

S O P for DUNNAGE

SCOPE

The scope of this SOP is to convey information to all stakeholders about the dunnage being a crucial part of the storage and transportation process of cargo and to maintain safe working environment in Mumbai Port. This SOP is useful to all persons involved in stacking, storage and transportation of cargo in Mumbai Port and all stakeholders shall follow this SOP strictly for prevention of any accident during such operations.

WHAT IS DUNNAGE

Dunnage is the durable padding material used to protect goods during its storage and transportation. Dunnage helps to keep cargo from shifting during transit, preventing damage to the shipment and the container itself and helps to absorb shock. In addition, floor dunnage can protect the cargo from moisture, contamination and protecting against spills, which helps to keep cargo clean and dry. Therefore, dunnage is an essential component of safe and effective shipping operation. Dunnage is relatively inexpensive and easy to procure, making it a wise investment in shipping process. Proper dunnage are cheap, but it protects valuable, fragile and loose item from any damages during transit and storage.

Role / benefits of Dunnage

The role of dunnage or main benefits of using dunnage are as follows:

1. **Damage Protection** - To protect cargo from sliding across during transit or storage and against any mechanical damage, like contact with components of cargo transport unit itself or other loads or load items, contact with corrugations, corner posts, doors, lashing points, stanchions, edges and corners of other cargo items, load securing materials, protruding nails, screws, etc., appropriate dunnage must be used.
2. **Moisture protection** - Sweat water can occur as container sweat or cargo sweat. It is primarily the roof surfaces that are susceptible to container sweat with the sides and the floor of the container only being a secondary source of problems. Top dunnage and side dunnage can absorb sweat dripping from the container roof until they reach saturation point. This can sometimes significantly delay, or even completely prevent, moisture damage. Dunnage cannot protect against cargo sweat, although this is rarer when goods are transported in containers. To ensure protection against moisture and liquids, valuable cargoes or their sensitive parts must be shielded appropriately.
3. **Shock absorption** - Products being shipped can slide around, drop, get squished, or be subject to collision, which can lead to shock and vibration. Dunnage is put in place to act as a shock absorber to prevent damage. They act as cushions, absorbing shocks and vibrations and keeping the contents safe in additions protecting against physical damage.

4. Easy handling of Heavy Items - One of the significant benefits of dunnage is that it makes it much easier to handle heavy items. By filling in the gaps between the items, dunnage prevents them from shifting around during transport.
5. Air Circulation - Another benefit of dunnage that it helps to improve air circulation. Air circulation is crucial in case of food storage, as poor air circulation can lead to spoilage.

Forces acting on Cargo during transportation

During Road Transport, due to following operations of driving, hazards exist:

- a) Braking and acceleration,
- b) Sway on curves,
- c) Coupling impact, and
- d) Vibration and shocks.

Rapid acceleration, deceleration from sudden stops and rapid change in traffic lanes by vehicle, creates forces of 0.8 g (gravitational acceleration) in longitudinally forward direction and 0.5 g in longitudinally rearward direction.

Materials for Dunnage

The nature of the materials used must ensure that the packages or the cargo transport units are adequately protected. The materials themselves must not be wet, moist, odor tainted or contaminated. The quality of the material must be determined for each individual case by assessing the value and susceptibility to damage of the load, the means of transport, the intended protection and other similar factors. The special properties of the particular type of dunnage used must be taken into account.

Common dunnage materials used for packages are:

1. Solid plastics - This kind of dunnage is used mostly in industrial, high-value shipping. Solid plastics are more expensive than other dunnage types but are worth the cost for high-value products that need protection.
2. Bubble wrap - Bubble wrap is one of the most common ways of shipping glass and other fragile products. It can be reused repeatedly as long as the bubbles do not pop.
3. Wood – Wood can be used to create barriers between items, usually used for strong and heavy goods. Since, in Mumbai Port, this type of dunnage is often used, hence detailed information about quality of wood is given in the next section.
4. Air pillows - Air pillows can be deployed inside packages in order to keep items from sliding. These are often used as a gap filler to fill in missing space.
5. Foam - Foam is often used to pad electronics, medical equipment, sensitive items, and fragile or sharp pieces.

6. Steel - Steel is one of the most expensive dunnage options, which is typically used for high-value shipping. If your products are heavy, steel is a good dunnage option because it can prevent heavier products from damaging lighter products.

7. Corrugated paper - Corrugated paper is another popular dunnage choice. Its high-tech construction ensures the material can carry a wide range of weights, protects against moisture, and provides sustainable packaging options.

8. Custom dunnage solutions - Custom dunnage is needed sometimes when you have fragile materials that have very specific dimensions. You can work with dunnage providers to help you design the dunnage needed to protect your product/cargo.

Placing of Dunnage

How to lay dunnage most appropriately and what materials are to be used depends on the stowage plan, space, the structural design of the cargo transport unit and the restrictions anticipated during transport. These include the climatic zones through which the cargo will travel changes in weather, storage duration and anticipated mechanical, climatic stresses, etc.

Bottom Dunnage - If a good distribution of load forces is the primary consideration, the wood at the bottom must be laid out in such a way that as many load-bearing components of the cargo transport unit are covered as possible.

If the main aim is to dissipate moisture or damp, the wood at the bottom must be laid in such a way that water and other fluids are conducted along the quickest route outside or to any available discharge outlets and do not produce any accumulation of damp

If the most important consideration is to protect against mechanical damage, it is essential that potential shifting or movement resulting from transportation stresses.

On open chassis and trailers, wood must be laid out to distribute load forces in such a way that the vehicle's chassis take the load.

In stores, sheds, warehouses, hangars and open areas, it can be used for levelling out storage areas, protecting against damp and dirt or for distributing load forces. The materials used must be able to provide the necessary protection. Especially on open areas, weather changes such as rain, exposure to sunrays, etc. must be taken into full account and other factors to consider are bacteria on the ground and rot pathogens, which could damage the cargo.

Top dunnage – It is laid to protect from the effect of moisture or damp penetration, contamination or chemical reaction, bad weather, mechanical damage by vertical loads etc., which could damage a particular cargo or the cargo transport unit and its components.

Interlayer dunnage - Various has the functions of floor dunnage, side dunnage or top dunnage, depending on how it is arranged. It is laid between two different tiers of cargo to help to secure the load by increasing friction, improving the distribution of load forces or improving the stability of the load. Wooden dunnage boards are used to create a level packing surface of the load be able to bear the load packed on top of it.

Quality of Wooden dunnage

Wooden dunnage made of squared lumber, planks, boards, slats and battens are very suitable for distributing pressure, bridging or lining cavities and gaps, creating air channels and enhancing friction. Since wood can be infested by pests, only wood which has been impregnated against insects or fumigated may be used on certain trade routes. To distinguish such treated wood from normal wood, it must be appropriately stained or marked in some other way. The timber shall be seasoned to a moisture content not exceeding 18 percent and the inclination of grain shall not exceed 1 in 10. The timber shall be free from objectionable knots, centre heart (pitch), insect attack, any kind of decay, warping, splits and any other defect which may reduce the strength or usefulness of the pallet. Pinholes (dead infestation) shall be permissible provided they are not of powder post beetles and are scattered (not concentrated). The materials themselves must not be wet, moist, odor- tainted or contaminated. The quality of the material must determine for each individual case by assessing the value and susceptibility to damage of the load, the means of transport, the intended protection and other similar factors. The special properties of the particular type of dunnage used must be taken into account.

Objectionable knots - A live knot in a scantlings shall be considered objectionable, if its diameter along the major axis exceeds one-third of the width of the scantling, provided such knots do not reach the edge of the member and are not so numerous or grouped or located as to affect unduly the strength of the pallet, or are situated within 25 mm from a place through which a nail may be driven.

A dead knot in a scantling shall be considered objectionable, if its diameter along the major axis exceeds one-fourth of the width of the scantling, provided such knots do not reach the edge of the member and are not so numerous or grouped or located as to affect unduly the strength of the pallet or are situated within 25 mm from a place through which a nail may be driven.

Dunnage sizes and permissible load per dunnage unit:

Thickness (inch)	Width (inch)	Length (inch)	Permissible Load (Metric Tons)
2	8	60	4.8
2	6	60	3.6
2	4	60	2.4
3	3	60	4.05
4	4	60	9.6

The height of dunnage should be such that forks can easily pass below the package.