Packaging for Better Living

भारतीय पैंकेजिंग संस्थान
Indian Institute of Packaging
An autonomous body under the Ministry of Commerce & Industry, Govt. of India
Bengaluru Centre

The Role & Functions of Packaging

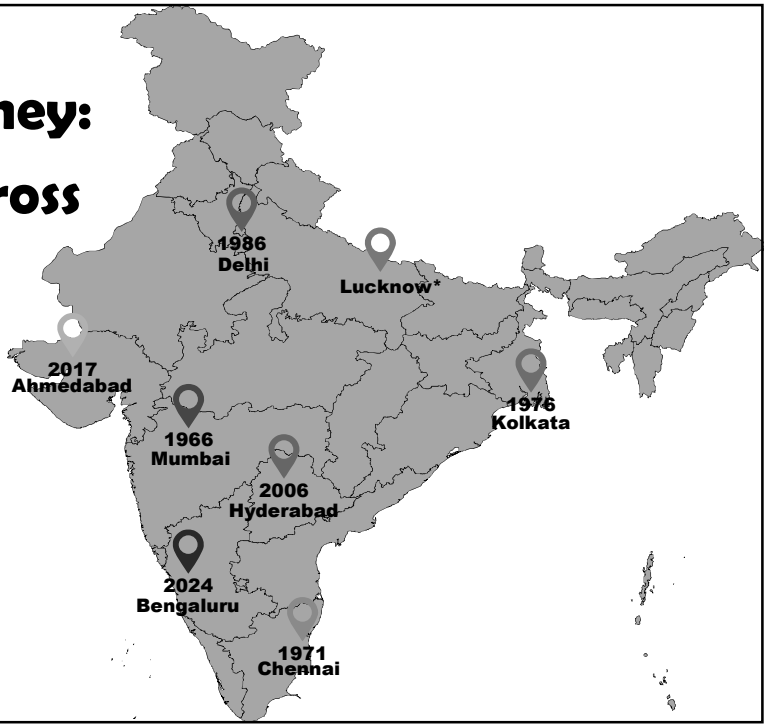
Discover the essential role of export packaging in protecting, presenting, and preserving the products. Learn about different types of packaging materials and their attributes.

Harish Kumar R K
Tech. Officer, IIP - Bengaluru

About IIP

- ✓ The Indian Institute of Packaging (IIP) is an autonomous body, established in 1966, under the Ministry of Commerce and Industry, Government of India
- ✓ Headquartered in Mumbai, with regional centers in various other cities across India
- ✓ Primary objective of the Indian Institute of Packaging is to promote and advance the field of packaging in India

Our Growing Journey: Branching Out Across



Our Activities

Education & Training	Research & Development	Testing & Certification	Consultancy Services	Publications & Conferences
✓ PG, Diploma ✓ short-term certificate courses, and ✓ customized training for industry professionals	✓ R&D activities related to packaging, materials, and processes aiming to contribute to the advancement of packaging science and technology in the country	✓ Evaluating the quality, safety, and performance of packaging materials & packages ✓ UN testing & certification as per IMDG/ICAO	✓ Offering consultancy services by providing expert advice on packaging design, materials, and processes	✓ Publishing research papers, journals, and other publications; ✓ Organizing conferences, seminars, and workshops to facilitate knowledge exchange and networking

PACKAGING FRATERNITY

- **Certificate Programme, conferences, seminars, workshops, exhibitions in Packaging**
  - ✓ **51,000+ Packaging Professionals**
- **Two years M.Sc., MS & Post Graduate Diploma Programme in Packaging Technology**
  - ✓ **5,000+ Packaging Professionals**
- **Diploma in Packaging through Correspondence (DPC)**
  - ✓ **4,000+ Packaging Professionals**

ASSOCIATIONS

WHAT IS PACKAGING

- **Multifaceted Approach:** Integrating science, art, & technology of enclosing products throughout their lifecycle
- **Process-oriented:** Covering design, evaluation, and production
- **Holistic system:** Prepares goods for transport, storage, sale, and end use
- **Versatile:** Incorporating a range of materials, shapes, and designs, essential for enhancing the overall product experience
- **Widespread impact:** Integral and crucial across diverse sectors

WHY PACKAGING?

Product Protection

Product Safety

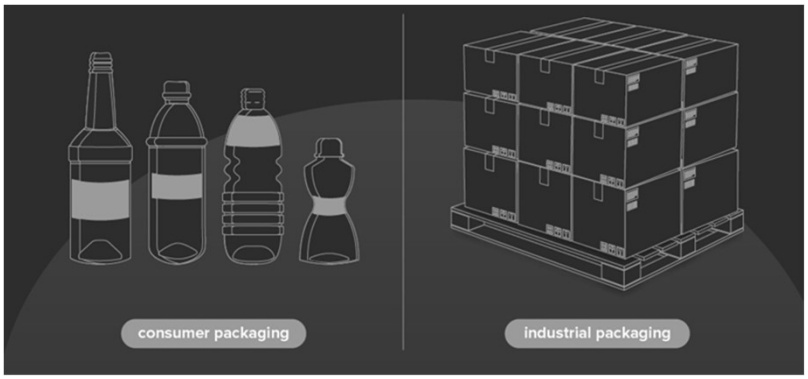
Utility

Effective product use
Distribution
Point of sale presentation

Communication

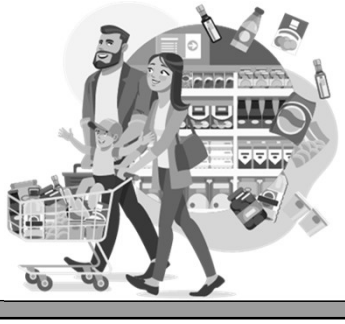
Brand
Content information

PACKAGING PERSPECTIVES
CONSUMER VS. INDUSTRIAL

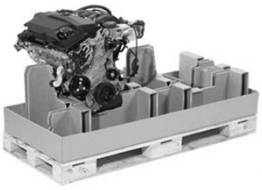


CONSUMER PACKAGING

- designed for products that are directly purchased by end-users
- showcases product attributes
- differentiate products on store shelves
- enhances the consumer experience
- contributes to brand loyalty
- influence consumer purchases & repeat purchases



INDUSTRIAL PACKAGING



- **Function over form:** durability and functionality over colorful aesthetics
- **Heavy-duty:** strong materials like wood, metal, or reinforced cardboard to withstand significant weight, stacking, and transportation hazards
- **Bulk handling:** efficiently handle and transport large quantities of goods
- **Supply chain efficiency:** safe and efficient movement of products throughout the supply chain

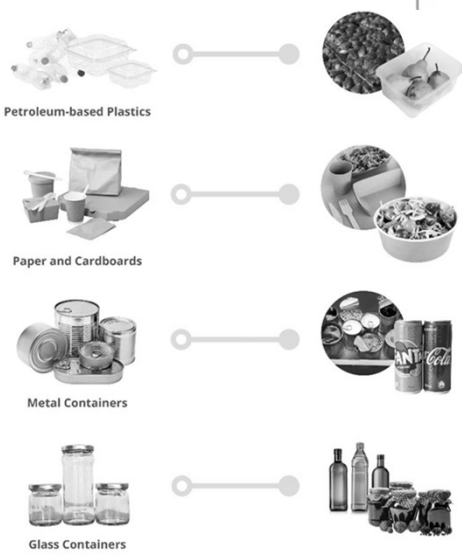
LEVELS OF PACKAGING

- ✓ Each level of packaging plays a distinct role in ensuring the safety and integrity of the product throughout its journey from the manufacturer to the end consumer
- ✓ The design and choice of materials for each level of packaging are influenced by factors such as product characteristics, transportation methods, storage conditions, and retail display requirements

Primary Packaging | Secondary Packaging | Transportation Packaging

LEVELS OF PACKAGING

- ✓ **Primary Packaging (Innermost Layer):**
  - ➢ layer that is in direct contact with the product
  - ➢ provides containment & primary protection against factors like contamination or physical damage
  - ➢ Examples include bottles, blister packs, cans, tubes, pouches etc.



LEVELS OF PACKAGING

- ✓ **Secondary Packaging (Intermediate Layer):**
  - groups primary packages for efficient handling, sale, and marketing
  - layer offers additional protection and information
  - Examples include cartons, plastic wraps etc,

LEVELS OF PACKAGING

- ✓ **Tertiary Packaging (Outermost Layer):**
  - layer designed for bulk transportation and storage
  - Offers efficient space utilization and protection during large-scale product movement
  - CFB boxes, pallets, shipping containers, or shrink/stretch wrap.
  - Material selection focuses on durability, stacking strength, and potential weather resistance.

PRIMARY*

- Laminated pouches
- Plastic – Jars, bottles
- Thermoforms
- Aluminium can
- Coated paper
- Lamitubes
- Mono/duplex cartons
- Retort pouches
- Composite containers
- Glass containers
- Shrink wrap
- Cling film
- Liners
- Woven sack
- Jute bags
- IBC/FIBC
- Paper bags
- Bubble wrap
- Plastic drums
- MS Drum
- Jerrycans

SECONDARY*

- Crates
- Wrapping films
- CFB box
- Cartons

TERTIARY*

- CFB box
- Wooden Containers
- Pallets

THE WHY & HOW OF MULTI-LEVEL PACKAGING

Why?

- ✓ **Enhanced Protection** - provides a layered protection during transportation & storage (fragility, environmental factors, handling)
- ✓ **Optimizes Logistics** - allows for efficient storage & transportation (stacking & stability, space efficiency, bulk shipping)
- ✓ **Customer Experience -** Proper packaging ensures products arrive in pristine condition (Brand image, functionality, reduced returns)

How?

The number of layers and materials used are customized for each product

- ✓ **Product Needs:** Fragile items require more protection compared to sturdier products
- ✓ **Safety Concerns:** Evolving safety standards demand additional layers or specialized materials
- ✓ **Cost Optimization:** Finding the right balance between protection & minimizing unnecessary materials - reduces costs
- ✓ **Specific levels/layers:** Each level serves a distinct purpose

Understanding the why & how – leads to a ***system*** that ensures product safety, optimizes logistics, & contributes to a positive customer experience

UNIT PACKAGING

- ✓ directly encloses a single product or a small number of similar products sold as a unit
- ✓ provides marketing and branding opportunities
- ✓ easier for consumers to handle and purchase
- ✓ includes information about ingredients, instructions, & expiry dates
- ✓ Application:
  - Consumer goods (food, beverages, cosmetics, electronics)
  - Pharmaceuticals and medical supplies
  - Household items (cleaning products, toiletries)
  - Toys and games

BULK PACKAGING

- ✓ Holds large quantities of products
- ✓ Used for transporting and storing goods
- ✓ More economical for large volumes
- ✓ Durable materials - cardboard, plastic, metal
- ✓ Application:
  - Raw materials (grains, chemicals, powders)
  - Industrial goods (lubricants, solvents)
  - Food service (ingredients, beverages)
  - Manufacturing (components, parts)

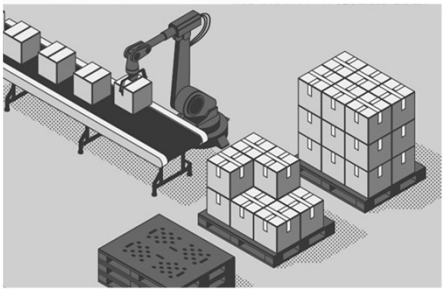
UNITIZATION

process of grouping individual packages or items into a larger, more manageable unit for efficient handling, storage, and transportation

- ✓ **Pallet stacking:** products are stacked and secured on a pallet
- ✓ **Shrink wrapping:** a plastic film that shrinks around the load when heated, providing a secure and weatherproof barrier
- ✓ **Strapping:** Straps made of plastic, metal, or nylon are used to secure the load to the pallet
- ✓ **Containerization:** Unitizing individual packages allows them to be efficiently loaded into shipping containers for international transport

PALLETIZATION

- ✓ process of arranging, stacking, & securing goods on a pallet
- ✓ Pallets are flat, platform-like structures that facilitate the movement of goods using forklifts and other material handling equipment
  - **Improved Efficiency:** Faster and easier loading, unloading, and transportation of goods
  - **Enhanced Protection:** Elevates goods off the ground, minimizing damage from moisture, dust, and pests
  - **Optimized Storage:** Palletized goods can be stacked higher in warehouses, maximizing storage space utilization
  - **Reduced Costs:** Lower labor costs and potentially reduced shipping costs due to improved efficiency



PACKAGING TYPES – BASED ON THE CONSTRUCTION

1 **Diverse Packaging Options**

Flexible, semi-rigid, & **rigid** designs cater to various needs.

2 **Optimized Functionality**

Each type offers unique benefits for specific applications.

FLEXIBLE PACKAGING

Characteristics

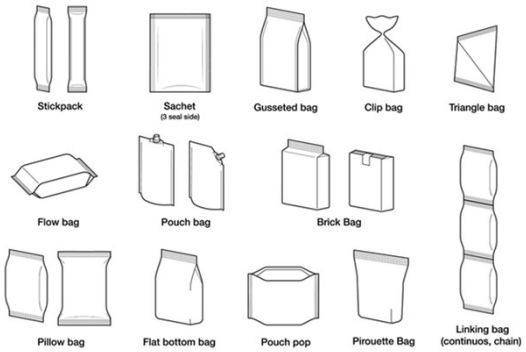
Lightweight, malleable, and easy to transport.

Applications

Food, cosmetics, and medical supplies.

Benefits

Cost-effective, customizable, and easy to use etc.



SEMI-RIGID PACKAGING

Firm Structure
Offers more protection than flexible options.

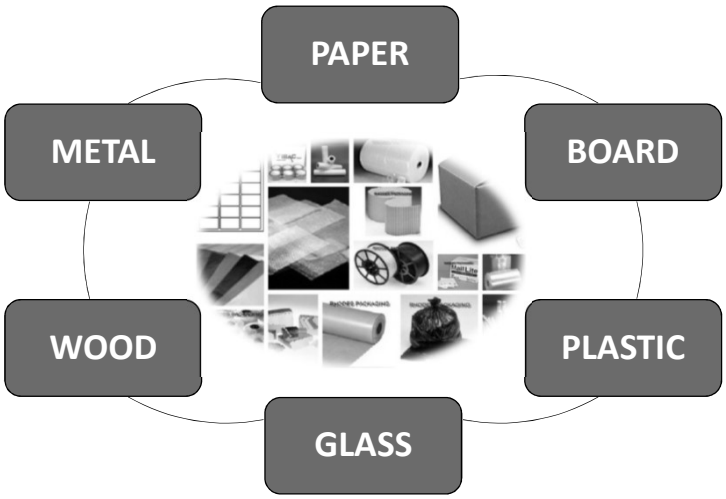
Versatile Design
Suitable for a variety of products.

Increased Durability
Withstands handling and transporting demands.

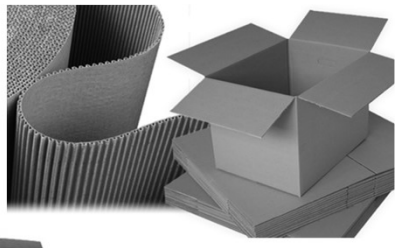
RIGID PACKAGING

1. **Strength**
   Provides maximum protection.
2. **Branding**
   Offers a premium look and feel.
3. **Reusability**
   Can be repurposed or recycled.

TYPES OF PACKAGING MATERIALS



PAPER PACKAGING MATERIALS



FLEXIBLE & RIGID - PAPER PACKAGING SOLUTIONS

Flexible Solutions

Pouches, bags, provide lightweight, durable, and cost-effective options for a variety of products.

Rigid Solutions

boxes and containers, offer sturdy and customizable options for protecting and displaying products.

Versatility

versatility of paper allows for unique and creative packaging designs that enhance the user experience and brand identity.

CONSUMER & INDUSTRIAL APPLICATIONS

1 **Consumer Packaging**

widely used for consumer goods such as food, cosmetics, and e-commerce products, providing a sustainable and attractive option

2 **Industrial Packaging**

employed for shipping, storage, and transportation of a variety of products, ensuring protection and efficient logistics.

3 **Benefits**

- Renewable and recyclable
- Lightweight and durable
- Cost-effective, customizable
- Environmentally friendly

4 **Limitations**

- Vulnerable to moisture and damage
- Limited barrier properties

PLASTIC PACKAGING MATERIALS

1. **Lightweight**
   significantly lighter than traditional materials like glass or metal

2. **Durability**
   highly resistant to damage, making them ideal for protecting and preserving the contents of a package.

3. **Customizability**
   can be molded into a variety of shapes and sizes to meet specific product needs.

4. **Cost-Effective**
   generally less expensive to produce and process compared to other packaging options.

FLEXIBLE PLASTIC PACKAGING

Cast Film
A manufacturing process that creates thin, flat plastic films with high clarity and uniform thickness.

Blown Film
A process that uses air to inflate and stretch molten plastic into thin, flexible films.

Laminates
Layers of different plastic films or other materials combined to create a stronger, more functional packaging material.

Applications
Flexible plastics are used for food packaging, stand-up pouches, shrink wrap, and many other consumer goods.

PLASTICS IN FLEXIBLE PACKAGING

Commonly used plastics used in Flexible Packaging are:

- High Density Polyethylene (HDPE)
- Low Density Polyethylene (LLDPE)
- Polypropylene (PP)
- Poly Vinyl Chloride (PVC)
- Polyamide (Nylon)
- Polyesters (e.g. PET)

APPLICATIONS

HDPE	LDPE	PP	PVC	PET
✓ Shopping bags ✓ Agricultural films	✓ Used in applications where heat sealing is necessary. ✓ Frozen-food packaging. ✓ Plastic wrap ✓ Stretch wrap	✓ Suitable for applications where thermal resistance is required, such as hot-filled and microwavable packaging. ✓ Popular uses include yoghurt containers.	✓ Films ✓ Bottles ✓ Thermoformed Containers	✓ Beverages ✓ Mineral water Pouches & Bottles

RIGID PLASTIC PACKAGING

1. **Injection Molding**

   A process that injects molten plastic into a mold to create shaped containers and closures.

2. **Blow Molding**

   Uses pressurized air to inflate and shape molten plastic into hollow structures like bottles and jars.

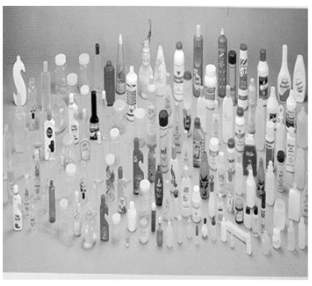
3. **Thermoforming**

   Heats plastic sheets and molds them into desired shapes, often used for trays, lids, and clamshell packaging.

PLASTIC CONTAINERS

Rigid Plastic Packaging

Injection Moulding eg. containers, pails, closures	Blow Moulding eg. bottles, jars	Thermoforming eg. cups, glasses, tubs, potion packs



PLASTIC CONTAINERS (Injection Molded)

PLASTIC CONTAINERS (Blow Molded)

Drinking Water Bottles

Bottles for FMCG

Feeding Bottles

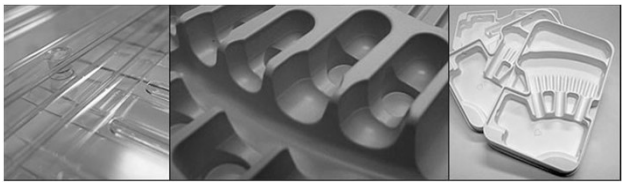
PLASTIC CONTAINERS (Blow Molded)

Narrow Mouth Drum

Open Head Range

Jerry cans

PLASTIC CONTAINERS (Thermoforms)



GLASS PACKAGING MATERIALS

PROPERTIES & ADVANTAGES OF GLASS

Durability

Glass is highly resistant to wear and tear.

Transparency

Glass offers a clear, pristine appearance.

Recyclability

Glass can be recycled repeatedly without loss of quality.

Chemical Inertness

Glass does not react with or contaminate contents.

APPLICATIONS -

Glass used extensively for food, beverages, cosmetics, and pharmaceuticals.

METAL PACKAGING MATERIALS

PROPERTIES & ADVANTAGES

Strength & Durability

Metal is highly resistant to damage, ensuring product protection.

Barrier Protection

Metal provides an airtight, moisture-proof seal to preserve contents.

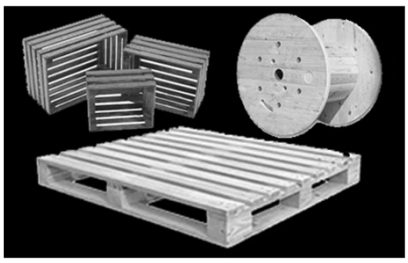
Recyclability

Metal can be recycled repeatedly without loss of quality.

APPLICATIONS OF METAL PACKAGING

Metal packaging materials are widely used for a diverse range of products, including food, beverages, personal care items, and industrial goods.

WOODEN PACKAGING MATERIALS



COMPOSITE CONTAINERS

Composite containers are packaging solutions that are made by combining two or more different materials to create a single packaging structure.

Plastic and Paperboard Composite Containers: These containers often feature a plastic exterior for durability and moisture resistance, combined with a paperboard interior for structural support and printability.

Metal and Plastic Composite Containers: Metal and plastic can be combined to create containers with excellent barrier properties against oxygen, light, and moisture, making them suitable for packaging sensitive products such as food and beverages.

Glass and Plastic Composite Containers: Glass containers can be combined with plastic lids or closures to provide a sealable and resealable packaging solution for products such as sauces, condiments, and beverages.

COMPOSITE CONTAINERS

ANCILLARY PACKAGING MATERIALS

- ADHESIVES
- PRESSURE SENSITIVE SELF ADHESIVE PLASTIC TAPES
- PLASTIC OR METAL STRAPS
- INK OR VARNISHES
- LABELS
- CAPS AND CLOSURES
- PLASTIC OR WOODEN PALLETS ETC.

MILLET SNACK EXPORT: FINDING THE PERFECT PACKAGE

- We'll explore packaging options to ensure the freshness and quality of our millet-based extruded snacks during their journey from India to the US market.
- Let us think of maintaining a shelf life of 6 months which is crucial, and the right packaging will play a vital role in achieving that goal.

CHALLENGES OF LONG-DISTANCE EXPORT

Moisture Protection

- vulnerable to moisture absorption during the long journey
- Robust packaging is crucial to maintain the texture and freshness of the product.

Oxygen Exposure

- Prolonged exposure to oxygen can cause the snacks to lose their flavor and nutritional value.
- Effective barrier materials are needed to shield the product from air penetration.

Physical Damage

- Sturdy packaging is essential to safeguard the product from handling, stacking, and potential drops, that can lead to crumbling or breakage of the delicate millet snacks

KEY CONSIDERATIONS – MATERIAL SELECTION

Properties of the Content

since these snacks prioritize staying crispy, materials with good moisture barrier properties are ideal.

Barrier Properties

excellent barrier protection against moisture, oxygen, etc. to preserve the freshness and quality of the snacks.

Secure Seal

reliable, tamper-evident seal is crucial to prevent spoilage and maintain the integrity of the product

Durability

packaging must be sturdy enough to withstand the handling, stacking, and potential drops

Cost effectiveness

PACKAGING OPTIONS FOR MILLET SNACKS

Metallized Laminate Pouches	• These pouches combine the strength of plastic film with the superior barrier properties of aluminum foil/ metallization. • They offer excellent protection against moisture, oxygen, and other environmental factors.
Laminated Stand-Up Pouches with Zip lock	• This flexible packaging solution features a stand-up design and resalable, reusable allowing for portion control. • Fully plastic or paper/poly combination pouches
Laminated Pouches with see through windows	• The clear window allows consumers to see the product. • This is crucial for food items, as it showcases the product's quality, freshness, and visual appeal, potentially leading to increased sales.

FDA REGULATIONS FOR PACKAGING MATERIAL

1. Adhere to **FDA CFR Title 21** regulations for materials and additives in food packaging
2. Obtain **FDA Food Contact Notification (FCN)** or **GRAS (Generally Recognized As Safe)** status for all components
3. Ensure package design and sealing methods prevent **contamination or leakage** during transit
4. Comply with **labeling and traceability** requirements for imported food products
5. Undergo rigorous **migration and toxicology testing** to prove safety for human consumption

TESTING AND EVALUATION OF PACKAGING MATERIALS

Mechanical Tests	Barrier Properties	Transport worthiness	Migration studies
Tensile strength, seal strength, peel bond strength, puncture resistance	OTR, WVTR	Exposure of the transport packages to simulation tests such as drop, vibration tests	Overall/specific migration studies, heavy element analysis, etc

SHELF-LIFE AND PRESERVATION

1. **Shelf-Life Studies**
   Conduct extensive shelf-life tests to validate the packaging material's ability to maintain the freshness and quality of the millet-based snacks

2. **Accelerated Aging Tests**
   Employ accelerated aging methods, such as elevated temperature and humidity conditions, to rapidly simulate the effects of long-term storage and transportation

3. **Microbial and Sensory Evaluation**
   Regularly assess the millet snacks for any microbial growth, changes in texture, aroma, or flavor to confirm the packaging's effectiveness

4. **Protective Atmosphere Packaging**
   Consider incorporating protective atmosphere packaging techniques, such as modified atmosphere or vacuum sealing, nitrogen flushing etc.

MANDATORY LABELING AND MARKINGS

Nutrition Facts

FDA Certification

Expiration Dating

Country of Origin

- **Essential information includes:**
- **Dimensions (L x W x H):** In millimeters (mm) for the EU.
- **Gross Weight:** Total weight of the packaged product, including the packaging itself. Typically in kilograms (kg).
- **Bursting Strength Value:** Indicates the box's resistance to internal pressure (measured in kilopascals, kPa).
- **Additional markings:**
- Your company logo or identification information.
- Handling instructions (e.g., fragile, keep dry).
- Recycling symbols.

EXPORTING APPAREL, FOOTWEAR & ACCESSORIES: CHOOSING THE RIGHT PACKAGING

Packaging Material Options

- **Cardboard Boxes:** The go-to choice for most apparel and accessories. They offer good protection, come in various sizes, and are recyclable.
- **Polypropylene (PP) Bags:** Lightweight, water-resistant, and ideal for bulkier footwear or protecting carboard boxes from moisture.
- **Cloth bags / Woven Sacks:** Strong and reusable for large shipments, but not ideal for delicate items.
- **Wooden Crates:** Offer the most robust protection but are heavy and expensive, best suited for high-value items.

Mandatory Testing for Packaging Materials

- **Focuses on safety and compliance:** Ensuring materials are free of harmful substances and meet performance standards.
- **Testing can be performed by accredited labs:** Ensure they are authorized to test for EU compliance.
- **Common tests include:** Material composition, migration testing, mechanical strength, and compliance with chemical restrictions.
- **Certificates:** Documentation demonstrating compliance with EU regulations

EXPORT PACKAGING FOR DANGEROUS GOODS

UN Certification Mandate for Dangerous Goods Packaging

1

Regulatory Requirement

The United Nations has established strict regulations for the packaging and transport of dangerous goods, requiring UN certification for all such shipments.

2

UN Approved Packaging

Packages must meet specific UN performance testing standards and be marked with the relevant UN certification before shipping dangerous goods.

3

Compliance Enforcement

Certification is essential for legal and safe transport. Strict enforcement & significant penalties for non-compliance.

ROLE OF IIP IN UN CERTIFICATION

1 **Expertise**

The Indian Institute of Packaging (IIP) is the premier national body for packaging research and development in India and authorized to issue UN certificates in India.

2 **Testing Facilities**

IIP operates state-of-the-art testing laboratories to evaluate packaging materials and designs for UN certification.

3 **Certification Process**

IIP can test and certify packaging as meeting UN performance standards for the safe transport of dangerous goods.

4 **Advisory & Training**

IIP provides guidance to Indian exporters and packaging manufacturers on UN certification requirements and compliance.

SHIPPING EQUIPMENT CONTAINING BATTERIES

- Essential considerations for shipping equipment containing batteries according to the International Maritime Dangerous Goods (IMDG) Code.
- We will discuss the UN number for such items, permissible packaging materials, mandatory tests, suitable materials for packaging construction, performance and additional tests as outlined by the IMDG Code, the roles of the Independent Inspection Body (IIP) and UN certificate, and finally, the responsibilities of both the exporter and the packaging manufacturer as per IMDG regulations.

UN NO. FOR EQUIPMENT CONTAINING BATTERIES

- **UN 3481:** This is the most common UN number assigned to equipment containing lithium ion (Li-ion) batteries.
- **Consult the IMDG Code:** For specific UN numbers based on battery type and quantity.
- **MSDS:** Reference document from the manufacturer

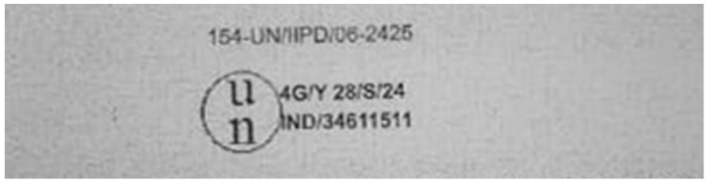
PACKAGING MATERIALS ALLOWED AS PER IMDG

- **Strong outer packaging:** CFB / Wooden box (4G/4D)
- **Inner packaging:** molded plastic inserts or foam cushioning to restrict movement.
- **VCI sheet (optional):** Can be used to inhibit corrosion of metal parts within the equipment.
- **Strapping:** Metal or polypropylene (PP) straps are used to secure the package.

PERFORMANCE AND OTHER TESTS AS PER IMDG

- **Drop Test:** Simulates the impact of the package falling during transport, ensuring it can withstand potential drops.
- **Stacking Test:** Evaluates the package's ability to bear the weight of other packages stacked on top of it during transport.

UN MARKING & CERTIFICATE



UN MARKING & CERTIFICATE

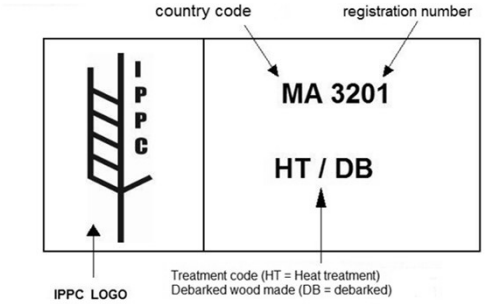

भारतीय पैकेजिंग संस्थान
Indian Institute of Packaging
UN CERTIFICATE
No. 11511
Date : 07 Jun 2024
This is to certify that the samples of the packages/packagings as per the following particulars have been tested in accordance with the provisions of the IMDG-CODE, Volume-I for the transportation of the chemicals as specified in the Annexure and have been found to meet the prescribed criteria :-
Name & Address of the Applicant : M/S. PROGRESSIVE CORRUGATED FIBERBOARD PVT. LTD. Plot No. 37, Sector 27 A, Faridabad, Haryana,121003
Name of the Exporter : Signify Innovations India Limited.
Application Reference : Covering Letter
Description of the Package : 5-ply corrugated fibre board RSC type box (outer side plastic laminated) for "Lithium Ion Batteries" (ZJ5801 150AH 25.6V SOLAR BATTERY TR ZZ)"
Date of Manufacture : 31 May 2024
Quantity of the package : 8 nos
Test Report : 154-UN/IIPD/06-2425
UN Marking allotted : 4G/Y 28/S/24 IND/34611511
Specification of UN Marking : Marking should be legible, durable and readily visible. The marking letters or symbols should have at least 6 mm height (upto 30 Kg) or 12 mm height (above 30 Kg).
This certificate is issued for the transportation of chemicals reflected in the annexure on the basis of the declaration given by the manufacturer regarding the product/package compatibility.
This certificate has been issued pursuant to the approval issued by Directorate General of Shipping.
Government of India and is valid upto : 29 Nov 2025
No extension is given for this certificate.

OVERVIEW OF ISPM 15 (INTERNATIONAL STANDARDS FOR PHYTOSANITARY MEASURES)

- ISPM 15 is a crucial international standard that regulates the treatment of wood packaging materials used in international trade.
- It aims to prevent the spread of invasive plant pests that can hide in wooden pallets, crates, and other packaging.
- Approved treatment measures mandatory for authorizing the entry of WPM
- Thermal Treatment
  - Heat Treatment (HT)
  - Dielectric heat (DH)
- Fumigation
  - Methyl Bromide fumigation (MB)

FORCED HOT AIR TREATMENT FACILITY AT IIP

MARKING



Thank you…

INDIAN INSTITUTE OF PACKAGING - BENGALURU

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