optimizes the use of renewable or recycled source materials.
- Is manufactured using clean production technologies and best practices.
- Is made from materials healthy throughout the lifecycle.
- Is physically designed to optimize materials and energy.
- Is effectively recovered and utilized in biological and/or industrial closed loop cycles.

*[**]https://sustainablepackaging.org/resources/*

The criteria presented here blend broad sustainability objectives with business considerations and strategies that address environmental concerns related to the life cycle of packaging.

Suppliers to Lockheed Martin will initially focus on the following elements of sustainable packaging:

- Reducing packaging volumes so as to reduce the amount of packaging that must be disposed of by Lockheed Martin.
- Using packaging materials that are more easily recycled or reused.
- Using returnable containers wherever feasible and economical.

# Use of Conjectures

**Should –** Should refers to being requested but not required.

## Requirements

All suppliers of packaging and packaging products should ensure the following Lockheed Martin Global Supply Chain Operations (GSCO) packaging specifications are considered:

**Restricted Materials:** Unless Lockheed Martin has indicated otherwise, all packaging and/or packaging products should not contain a restricted substance above the threshold level for the reporting application listed in *Appendix A.*

**Substances of Very High Concern (SVHCs):** Suppliers should declare the presence of any/all SVHCs greater than 0.1 percent w/w of packaging and packaging products. SVHCs are identified on the 'candidate list' in Annex XIV of the European Chemical Agency (ECHA), Article 59(1) of Regulation No. 1907/2006 (EU REACH). SVHCs are found at: https://echa.europa.eu/candidate-list-table.

Suppliers should also review biannual updates to the list of SVHCs and inform Lockheed Martin if a newly added SVHC is present in any/all packaging and packaging products provided to Lockheed Martin greater than 0.1 percent w/w.

**Specific Requirements for Plastic Packaging and Packaging Products**: All plastic packaging and packaging products should be marked with the appropriate Society of the Plastic Industry, Inc (SPI) resin identification code. Exceptions apply to metalized films and laminates, shrink/plastic wrap, foams and materials that have a dimension or shape that makes marking impractical.

**Specific Requirements for Wood Packaging and Packaging Products:** Unless Lockheed Martin has indicated otherwise, all packaging and/or packaging products constructed of wood should be treated and marked when

exported or imported according to UN ISPM-15. Sawdust, wood wool, shavings and raw wood cut into thin pieces are excluded, as are certain engineered wood products such as OSB, pursuant to ISPM-15.

**Recycled Content:** Suppliers should disclose any recycled content, inclusive of post-industrial or post-consumer waste used in the composition of the packaging and/or packaging product.

**Weight:** Suppliers of packaging and packaging products should disclose the weight (mass) of individual packaging components as separable by paper, plastic, metal, glass, etc., as applicable.

# 3.0 Benefits of Improved Packaging

From Lockheed Martin's perspective, the direct benefits of improved packaging from our suppliers are to 1) reduce the quantity of packaging waste we send to landfills (which benefits the environment and helps reduce waste to landfills); and, 2) reduce product damage due to improper packaging.

There are also indirect benefits from improved packaging that help fulfill broader sustainability objectives. These include, among others:

- **Higher Cube Utilization**: In warehousing and logistics, cube utilization refers to the use of space within a storage area, trailer or container. Cube utilization is generally calculated as a percentage of total space or of total “usable” space. Higher cube utilization is desired.
- **More Efficient Transportation**: Items that can be sourced locally and do not have to be transported longer distances are preferable because the shorter transportation routes lead to reduced fuel use/ greenhouse gas emissions.
- **Increased Use of Renewable Materials**: Use of renewable materials encourages the conservation of resources and reduces dependence on finite resources. Using renewable materials, including renewable energy, encourages the sustainable management of resources.
- **Lower Costs**: Using less material or engineering solutions can have monetary benefits since less packaging must be used for the product.
- **Increased Safety**: Renewable materials may be safer than some conventional packaging materials which leads to safer handling and easier waste management.

# 4.0 Packaging System Redesign Considerations

Changes to supplier packaging systems must be compliant with existing contractual and technical (i.e., engineering) requirements and must protect the part(s) to prevent damage. Suppliers must consider the following before changes are implemented:

- Review contract provisions before changing existing packaging systems, as these have precedence when making decisions on the packaging used for certain products.
- Federal Department of Transportation and state agency shipping requirements must be followed.
- Damage prevention must be a primary consideration when packaging products. One of the most important principles of proper packaging protection is complete encapsulation, the “float,” to eliminate movement and to keep the item away from the sides of the container. The “fragility factor,” or how sensitive the part is to damage, also helps determine the cushioning type and required thickness. Delicate cargo/products may require more float.
- Ensure product integrity when electrostatic discharge requirements exist. In addition to cushioning protection, Electrostatic Sensitive Devices (ESD) must also be protected from electrical discharges (like static electricity in a low humidity environment) by placing the ESD part in shielding or barrier materials to prevent charges from passing to the part and damaging the components. An electrostatic discharge label must be placed on the protective bag and container.
- The surface/area size of a skid or pallet should always be greater than the size of the cartons stacked on it. This will prevent damage from pallets banging into other pallets with loads overhanging and will help evenly distribute the weight across a flat surface to increase stacking strength. Void space in cartons should be eliminated by use of adequate cushioning. A combination of cushioning materials can be used to achieve proper protection.

# 5.0 Reducing Packaging Waste

The logical way to reduce waste is not to generate it. It is imperative to reuse, recycle and reduce as much as possible.

Suppliers should explore the following options when determining how to approach packaging of its products.

The options of reuse, recycle and reduce are presented below in order of feasibility, not in order of preference. The most preferred option is to eliminate or reduce the amount of waste generated. The second preferred option is to change the packaging materials, so they are more easily reused, recycled or composted.

## Reuse

Suppliers should provide reusable packaging whenever possible. Consider a “cradle-to-grave” concept when choosing packaging. Consider the following:

- What type of product does the packing material hold and how could it be reused?
- How many times can the packing materials be reused and still maintain the quality and the integrity of the product being shipped? The higher the number of reuses, the better.

## Recycle

Suppliers should use recyclable packaging as much as possible. Consider:

- Do I know what the numbers and symbols on each of these containers or packing items mean? By knowing the number codes on the packaging, this can provide a greater understanding of how much packaging can be recycled.
- Can recyclable packaging be used without impacting the packaging quality?

**Note**: A list of preferred packaging materials and materials to be avoided is provided in Section 6. This list will facilitate the substitution of packaging materials that are not easily recycled to those that are recyclable.

## Reduce

Suppliers should reduce packaging when practical and viable for an end item. Consider the following:

- Do the packing materials need to be this heavy or dense, or can they be lighter while still serving the same purpose?
- Can the total inner packaging be streamlined to eliminate unnecessary waste in the package?
- Maximize the product-to-package ratio.

Ensure containers are right-sized and as full as possible. Increasing the product-to-package ratio means using less material to package a product. Suppliers can achieve a higher product-to-package ratio by making sure containers are mostly full.

# Examples

Described below are some examples of how Lockheed Martin and suppliers to Lockheed Martin have developed solutions to reduce packaging waste:

- Instead of providing one laptop per box, in many cases, a Lockheed Martin computer supplier is now providing Lockheed Martin with shipments of six laptops per box to decrease the amount of packaging it takes to send the same number of products.

- A sustainability lifecycle analysis on the impact of replacing single-use wooden crates to ship wing skins with multi-use metal crates was conducted. The analysis revealed that the reusable metal crate has smaller midpoint and endpoint impacts overall compared to the wooden crate when looking at impact categories like land and water use, human health, ecosystem quality and resource availability.

- An initiative was launched by a Lockheed Martin supplier in 2012 that reduces that environmental impacts and hassle associated with delivery waste by creating more than 120 box configurations that customize box sizes to each order as it's being filled. This greatly reduces the use of corrugate and air filler and results in less work and waste to break down and dispose of boxes.

# 6.0 Preferred and Non-Preferred Packaging Materials

This section provides a list of preferred packaging materials that Lockheed Martin suppliers should evaluate for use wherever practical. Packaging materials whose use should be restricted are also listed. The items listed should be viewed as recommendations; the list is not all-inclusive. When considering how best to improve packaging, both pre-usage (production costs/energy usage/transport costs) as well as post-usage (compostable materials need to be properly composted, not simply thrown out with general trash) criteria should be considered. Product protection must be maintained, and contractual packaging requirements met.

Reusing and recycling packaging and packing materials is encouraged. Suppliers reusing packaging reduces spending, prevents or reduces sending non-biodegradable materials to landfill and supports Lockheed Martin's sustainability and Go Green initiatives. However, good judgment must be used when deciding what to use and how to use it. Reused materials must be clean, free of foreign object debris and must still have the original cushioning or container properties.

*Note that the use of glue to attach cushioning material to other packaging should be avoided where possible in all types of packaging, because it makes packaging difficult (if not impossible) to recycle.*

## Preferred Packaging and Packing Materials

### Preferred Interior Packaging Materials – Cushioning

Cushioning is the protection from physical and mechanical damage for an item by means of resilient or elastic materials designed to absorb energy caused by shock and vibration from external forces and to prevent movement. Typically consists of a part being "floated" or encapsulated in materials on all sides. The following are preferred interior cushioning materials that should be used by suppliers where practical:

- **Air Cushioning Bags**: Use less weight and fewer materials to fill voids (Check the bags for #2 or #4 plastics, which can be recycled).
- **Biodegradable Bubble Wrap**: Plastic material consisting of air-filled bubble cells, in large and small size cells, with anti-static properties available. Used to provide cushioning and protection for items up to a weight of 20 to 25 lbs. Note that biodegradable bubble wrap must offer the same level of protection as non-biodegradable bubble wrap. This material is only recommended for commercial shipments involving short-term (less than six months) storage.
- **Cellulosic Paper**: Commonly known as Kimpac or Creped Wadding. This paper is less expensive and is used for the protection of durable metal or plastic parts (heavy or light). It can be recycled or reused and biodegrades relatively quickly compared to other materials such as foam.
- **Fiberboard or Molded Paperboard**: This material can be recycled and biodegrades relatively quickly compared to other materials such as foam. However, energy usage during production of recycled paper products tends to be higher than that of foam products.
- **Polyethylene (PE)**: A dense, strong, light weight material used to float or block items that come in a variety of densities and thicknesses. This material is often placed along the sides of a carton to prevent

the movement of an item or under large, heavy items to absorb shock. PE can be recycled if foreign materials (e.g., glue, tape, etc.) are not adhered to edges of container, and if a recycling vendor is readily identifiable.

## Preferred Interior Packaging Materials – Bagging

Most items to be packaged are bagged at some point in the packaging process – either just before the outer box or before the inner cushioning is added. Similar to interior packaging, some bagging materials are preferred over other, less sustainable choices. The following interior bagging types are preferred and should be used by suppliers where practical:

- Bioplastics that are derived from renewable biomass sources and can be composted.
- Paper that can be recycled.
- Plastics that are typically recyclable in most every location.
- Bagging that can be reused by Lockheed Martin.

## Preferred Exterior Packing Materials – Shipping Containers

When selecting the exterior packing, choose sustainable materials whenever possible. Cartons, reusable boxes and crates are preferred exterior packing materials and should be used by suppliers whenever possible. Exterior packing options include:

- **Banding**: Straps used to secure groups of cartons or a single large carton onto pallets. It can also provide additional strength and security to wood boxes and crates.
- **Corrugated Cartons**: The outer container protection used to contain the asset being shipped. Cartons are available in various sizes and thicknesses, and can be single-, double-, or even triple walled to increase strength depending on the item being packaged. All cartons contain a Box Manufacturer's Certificate (BMC) that states pertinent information on the carton's characteristics such as bursting or edge crush strength and the maximum weight it can hold. Lockheed Martin recommends packing a carton up to 75 percent of the maximum weight indicated on the BMC.
- **Pallet or Skid**: A flat transport structure (often made of wood but there is increased use of plastic pallets made from recycled and recyclable plastics) used as a stable foundation that provides for material handling, often for a stack of cartons. Pallets that can be reused or recycled, or are otherwise considered environmentally preferable, should be used whenever possible.
- **Stretch Wrap**: A plastic film that is wrapped tightly around containers and mainly used to keep cartons stable on skids. It provides some water protection and helps prevent tampering.
- **Wood Boxes**: Can be used for packing items that are more than 90 pounds but do not exceed 1,000 pounds.
- **Wood Crates**: Can be used for packing items that exceed 1,000 pounds. Depending on the lumber used, crates can be designed to hold up to 30,000 pounds.

# Non-Preferred Packaging and Packing Materials

## Non-Preferred Interior Packaging Materials – Cushioning

The following are non-preferred interior cushioning materials, the use of which should be restricted by suppliers when practical:

- **Biodegradable Loose Fill (Peanuts)**: Made from items such as grain sorghum and corn starch which can be composted; however, these materials may attract pests and insects. If these are exposed to moisture, they can degrade. Products cushioned with peanuts are often damaged.
- **Bubble Wrap**: Plastic material consisting of air-filled bubble cells, in large and small size cells, with anti-static properties available. Used to provide cushioning and protection for items up to a weight of 20 to 25 pounds. Not manufactured to be environmentally friendly and takes hundreds of years to break down.
- **Edible Food Items**: Such as popcorn as a cushion. These materials should be avoided as they can lead to pest infestations.
- **Foam-in-Place**: A combination of liquid polymers used to create a foam cushion that expands when activated and will conform to the shape of an item. Polyurethane foam-in-place is not recyclable or reusable, and all of these materials are directed to landfill. Foam-in-place should be avoided when possible.
- **Polystyrene (Styrofoam)**: A widely used type of plastic that is manufactured into a loose fill "peanut" form, in a sheet, or into specially molded forms. Sheets and molded end caps are typically used for items weighing approximately 20 pounds or less. Polystyrene is made from crude oil, leaches toxic chemicals and is specifically manufactured for one-time usage; once used, this goes to a landfill and will not biodegrade. Recycling is limited and costly, and it is difficult to find companies to recycle this material.
- **Polyurethane**: A foam material in various densities and thicknesses, used to cushion medium weight items from shock and vibration damage. Polyurethane is a superior packaging material for extremely fragile products. Suitable substitutes are slowly making their way to the marketplace, including a plant-based foam material (called Earth-Cell Foam) that is comparable in cushioning properties to traditional petroleum-based polyurethane foam.
  - Traditional Flexible Foam Sheeting: Uses several hazardous intermediates and creates numerous hazardous by-products. These include phosgene, isocyanates, toluene, diamines, and the ozone-depleting gases methylene chloride and chlorofluorocarbons (CFCs), as well as halogenated flame retardants and pigments. The burning of polyurethane releases numerous hazardous chemicals such as isocyanates, carbon dioxide, hydrogen cyanide, polycyclic aromatic hydrocarbons (PAHs) and dioxins. Polyurethane provides superior protection to extremely fragile products; make sure there are no technical requirements for its use before changing to another material.
- **Starch-based Flexible Foam Sheeting**: While this material can be composted, it may attract pests and insects. When exposed to high humidity, this material can be significantly compressed, or it can "melt away" before the product is delivered.

## Non-Preferred Interior Packaging Materials - Bagging

Suppliers should restrict the use of these bagging materials when practical:

- **Non-recyclable Petroleum Plastics**: These materials are not recyclable and take many years to break down in a landfill. These include plastics imprinted with the number seven or nothing at all.

## Non-Preferred Exterior Packing Materials – Shipping Containers

Suppliers should restrict the use of the following exterior shipping containers when practical:

- **Non-recyclable and Non-compostable Packing**: If the packing cannot be reused or recycled, it should be avoided.
- **Packing Not Easily Separated from Non-recyclable Components**: Nails, tape, glue and adhesives that may prevent materials from being recycled must be removed.

# 7.0 Helpful Links

Lockheed Martin Greening the Supply Chain Website
https://www.lockheedmartin.com/en-us/suppliers/sustainable-supply-chain.html

Lockheed Martin Energy, Environment, Safety and Health (EESH)
https://www.lockheedmartin.com/en-us/who-we-are/eesh.html

Lockheed Martin Suppliers Website
www.lockheedmartin.com/suppliers

Lockheed Martin Sustainability
https://sustainability.lockheedmartin.com/sustainability/index.html

# Appendix A

| Substance / Substance Category | Reportable Application | Threshold Level |
|---|---|---|
| Arsenic/Arsenic Compounds | All | Intentionally added |
| Asbestos | All | Intentionally added |
| Azo colorants and azodyes which form certain aromatic amines | Leather or textile packaging | 30 ppm |
| Dibutyl tin (DBT) compounds | All | 0.1% by weight of tin |
| Dioctyl tin (DOT) compounds | Textile packaging | 0.1% by weight of tin |
| Dimethylfumerate (DMF) | All | 0.00001% by weight of the packaging item |
| Heavy Metals:<br>Cadmium/cadmium compounds<br>Hexavalen chromium/ hexavalent chromium compounds<br>Lead/lead compounds<br>Mercury/mercury compounds | All | Intentionally added. The total concentration of these four (4) heavy metals must not exceed 100 ppm (0.1%w/w) |
| Formaldehyde | Textile and composite wood packaging | 0.0075% by weight of the textile packaging item |
| Methyl bromide | Fumigation of wood pallets | Intentionally added |
| Ozone depleting substances (ODS) | All | Intentionally added or used during manufacturing |
| Phenol, 2-(2H-benzotriol-2-yl)-4,6-bis(1,1-dimethylethyl) | All | Intentionally added |
| PCBs | All | Intentionally added |
| PCNs | All | Intentionally added |
| PCTs | All | Intentionally added |
| Tri-substituted organostannic compounds | All | Intentionally added |

LOCKHEED MARTIN