HOW TO PACK A MARINE CONTAINER

Although containers are thoroughly tested to ensure that they can withstand every sort of stress and strain, shippers should not assume that they can disregard other cargo protection precautions.

Most cargo losses are preventable. The conscientious traffic manager will quickly realize that the proper packing of containers will greatly influence successful delivery of his goods.

Satisfied customers and repeat orders are only two of the benefits that stem from a careful approach to container packing. Reductions of time and money spent in tracing, locating and making adjustments on lost, damaged or stolen merchandise all lead to a much greater benefit - increased profits.

The following suggestions will help you to minimize possible loss and damage. The first step, of course, is to check and prepare each container before packing it. For example:

EXTERNAL:

a) The container must not have any obvious holes or tears in the outside paneling.

b) The doors should be in good order. Check that gaskets, door hinges and locks are not broken or twisted.

c) Before packing open-top and open-side containers make sure the canvas tilts are complete and not ripped. Customs seal ropes should fit correctly and their end pieces should be intact.

d) Soft-topped containers should have all the roof-bows (supports) in place. The same applies to the removable stanchions found on flats.

e) Any labels remaining on the outside of the container which refer to the previous cargo (e.g. IMCO Labels) should be removed to avoid misunderstandings and penalties.

f) When using refrigerated containers, check whether the temperature setting is correct for the commodity about to be packed.

INTERNAL:

a) The container should be clean and there should be no evidence of the previous cargo. Make sure that nails or other protruding objects will not cause damage to your cargo.

b) If delicate goods, susceptible to odor damage, are to be packed, the container should be treated. Either burning coffee beans or using a deodorant spray can saturate cross taint.

c) Before packing highly delicate goods the container should be lined with paper or plastic.

d) Make sure the interior is absolutely dry. Any sweat or frost should be wiped off to avoid moisture damage.

e) To check whether the container is watertight, enter the unit and have both doors shut. If any light can be seen, water can gain entry.

f) If you intend to ship goods liable to leakage and/or producing bad odors the container should be protected by plastic foils and absorbing material (e.g. peat, sawdust, infusorial earth, etc.).

In box and open-top containers, the superimposed pressure caused by the load is spread over the floor to the bottom cross members. Hence it follows that when utilizing the full payload of such containers, all bottom cross members should preferably be straddled.

The maximum permissible load per container (e.g. 4.5 t/m in 20-footers and 3 t/m in 40-footers) must not be exceeded. If you intend to ship a relatively heavy item with a small floor contact area, then this contact area needs to be enlarged to stay within the permissible load capacity.

A good spread of weight can be achieved by a double layer of timber dunnage (the boards laid crosswise on the floor with the lower layer put down along the length of the container). Or by means of a sled with its skids tightly fastened to the load. Skids should preferably run lengthwise to minimize the load.

In principle, cargo within a container should be distributed in such a way that the center of gravity meets the crucial point of the container vertically. The resulting sum of all individual loads, longitudinally as well as crosswise, should be in the middle to the container. Longitudinally, the center of gravity may be a maximum out of the middle:

- For 20 ft containers, $\pm$ 0.60 m.
- For 40 ft containers, $\pm$ 0.90 m.

If for some reason you can't keep to these tolerances, inform all carriers concerned. The center of gravity should be indicated, as transportation systems are not the same everywhere.

Sometimes containers with one end more heavily loaded than the other may not fit into a vessel's cell guides and can be carried on deck only. The dynamic load on the floor of a container, imposed by a laden forklift truck, is limited as follows (according to ISO recommendation DIS 1496/1):

- Front axle weight - max. 5.460 kg
- Weight per front wheel - max. 2.730 kg
- Contact area per wheel - min. 142 sc. Cm
- Wheel width not less than 180 mm
- Wheel centers about 760 mm

To achieve the most efficient use of a container, choose the most suitable unit for your packing possibilities. Make sure that the type of container you choose suits your consignee's facilities as well. In addition, you should obtain information about the maximum permissible gross weights of the container for road and rail haulage. This applies to pre-carriage to the port of loading, as well as to on-carriage in the country of destination.

To make the optimum use of the container you should make up a stowage plan, to scale, on graph paper showing the vertical and horizontal section of the container. Either draw in those packages which have to be stowed, or cut out the packages to scale and fit in the complete "furnishing plan". Or you can pre-stow your cargo in a rectangle, marked by chalk or paint,

representing the internal dimensions of the container. In no case must it be forgotten that door and roof openings are normally smaller than the maximum internal dimensions.

Container transportation implies the possibility or the shipper to reduce the amount of packing material and thus cut costs. In “house-to-house” moves packaging (e.g. of machine) can often be relaxed. In most other cases, the packaging used for domestic transport is sufficient for shipment in containers.

You should also check whether the cargo, after being stripped from the container, is stored for a certain time or whether it goes directly into the consignee’s production or distribution chain.

Excessively radical steps to cut down the material strength or quality of packaging materials may result in handling damage. The shipper, therefore, should find out whether the transport consists of through freight or whether, at some stage, it is to be forwarded in the conventional way (i.e. transported and stowed outside the protection of the container).

Materials strength is also of importance concerning the height to which goods are stowed on top of the packaging. It should be able to withstand the pressure and vibrations that occur at full load height. Intermediate layers of strong cardboard, plywood, timber, etc., may distribute top pressure and reduce it.

A risk of damage also arises when goods in different types of packaging are to be loaded together. It has been found that goods packed in wooden crates often cause damage to goods packed in cartons or corrugated board.

Should the contents of the packages be able to withstand the stacking pressure, the demand made on the packaging is reduced to a corresponding extent.

Considerably greater stacking strength is required for cardboard boxes. It should be based on moisture conditions and voyage duration.

It is impossible to state any general rules for the tipping and shocking strength of packages. Estimates must be made in each individual case.

Besides protection against mechanical damages, packaging should provide protection against climatic changes.

Once the doors of a dry freight container are properly shut, it becomes virtually watertight. (Open-top and open-sided containers do not achieve the same degree of water-tightness.)

Once the container is loaded and the doors securely shut, the only way in which weather can affect the cargo is through changes in temperature. Unless the internal temperature of the container is controlled somehow, it will match the temperature of the air outside.

Another problem is condensation. Moisture thus formed can cause the following damage to cargo; rust, discoloration, mould, caking and clogging, dislodging of labels, collapse of packages and parts of the stow (depending on the commodity, its packaging, the time factor, and other variable conditions).

There are two types of condensation affecting container cargoes: container sweat and cargo sweat. Each is caused by a separate set of circumstances, and each affects cargo in a different way.

For condensation to appear at all two conditions must be present; there must be a source of moisture and there must be a temperature gradient. The source of moisture may be the cargo itself, the dunnage restraining the cargo, the packaging, the pallets or skids supporting the cargo, or the air trapped at time of packing. The temperature gradient may be caused by a sudden change in outside temperature, or change of cargo temperature, for instance, self-heating fishmeals, etc.

Here's a look at how cargo sweat occurs. A container is packed with cartons of canned goods that have been stored in a highly humid atmosphere for some weeks. The doors are shut and the container is sitting in an open area. The sun heats the roof during the day, warming the air between roof and cargo. Being warmer, the air is able to hold more water vapor, which it draws off the relatively damp cartons. The temperature of the cans though, is much slower in rising because of their relative density and distance from the source of heat. So they remain cold and the moisture collected by the recently warmed air condenses on them.

There is another way in which cargo sweat can form. When a container that has been kept relatively cool is opened in a hot and humid atmosphere, the warm air entering the container can cause condensation to form on the relatively cool cargo. Although this situation is not desirable, the damage caused is usually much less than when condensation forms during transit.

Container sweat occurs differently. When night falls, accumulated heat in a container's outside paneling is quickly dissipated in the cool air. A clear sky will even hasten the cooling of the container roof. The roof now becomes colder than the air inside the container, and that air deposits moisture on the inside of the roof. If enough is deposited, or if the container is moved, that moisture will fall in drops upon the cargo beneath it.

But how can sweat water be avoided? If the source of moisture within the container is eliminated or if no temperature gradient is allowed to develop there can be no sweat! Let's look at a few specific examples:

- *Cargo* - The cargo should be dry before packing. Commodities with a high moisture content must not be packed with goods susceptible to moisture damage.
- *Packaging* - Cardboard packages can hold a high proportion of moisture. If the moisture content is kept below 12%, however, the chance of moisture migrations is very low. In the case of canned goods, using shrink wrapping instead of fiberboard cartons can further reduce the risk of condensation.

  The timber used in packing cases and crates must also be dry. Moisture content of up to 18% is acceptable in timber. Wooden pallets, skids, and dunnage boards must also be seasoned and dry.
- *Rust Prevention* - Bare metal parts can be well protected by either chemical coatings or modern VCI-papers. Plastic foils should completely cover the cargo and no source of moisture must be allowed inside the wrapping. If only hoods are used, there is a risk that moisture will condense underneath them.

Desiccants, such as silica gel, are relatively ineffective for two main reasons:

(1) Although they absorb moisture they also, under extreme conditions, return the moisture to the surrounding air.
(2) The quantities required to have a noticeable effect in a 20-ft. container would be quite high.

Desiccants can be effective only if used in a completely airtight space. A rule of thumb for measuring the amount required is 500 g of desiccant per cubic meter of entrapped air.

The above steps can eliminate the sources of moisture within the container; the risk of a temperature gradient forming is more difficult to guard against. A container standing in the sun on a windless day, even in winter, will achieve relatively high skin temperatures.

Damage to goods shipped in containers is usually caused more by faulty stowing and securing than by the severe stresses that occur during transportation.

In most containers, the following techniques can be used to secure your goods:

Wooden container floor.	For anchoring with wedges and timber connectors.
Internal walls	To support lightweight goods.
Corner posts.	Suitable for securing by bracing.
Bull rings (eyelets) and lashing bars	Attaching points for lashing ropes, wires, chains, steel strapping, span-sets, etc.
Corrugated steel walls in open-top containers	Crossbeams may be anchored in the corrugation.
Wooden beams and planks.	For shoring and relieving pressure vertically and horizontally.
Intermediate decks and walls.	For loading at different levels and for separation.
Bars or rods movable vertically or horizontally.	For securing the load in sections.
Nets	To secure fragile cargoes.
Air bags (inflatable dunnage)	To absorb sudden impacts and to prevent the load from shifting.
Timber connectors	To secure pallets, skids and cases to the container floor.
Rope, wire, steel-strips, terylene straps, span-sets.	To fix the load to bull rings or lashing bars.
Blocks of styropor, corrugated paper, used tires, empty pallets.	To block off empty spaces.

Let's now turn to packing techniques for specialized cargoes.

BAGS

Too often, bagged cargo is carelessly thrown into a container with the only objective being to make sure the consignment fits in. Unfortunately, bags not packed in a block stowage (each layer bound by the next) tend to shift as soon as the ship starts rolling.

Shifting bagged cargo not only puts extreme pressure on the container walls but is also likely to burst out of the container when the doors are opened.

As it takes a comparatively long time to pack and unpack a container of bagged cargo, one should investigate whether or not the use of expendable pallets would be more economical. The size of the pallets depends on the internal dimensions of the container, the shape of the bags, and the weight to be loaded. There are various type of straps which can be used to lash the bagged cargo onto the pallet. Particular attention is drawn to the method of shrink-wrapping.

BALES

The strength, shape and rigidity of a bale are supplied by its contents. The outer covering may be of hessian, paper, or some other material. When packing bales into a container, care should be taken not to damage this outer covering.

Normally, bales are stuffed into the container by forklift trucks. When stowing bales of paper or wood pulp, wooden battens of the same length as the truckload should be laid out on the container floor and the lower layer of bales to assure mechanical discharge.

Protection must also be provided against sharp corners and edges. If the load does not fill the complete internal length of the container it should be secured by using timber strutted against the corner posts.

CARTONS

Cartons chafe easily, so a tight stow, using filler pieces, strutting or lashing is essential to absorb any movement. Packing is started at the front end of the container and filling is carried out from the sides to the middle. Try to avoid unnecessary wasted space.

If free space still remains, the cargo needs to be strutted. This is particularly important in the case of fragile goods with light packaging.

If you definitely know before packing is started that the entire cube of the container is not going to be utilized, then the stowing height should be modified so that the load covers the entire floor. This reduces the need of strutting and also saves labor since the lifting height is reduced.

SMALL CASES AND CRATES

In principle, the same precautions and stowage patterns as for cartons apply. To improve the stability of the stow, cases should be turned or staggered to give a three-dimensional brick wall effect. To reduce movement and the possibility of collapse when the doors are opened, try nailing the cases to each other.

PALLETS AND UNIT LOADS

The cargo should be secured to the pallet by striping, gluing, or shrink-wrapping. The dimensions of the pallets should conform to those of the container for maximum space utilization. To fully utilize the floor area of the container only four-way entry pallets should be used.

If the dimensions are such that there is only room for one unit across the width of the container, then the row should be stowed down the middle.

If the dimensions of the unit load or pallet are such that there is room for two or more units beside each other across the width of the container, then the rows should be located close to the sides.

When pallets are stowed in a single layer, two to four timber connectors under each pallet are sufficient for securing. If the pallets are stowed in several layers on top of each other, securing should be done by means of timber strutting or air bags. These recommendations apply to all cargoes that are normally handled by forklift trucks.

DRY BULK CARGOES

For transportation of bulk solids many steamship lines offer 20 ft-bulk containers. However, closed and open-top units may also be used. Additional door protection may also be needed, depending on the specific gravity of the commodity to be shipped.

LIQUID BULK CARGOES

Special tank containers have been built for transportation of bulk liquids. The minimum tank-filling grade should be 80%, to avoid dangerous surging. To keep up with possible heat expansion, a maximum filling grade of 95% must not be exceeded. The working pressures marked on the outside of the tank containers must be regarded as well.

DANGEROUS GOODS (CHEMICALS)

Attention should be paid to the following points before packing the container:

1) The unit should be sound, dry and clean.
2) Labels referring to previously carried dangerous cargo must be removed.

Here are a few pointers to consider while packing the container:

1) The usual packing rules apply for stresses, payloads and distribution of weight within the container.
2) Packaging for dangerous goods must comply with current regulations.
3) Only safe and sound packages may be loaded.
4) Each individual package must bear the relevant IMCO Dangerous Goods Code Class Label.
5) Dangerous goods packed together in one container must be of the same IMCO class. Goods of the same class may only be packed together if this is in accordance with current regulations and the goods concerned are compatible.
6) When dangerous goods form only part of a container load, they must be packed so as to be accessible from the doors of the container.
7) When a container is to be packed with poisons, corrosives, foul-smelling goods or goods liable to drain liquids, the unit should be protected against damage or contamination.

8) The goods must be tightly packed within the container and adequately secured for the voyage. Packing of a container and bracing of the goods should preferably be done at the same time, under supervision of a responsible person.
9) Containers in which dangerous goods are packed must carry four IMCO Dangerous Goods Code Class Labels. One should be placed on the front wall and one at the doors. The label on the right sidewall is to be placed so as not to be concealed when the unit's door is opened. The left sidewall is marked accordingly, but the label should be placed more to the front end of the container.
10) Those responsible for packing dangerous goods into a container should provide a "Container Packing Certificate" certifying that this has been properly carried out and embodying the following provisions:
    - The container was clean, dry and apparently fit to receive the goods.
    - No incompatible substances have been packed into the container.
    - All packages have been externally inspected for damage, and only sound packages packed.
    - All packages have been properly packed in the container and secured.
    - The container and packages are properly marked and labeled.
    - The Dangerous Goods Declaration required in sub-section 9.3 of the International Maritime Dangerous Goods Code has been received for each dangerous goods consignment packed in the container.

TEMPERATURE CONTROLLED CARGOES

For these goods we recommend refrigerated containers with integral reefer units and insulated containers for refrigeration by ship's equipment or "clip-on-unit". The temperature range to be kept depends on the cargo. Generally, the following applies:

- Deep-frozen cargo may be stowed as a solid block. An "envelope" of cold air then surrounds the complete block.
- Fresh fruit and vegetables are "breathing" and therefore give off heat and carbon dioxide. Proper air flow through (as well as around" the stow is therefore essential. Some packages are so designed and the content so arranged that air flows through the package and no intermediate dunnage is required. Where this does not occur, vertical 10-15 mm strips of timber should be inserted between every second row. The air stream thus reaches each individual package. Care must be taken not to block any permanent air channels.

Make sure that the container is correctly packed and that the cargo is secured in the right manner. Putting a copy of the packing list inside the container is a useful custom.

Close doors and, according to the type of container, all other openings carefully. Reduce the risk of theft by sealing doors and other openings. Containers are usually transported over great distances and for long periods of time. They stand on terminals and trucks. These situations create ample opportunities for thieves. Seals, in addition to strong wiring or locks, give better protection against theft and make control possible.

Finally, customs seals on containers should never be opened, even if an accident happens. Only customs officials are allowed to open the seals.