Container Securing in Non-Cellular Vessels

In recent years the Club has investigated several collapses of containers stowed in non-cellular vessels. As can be appreciated, incidents of this type give rise to substantial claims. We are grateful to Mr. John Third of Brookes, Bell & Co., for the following description of common securing systems and summary of areas which need attention to avoid container collapses.

Introduction

The multi-purpose vessel developed from a demand for a vessel with a versatile stowage capability, capable of loading containers concurrently with break bulk cargo, while at the same time having flexibility so that plans could be modified to suit the changing situation of freight bookings. In designing such a vessel systems had to be developed to enable secure stowage of the containers, whilst at the same time not impeding flexibility of the vessel's design concept. Cell guide systems, whilst very efficient for container stowage, are an encumbrance to the stowage of general cargo. Independent and interconnecting stacking systems were thus developed to enable safe and secure container stowage on these multi-purpose vessels.

Independent Stacking

This system provides fittings upon the tank top for stowage and securing of individual stacks of containers. These stacks are secured independently at each end so that each stack can stand alone, if required, during a voyage.

This system uses the same fittings and equipment as employed in the deck stowage of containers - namely sliding base locks for the connection of first tier containers to the tank top, and inter-layer twist locks for connection of containers in intermediate tiers. Rods, wires, or chains, complete with auxiliaries, namely corner hooks, turn buckles, "D" rings etc. are used for lashing the stack.

Inter-connected Stacking

The inter-connected stacking system uses special stowage equipment designed to connect adjacent stacks of containers and tie them together across the vessel. Using this system containers are stowed by tier and must be discharged in the same manner.

The primary difference between independent and inter-connected stacks is the use, in the latter system, of double inter-layer cones. These comprise flat, rectangular plates which have a pair of cones at each end on both sides, separated by the appropriate ISO distance. The double inter-layer cone fits between the corners of four containers at each tier level between two adjacent stacks.

The containers are lashed to the tank top and the outboard stacks at intermediate and upper levels are usually provided with compression/tension pieces which connect between container corners and 'tween deck coamings.

Common Problems.

1. Tank top defects

If tank tops have indentations in way of container lashing pads and securing sockets, then stacks of units will not stand perpendicular. Because of the variation in the gap between units in upper tiers it may not be possible to activate twist locks or bridge fittings and double inter-layer cones cannot be used. Differences in the levels of adjacent tiers can occur when one stack is positioned upon a part of the tank top which is locally set down relative to the adjacent area. If these stacks are inter-connected at higher levels the double inter-layering stacking cones are subjected to a bending load from the outset.

In effecting repairs to tank tops damaged by the pressure of heavy container stacks it is essential to give proper consideration to the cause. The problem may well be lack of adequate reinforcement in the double bottom tank below.

2. Securing Points

A lashing requires a good point of attachment to the ship's structure and must be of optimum length, providing restraint in the required direction. Lashings which are too long cannot be tensioned properly with the result that elastic properties of the lashing material assume greater significance when loads are applied.

Lashings are customarily attached to the "D" rings. These may be portable, which engage and lock into tank top sockets, or may be permanently fitted. Both permanent and portable "D" rings should be used and positioned to set the lashings to the optimum length and direction. If an "inside crossing" lashing pattern is used, then "D" rings must align with the corner posts of the container. For an "outside crossing" pattern "D" rings should be no further than one container width outboard and inboard.

3. Fractured Inter-layer Stacking Cones

Double inter-layer stacking cones are vulnerable to fatigue failure caused by repeated bending resulting from movement and flexing of
The rate of failure of double inter-layer cones is directly related to defects or faults elsewhere in the system. If there is any residual tendency for containers to tip during heavy ship motions, due to slack lashings or insecure twist locks, then bending loads occur across the inter-layer cone plates between adjacent stacks. These loads alternate in application as the ship rolls first one way then the other.

The failure of double inter-layer cones warrants careful investigation. A check should be made on the lashing arrangements and upon the structural framework of the bottom containers in the stack. Fractures of door hinges and fractures of bottom rails adjacent to the corner points are indicative of high racking forces. When containers have been tipping corner castings can buckle under the loads. The door ends of containers will normally fail before the fixed ends.

4. Worn Twist Locks

Twist locks are frequently mishandled by stevedores and are thrown down to the decks or tank tops from the tops of containers. Fractures can result which may not be readily detected.

Wear and corrosion also reduces the effectiveness of the locking arrangement. Loose mechanisms can easily fall open, even induced by the motion and vibration of the ship.

Twist locks must be regularly inspected and checked and broken or worn out gear should be discarded.

5. Bridge Fittings

Bridge fittings are designed to transfer to loads in tension. However, spacer pieces are available which provide a capability to transmit compressive forces as well. The use of spacers prevents bridge fittings from being displaced and rendered useless if stacks connected in the upper tier move together. However, bridge fittings with spacers can only be used if stacks stand perpendicular upon the tank tops and correct gaps exist between containers throughout.

6. Compression/Tension Pieces for Connecting Stacks to Coamings

Compression/tension pieces usually take the form of two sections of threaded bar joined by a collar. The assembly can be extended or reduced in length in the same way as a turn-buckle. One end of the device locates into a container socket and the other locates in the hatch coaming. These fittings perform the important function of transmitting forces raised in the stowage into the ship's structure.

The mechanism of this fitting is similar to that of a turn-buckle, and so is the weight. As a consequence the heavy work fitting and tensioning is unpopular with stevedores and crew but is essential for the security of the stowage.

In order for these fittings to fit correctly container corners must align with coamings.

Conclusion

The flexible container stowage systems of non-cellular vessels have both advantages and disadvantages. There is an important interrelationship between the functions of the separate components of the stowage system which allows very little scope for compromise. This is a point which is frequently not appreciated by operators.

Proper and safe securing requires the correct application of the ship's system, but also relies upon regular inspection of equipment and careful attention to maintenance and proper supervision of stevedores and riggers. Shipowners and Managers should ensure that ship's officers fully understand their system and its limitations.