



Carefully to Carry

Heavy containers over light containers

One of the most persistent problems experienced onboard containerships is bad stowage. This can take many different forms, but the most potentially damaging example occurs when heavyweight containers find their way into the upper tiers of container bays on deck.

The problem can occur with any containership, if the permissible stack/tier weights are ignored for a specific securing arrangement. As an example, containerships of the latest generations feature deck stows comprising six or seven tiers of units which, to the casual observer, represent a huge carrying capacity. The better informed, namely the ship's officers and ship planners, have a different appreciation, as they should be aware that weight limits apply and, in the upper tiers (sixth and seventh layers) only empty containers can be carried.

Background

In containership liner operations there are normally three individuals who play an important part in the planning and/or loading operations, they are:

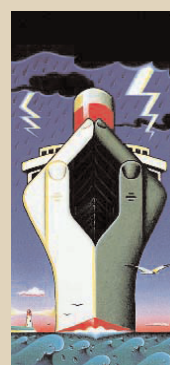
- The ship planning co-ordinator;
- The loading terminal's ship planner; and
- The ship's loading officer.

With modern communication systems, and the exchange of preliminary and final stowage plans, at least two of these important individuals, if not all three, should be in a position to verify whether stack and/or tier weights are within the permissible limits for the securing system being used. Problems can occur, given the complexity of modern Cargo Securing Manuals and this can result in mistakes and poor co-ordination.

Irrespective of whether it is an one-off voyage charter or a regular caller, the ship planning co-ordinator has the very important job, firstly, of ensuring that he has available the necessary particulars of the vessel that will enable the stowage planning, loading operation and securing of containers to be undertaken in a proper and seamanlike manner. He must, secondly, ensure that each loading terminal has the same information readily to hand.

Cargo Securing Manuals have become very complex, with numerous securing arrangements each having their own permissible stack and tier weight limits. This creates a requirement for the ship planning co-ordinator, in conjunction with the ship's staff, to make sure that the loading terminal planner is aware of the securing arrangement(s) to be used and their applicable permissible stack and tier weights.

The operating principle is that the weights of containers should not exceed the prescribed limits for slots in which they are stowed. These limits should be



"The carrier shall properly and carefully load, handle, stow, carry, keep, care for and discharge the goods carried."

Hague Rules,
Articles iii, Rule 2

Carefully to Carry Advisory Committee

This report was produced by the Carefully to Carry Committee – the UK P&I Club's advisory committee on cargo matters. The aim of the Carefully to Carry Committee is to reduce claims through contemporaneous advice to the Club's Members through the most efficient means available.

The committee was established in 1961 and has produced many articles on cargoes that cause claims and other cargo related issues such as hold washing, cargo securing, and ventilation.

The quality of advice given has established Carefully to Carry as a key source of guidance for shipowners and ships' officers. In addition, the articles have frequently been the source of expertise in negotiations over the settlement of claims and have also been relied on in court hearings.

In 2002 all articles were revised and published in book form as well as on disk. All articles are also available to Members on the Club website. Visit the Carefully to Carry section in the Loss Prevention area of the Club website www.ukpandi.com for more information, or contact the Loss Prevention Department.

set according to stack weight, tier position and the securing arrangement being used. In modern container handling systems the loading model for a particular class of vessel is usually sufficiently well detailed so as to 'prevent' an operator from planning the loading of a heavy container in a light slot. In a more sophisticated approach, the loading computer will calculate, on an individual stack basis, the resultant forces acting upon the containers and the lashing system. A maximum container weight will be determined for each position, and it is possible that a heavy container could be received over a unit of lesser weight, provided that securing loads are acceptable. In both examples, however, if the weight is excessive for the specified position, then the computer program will simply reject the container.

As far as ship operations are concerned, however, the container industry covers a broad spectrum. Vessels which incorporate the very latest technology run side-by-side with others from older generations. There are many services which rely upon chartered tonnage, either wholly for short or long terms, or from time to time to supplement an existing established service. In all cases, it is the responsibility of the ship planning co-ordinator and/or the loading terminal ship planner to stow the containers into the proper and appropriate positions on the ship.

As a result of a diverse service structure, and the utilisation of different classes and designs of vessels, it is inevitable that ship planners may, on occasions, find themselves working without detailed knowledge of the technical data for a particular vessel. However, in such cases, the ship planning co-ordinator and/or the loading terminal ship planner should look to attend the vessel to obtain the necessary information. Planners should not apply their own interpretation, as what may be applicable for one vessel may not be for another.

The requirement for detailed technical knowledge is crucial. Individuals must resist the temptation to overlook basic stowage rules on the assumption that margins of safety exist.

The causes

Whatever the background, the problem of heavy containers being loaded in high tier positions above light containers has been around for years and has been responsible for many very serious and expensive casualties.

The role of the ship planner in the operation is crucial. He or she is required to plan the stowage of large numbers of containers onto a vessel in a loading operation, which must take place quickly and efficiently. The planner must



cope with uncertainty in the loading information and in the time of arrival of units at the port.

It is assumed that a ship planner has knowledge of some basic principles in container stowage; i.e. keeping heavy weight items at the base. In practice, however, many ship planners simply rely upon the limit, which exists for the total weight of units that can be carried in a particular stack. This is simply insufficient, and there must be additional awareness of the limit existing for the weights of individual containers carried in different tiers.

Bad stowage can occur as a result of a mistake, or it can be deliberate. The following are the principal reasons why heavy containers are sometimes placed in the wrong slots:

- Inexperience

By mistake, an inexperienced planner faced with a problem of container distribution might simply allocate stowage on 'the best possible' basis ignoring good stowage principles and the vessel's stowage and securing criteria.

- Insufficient knowledge

A planner who lacks specific knowledge of the tier limits for a particular vessel, or class of vessel, will not know whether a particular plan he/she has composed meets with the criteria of the vessel's lashing system. For example, he or she may assume tier positions for empty units are suitable for laden containers.

- Deliberate bad stowage

An experienced planner may come across the 'impossible' stowage dilemma - too many heavy boxes and not enough suitable slots. In such cases, there is always a temptation to take a chance that an indiscretion in the loading distribution will pass unnoticed and the problem will simply 'sail away'. There have even been many examples, involving relatively sophisticated planning systems, in which planners have changed the weight information on containers so that they are not rejected by the computer when placed in particular positions.

- Late arrivals

A most common reason for errors occurs when containers are received for shipment late, for whatever reason. The vessel may be part loaded, and stevedores may have abandoned a scheduled loading plan in place of a hybrid, for reason that cargo was not available when the vessel arrived. When the containers arrive late, it may be the case that only relatively high positions are left available.

How can these errors be addressed onboard ship?

Without having to-hand the proposed stowage plan, detecting a weight problem in a container stow is not an easy task. A container has the ominous characteristic of looking exactly the same when laden with lead ingots as it does when filled with rattan furniture. Ships' staff should not allow loading operations to commence until they have received a copy of the proposed stowage plan. It may be the case that a full stowage plan has not been completed, but a loading terminal should be able to give the plan for the bays about to be worked. A relatively quick inspection should show whether heavy containers have been planned over light ones; and whether the stack and tier weights are within the permissible limits.

A reason for this is that the system for container loading is entirely driven from ashore by the planner, who creates a stowage plan and has the ability to vary and modify right up to the moment a particular unit is picked up by a crane. It is frequently the case the final bay plan, received after work that has been completed, bears only passing resemblance to the pre-load plan which was received just as work was commencing.

Vigilance is the key and ships' staff should be aware that mistakes are often accompanied by departures from plan. Accordingly, duty officers must not hesitate to report to the chief officer on any occasion when stevedores advise there is a change to the original plan. The chief officer should look carefully at any change which is proposed.

Containerships work around the clock, but it is during the night cargo watches that most deviations from the plan are experienced. This is also the time when a less scrupulous terminal may try to 'pull a fast one' and allow indiscretion to creep into the loading operation.

Ships' staff should always check the pre-loading plan for 'heavy' container stacks. These should be identified and, if possible, the container numbers in these stacks checked during loading. If a different container appears in the upper tier then it may be a heavy unit stowed by mistake and of sufficient weight to overload the stack and the lashing system.

Containership operators must instruct terminals to check weight against stowage slot, before allowing a unit to be shipped late in a position other than that originally planned. In most cases the plan will be sufficiently flexible to accommodate late loading, but in some instances it will not. Potential problems must be identified, and remedied, before sailing →DON'T LET IT GO BY!

How the problem is all too often discovered

The most common method by which a stowage error of this type is discovered is when the chief officer updates his loading plan using the final plan, normally provided on a CD. The update should tell him if there are any changes from the pre-load plan. Frequently, however, there are significant differences flashed up on the computer screen. In more extreme cases, the discovery is made when the vessel encounters moderate weather and starts to roll and pitch. The safety margins in lashing systems are very small, and an excessively heavy stack will soon begin to challenge the integrity of the securing arrangements. Container structures are overloaded, fittings fail and movement occurs.

On a modern vessel, the breakdown of the stowage usually commences in lower tiers, possibly at second tier level, where racking loads might cause failure of the door end structure. Alternatively, the compressive forces may cause buckling of a post. There may be excessive pull out loads on twistlocks or baselocks.

Once fittings have begun to fail, movement of the stack occurs and load is transferred to adjacent stacked containers. This type of problem can assume significant proportions, and in most cases an entire bay of containers is at risk. Examples where heavy containers have been loaded in high positions have involved:

- The loss overboard and a subsequent compulsory recovery of dangerous chemicals in 200 metre water depths.
- The capsizing of ships alongside a berth.
- The collapse of stacks and spillage of hazardous chemicals on deck. For illustrative purposes, it is appropriate to review a numerical example.

In the theoretical case illustrated, we have a 6-high internal (i.e. no wind load) stack of 40ft units in an aft located bay onboard a 230 metre long containership. The vessel has good stability with a GM of 1.5 metres. In ascending order the container weights planned are 18/18/18/11/9.7/3.5 tonnes. The stack weight is 78.2 tonnes, which is well below a nominal limit of 100 tonnes which applies to the vessel.

In a seaway experiencing rolling of 26° the lashing loads would be under a tension load in the order of 14.5 tonnes at the 'door ends' in a parallel lashing system.

If, because of last minute arrivals at the container terminal, a unit of 18 tonnes were placed in the sixth tier then the situation would be quite different. The stack weight would have risen to 93 tonnes, still well below the limit, but forces in the stack would increase as well.

For the conditions outlined, i.e. a roll angle of 26°, the lashing tensions would rise to about 17.5/18.5 tonnes. Compression forces in container corner posts at tier 1 level would rise to about 800 kN, exceeding higher strength standard limits, and tension forces in posts would also be high. The racking forces at tier 3 would be close to the allowable limits for a standard container.

The example shows a marginal case where slightly more stressful conditions could cause the stack to collapse. Ship motions would be important and even the over-tensioning the lashings might be sufficient to bring about failure.

This demonstrates that if the rules of good stowage are broken even with relatively modest loads then there are potentially serious consequences. If the stack included heavier containers, i.e. units of 20 tonnes and greater, then bad stowage would probably, if not certainly, cause collapse if the vessel were to meet adverse conditions.

It would be wrong to assume that bad stowage will cause a container collapse. There are other components to the equation. In addition, the vessel will have to encounter heavy weather and experience ship motions of amplitudes approaching design working limits. There are additional factors, which can influence events. Containerships can be very large vessels and lashing systems are of very substantial scale. Such large arrangements can easily conceal defects, both in lashings themselves and their manner of application.

The safest condition is one which has complied with the basic stowage rules.

A containership master must be prepared to use all available tools in the ISM system in order to report defective stowage to the vessel operators and designated person ashore. It is a fundamental requirement of ISM that defects of this type are reported.

There have been examples of vessels performing multiple chartered voyages, with overloaded and defective stowage conditions, and with no record of any protest by the master to charterers through owners.

A containership master should remember to use all the tools available, in order to check stowage and security. Modern vessels have computer programs to enable lashing integrity to be checked at the push of a button. These facilities must not be overlooked.