UK P&I CLUB

Carefully to Carry

SEPTEMBER 2006

Stuffing and stacking containers

The Club is concerned at the continuing incidence of damage to containers and cargo from within containers, and of damage to containers and contents from the collapse of containers in stack.

Losses continue

This article is a reminder and re-enforcement of earlier advices, and reference should be made to the following *Carefully to Carry* reports:

Report No.11 - July 1983,
Report No.12 - December 1986,
Report No.13 - April 1989.

Reference should also be made to such booklets as *Stuffing & Stowage* by ScanDutch, and to similar publications by Atlantic Container Lines and Hapag Lloyd, for example, with their excellent descriptive line drawings and practical advice, and to the catalogues of container securing components and securing systems available from all reputable manufacturers such as Coubro & Scrutton, Conver and Peck & Hale.

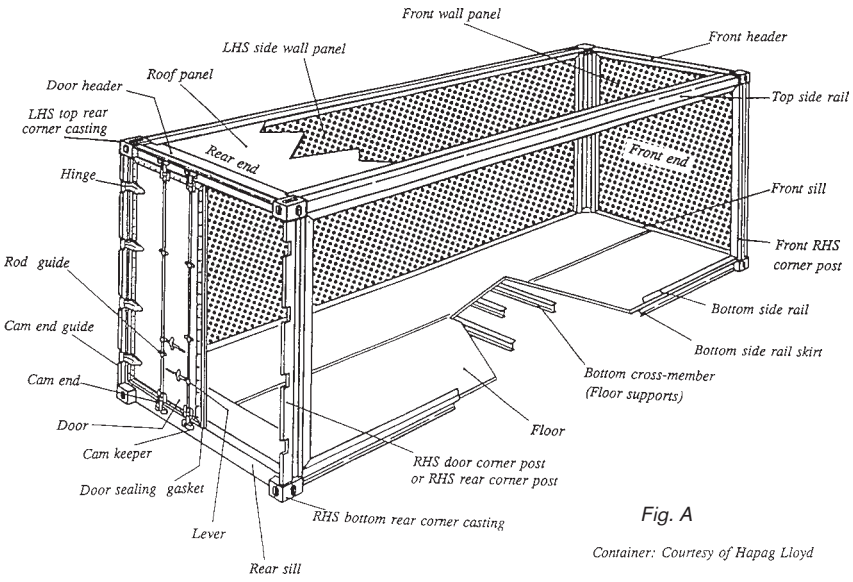


Fig. A

Container: Courtesy of Hapag Lloyd

Stuffing

The stuffing of containers is not just a ship operator's problem. Containers are often packed at places which may be many miles, and sometimes even several days' journey, from the marine loading terminal. It is therefore

"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.

important that everyone involved with the packing of containers, at whatever stage in transit, should be fully aware of the stresses that can be generated in the structure of the container itself and in and around the cargo within it, during transportation by road, rail or ship. It is also, of course, essential that containers are in sound structural condition each time they are put into service, and that the containers themselves are suitable for the cargo to be carried.

It should always be borne in mind that the side panels, the end panels, and the roof panels of an ISO container are not normally strength members. Beneath the floor timbers there are metal cross-bearers and it is generally those bearers which provide the floor's strength. Additionally, the corner posts, front and rear headers and front and rear sills provide the internal strength members. (See Fig. A). Whenever bracing is to be used in vertical, horizontal or diagonal form, it must act against those members and the floor bearers, and no others. Bracing and/or end chocking against side, end, and roof panels will surely result in disaster (photos 2 and 3).

The great problem is that, unlike break-bulk cargo, the ship's master and his officers do not sight, nor do they have any control over, the contents of containers or the methods by which the contents have been packed and secured. Hence, whenever and wherever containers are being packed, management and supervisory personnel should be properly trained and be provided with copies of the many relevant excellent handbooks and leaflets available from shipping companies engaged and specialising in container carriage by sea.

If the contents of just one container are improperly packed or lack adequate securing arrangements or are inappropriate for container carriage and, as a result, break adrift when the ship encounters heavy weather, the safety of many other containers, their contents, and the safety of the ship itself could be at risk. For

Photo 1: Poorly stuffed container – note the damaged packages, the pallet on top of cartons and the apparent lack of securing arrangements

Photo 2: Inspection of goods in container terminal

instance, round steel bars, inadequately secured, broke adrift within a container third in stack on deck, pierced and went through the container's side panels, shattered a corner post of the next adjacent container creating a domino collapse of other units. A single block of granite lacking securing arrangements within the lower tier of a below decks stack, broke through the container's side panel and fell corner down piercing the double-bottom fuel oil tank below. The consequential fuel oil flooding of the hold and lower level damage to base containers was a costly business. As has been said elsewhere: Only the foolhardy believe that a heavy cargo unit's inertia, alone, will restrain its movement during a sea voyage!

Photo 3. Note the damage caused to the container by the poorly secured coils

Of the casualties investigated it is often the case that horizontal spaces – that is fore-and-aft and longitudinally – are more-or-less adequately chocked, but the vertical component is entirely neglected. When a ship is pitching and scending in a seaway, vertical acceleration and deceleration forces acting on cargo components can attain values of 2g. That is, as it goes up and comes down the load upon the securing arrangements will be equal to twice the static weight of the cargo item. If there is no arrangement to *hold down* the cargo securely to the container's floor the cargo will lift, and once it lifts it will start to shift, and once it starts to shift it will go on shifting!

Where relatively lightweight cartons or good timber cases can be afforded tight block stowage, there will be little need for additional securing arrangements. However, where lightweight cartons with frail contents, or plastic jars, bottles and barrels, are to be stowed to the full internal height it may be necessary to provide a mid-height flooring so that the lowermost items do not suffer damaging compression and collapse. (Figs. B & C).

Fig. F

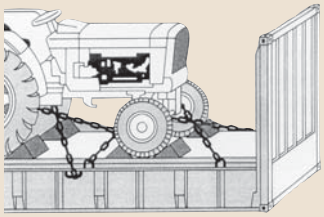


Fig. G

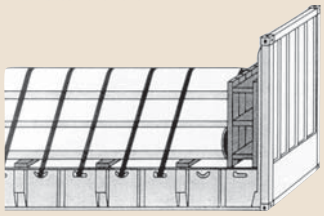


Fig. H

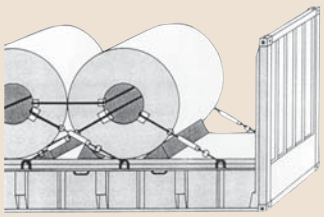
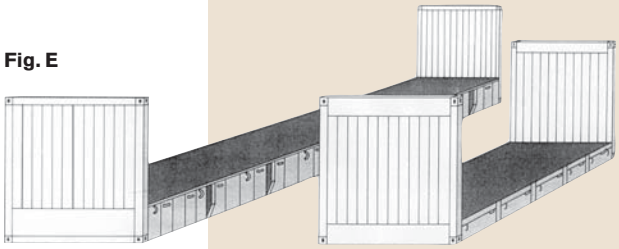


Fig. E



Source: ScanDutch

Where bags, cartons or cases do not occupy the full internal space, then chocking and bracing with timbers and/or air bags is necessary. (Fig. D).

And where heavy items are involved, securing with downward-leading wire lashings and/or strapping to 'D' rings attached to the upper parts of the floor bearers will be required.

So it is important that the correct form of container is used, because not all have provision for mid-height flooring to be fitted, and not all are provided with 'D' rings.

Steel coils, steel pipes and bars, and heavy machinery items should be shipped on specially designed 'flat racks', 'flats' or 'sledges'. (Fig. E).

These units are strengthened for such loads, and adequate securing terminal points are provided. (Figs. F, G & H, for instance.)

It is when such items are packed into ordinary cargo containers that disasters occur.

As the Atlantic Container Lines booklet says to shippers: *"When you have finally packed your cargo into the container, sealed the doors and dispatched the unit, it is extremely difficult to correct an inadequate stow. If your load has not been properly secured or if the packaging is unsuitable the risks of damage to your cargo will increase during transit."*

Containers in stack

Most ISO containers are designed and constructed to allow nine-high stacking *when empty*. They should be placed and must stand on the four lower and four upper corner castings, alone, with the appropriate stacking/locking components between. The bottom and top side rails, the front and rear sills and headers, and the underside floor bearers should remain free of vertical stacking contact at all times if transient wracking stresses are to be avoided.

A variety of securing systems sometimes create problems where ships' officers/charterers' superintendents familiar with one specific system fail to update themselves when faced with something different. It is not possible within the scope of this article to examine the many different fully approved and highly efficient systems in current use, but the Club cannot stress firmly enough the need to comply with, and to fully implement the requirements of, the stowage and securing system formally approved and planned for a particular vessel. All too often, container stack wracking failures occur in non purpose-built vessels because charterers insist on stacking containers in the holds and on the weather-deck in a manner which would not be approved even in a purpose-built ship. Unfortunately, stack collapses within the holds, and within weather-deck stacks, occur just as frequently in purpose-built vessels.

Fig. B

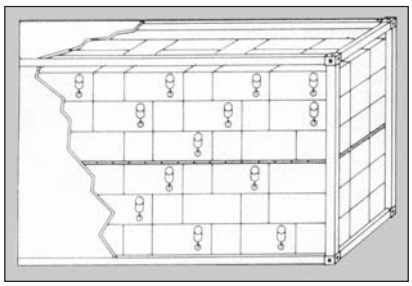


Fig. C

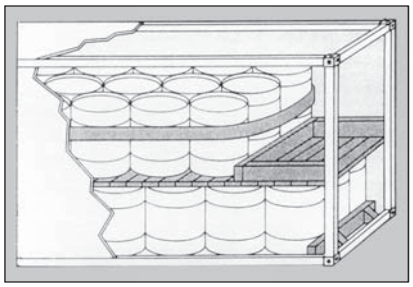
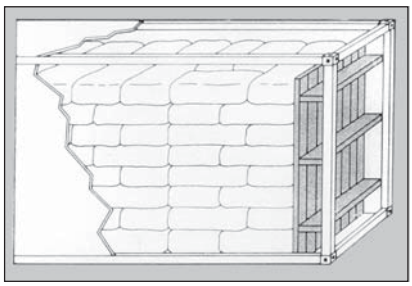


Fig. D



Independent of casualties arising from lack of securing arrangements and use of inappropriate containers as indicated earlier, container stack failures seem to arise from three prime causes, all of which involve unacceptable wracking stresses in one form or another.

Firstly, it is found that container stacks have failed because a fully-approved and fully adequate securing system has become downgraded with time. That is to say, after the casualty all concerned aboard the vessel insist that "we always secure them that way" when what proves to be the case is that, over time, one small recommended aspect after another has been omitted incrementally and successively without casualty until the day that circumstances conspire to subject the stacks to the maximum stress which the system was designed to withstand. Damage and loss result. A chain is only as strong as its weakest link, and a container stack securing system is only as effective as its least efficient component. *Do not omit from a container stack securing system any single component which comprises the full and approved arrangement*.

Photo 5: The ultimate lashing failure

Secondly, and with disturbing frequency, it is found that container structural collapse has occurred due to excessive superincumbent weight in stack. This occurs mostly in chartered vessels where charterers neglect to consult, or deliberately ignore, the stack weight restrictions set out in the approved stacking plans. *It is most unusual for ships to be approved for on-deck and under-deck stacks of 4, 5 or 6 units high in the absence of very rigorous unit-weight restrictions. In other words, an approved stacking plan for 5 or 6 units high may well specify a sliding decrease in weight per unit up to 4 high, with tiers 5 and 6 required to be empty.* Time and again, casualty investigation reveals a blatant disregard for these restrictions.

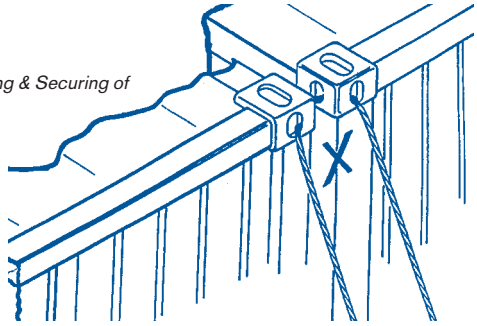
A very large, purpose-built, container vessel was slot-chartered on her maiden voyage to a number of container carrying interests. The Classification-approved plans allowed 6-high stacks in the holds, so 6-high stacks were used throughout. Not a single charterers' superintendent bothered to check the stack plans, so many heavier units were placed in the upper three tiers because of the port discharge rotation. A week before arriving at the first discharge port the base tier containers in Nos. 2 & 6 holds suffered widespread collapse and crushing and tank-tops were pierced. Investigation revealed that the approved stacking plans provided a sliding scale, in which unit height increase should have been traded off against unit weight decrease: 20ft base and second tier units should not have exceeded 20 tonnes; third tier units should not have exceeded 10 tonnes, fourth tier units should not have exceeded 6 tonnes, and the two top tiers should have been empty. Sad to say, anything learnt from that loss appears to have been quickly forgotten bearing in mind that a similar train of events occurred in the same vessel some twelve months later.

The records of all the P&I Clubs combined would reveal the unwelcome frequency with which a similar sequence of events has created widespread damage and loss to containers carried on the weather-decks, and continues to occur. *Don't overload the stack. Consult the stacking plans. A container constructed to accept 8 empty units above it (a total of 20 tonnes) is unlikely to withstand a superincumbent weight of 160 tonnes even when static; when subjected to vertical acceleration/deceleration forces at sea, collapse is almost certain to occur*.

Thirdly, where two 20ft units are stowed on the weather deck in what would otherwise be a 40ft unit position, it is very difficult – in many instances, impossible – to apply wires, chains or bar-lashings to the adjacent end-butting corners. Their absence is not compensated for by using double or four-way inter-layer stackers (spades) or longitudinally positioned screw-bridge fittings, tie-wire, or the like. (Fig. I).

Fig I. A recipe for disaster. Adjacent corner castings should never be loop-lashed like this, or similar.

Source: Lashing & Securing of Deck Cargoes



The problem is that the container stack as a whole, and particularly those units in the base tier, will be subject to excessive wracking stresses should the ship start rolling in heavy seas or pronounced swell conditions. Some compensation can be applied by the use of anti-rac bands (two tensioned metal straps fitted diagonally across the corners of the 'free' ends of the base tier containers) but they suffer from the same inability to secure the 'butting' ends. A full lashing system, properly planned for the dual carriage of 20ft and 40ft units is to be preferred if container losses from this cause are to be prevented

When all else fails – read the instructions!

For further information please contact:
Loss Prevention Department, Thomas Miller P&I Ltd
Tel: +44 20 7204 2307. Fax +44 20 7283 6517
Email: lossprevention.ukclub@thomasmiller.com