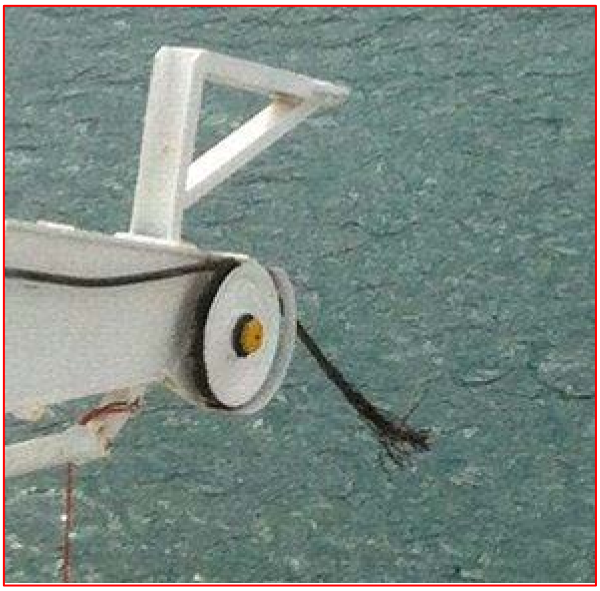
LIFEBOAT INCIDENTS – A REVIEW OF ISSUES

The maritime industry continues to report a high number of accidents involving lifeboats, particularly at drills and when launching boats. Failures have been attributed to both the poor design of hooks and the failure of wires. Many of these incidents have resulted in severe injuries or fatalities. It is fair to say then, that despite the amended regulations and guidance from IMO, including support from the Industry Lifeboat Group, (ILG), a great deal of work needs to be done to prevent reoccurrence of the incidents.

Wire Ropes

Looking at wires first, the current SOLAS requirement is for wires used as falls to be changed out every five years. This is an arbitrary period intended to coincide with docking intervals. It should be noted that in a shore-side environment such as crane operations, a five year change out would be considered unacceptable.

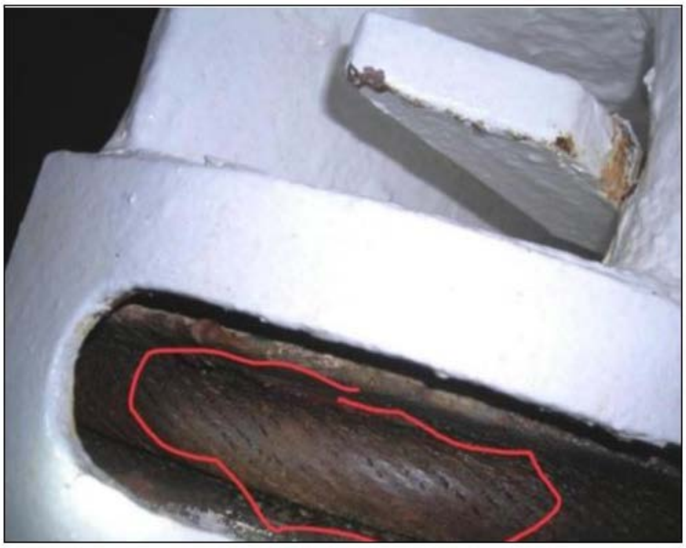
In addition, Regulation 20 of SOLAS III no longer requires wires to be end-for-ended. In an amendment, the end-for-ending has been replaced by an inspection regime to identify deterioration. This means however that the same sector of wire rope could be positioned over the davit and fall block sheaves for the entire five years of service of the wire rope. In the light of recent reports of accidents involving wire rope falls, this policy has to be questioned.



Typical wire failure in way of the davit head / sheave – Picture courtesy BBC News/J. McArthur

Any seafarer who has end-for-ended wire rope falls will be aware that the ropes, when removed from the davits, are usually deformed in way of the sharp turns of the sheaves and do not return to straightened alignment. If a material deforms and does not return to its original shape it has passed its elastic limit and moved into plastic deformation. This is normally taken as the beginning of fatigue and precedes the cracking of surfaces referred to in laboratory reports on samples from failed wire ropes.

Wires often fail at a position around a sheave. They would have been straightened only on those occasions when the boat was lowered. Bending would cause the strands on the outside of the bend to open and expose the inner surfaces to the elements. Unless effectively coated by grease, these surfaces would have relied on their galvanised coating alone to protect them from the corrosive influences of the marine environment. The galvanised surfaces, if deficient in lubricant, would wear and potentially break down. Furthermore, the position, within the throat of the fall block, could be difficult to reach to apply grease effectively. Sensitivities regarding pollution and cleanliness, combined with a desire to limit exposure of seafarers to dangers when working at height, would serve to discourage regular greasing.



Deformed wire strands opening up around a sheave – (Picture courtesy Malta MSIU Report 05/2014 – Figure 19)

Another factor is the type of wire in use. Rope constructed with an Independent Wire Rope Core (IWRC) has greater tensile strength than a fibre core rope of the same diameter, but it is also more resistant to bending and lacks a reservoir for lubricant. Pressure lubrication is most effective with IWRC wire ropes but may introduce further environmental sensitivities. It is noted that a number of failures have involved IWRC when pressure lubrication has not been available on board the ship.

Wire Rope: Inspections and Failures

Inspection regimes for galvanised steel wire ropes have time and time again been proved inconsistent in providing an effective means of judging the safe condition of every wire. Wire failures are almost inevitably preceded by a satisfactory inspection report. This is so even when the inspection has been apparently thorough and carried out by a trained and skilled crew.

The reason is that internal corrosion is almost impossible to ascertain along the full length of the wire without impractical and destructive opening of the lay. Even external corrosion is challenging to identify where the wire has been previously greased. Grease on top of rust hides it very well.

Five-year end-for-ending does not make wear and corrosion consistent over length and offers no guarantee of longevity. Owners and Masters may well wish to consider the following practical steps to assist in preventing failures:

- Consider a maximum life span of a galvanised steel wire rope at sea to be limited to two years. Date of fitting, due date of disposal and three month reordering notices are much easier to track and assist in establishing a reliable maintenance regime. Examination of incidents suggests that corrosion failures occur on wire which has been in service longer than two years. Corrosion failures are therefore preventable. Also consider that the actual cost of galvanised steel wire rope is often significantly less than anticipated. This is especially so with an owner's advanced central ordering at known predictable order dates, where access to competitive suppliers and low-cost sea freight to the ship are easily managed.

- Ensure the length of the wire ordered has sufficient spare length so that annual cropping of one metre of length is possible. Lifeboat falls need sufficient length for the lifeboat to be lowered to the water in the ship's lightest condition with adverse heel of 20 degrees and also still retain at least a minimum of three safe turns on the drum - and preferably much more. If there are plenty of spare turns on the drum at the longest lowering position, then there is room to crop.

- By cropping one metre off the end of the wire at the drum end on an annual basis the points of wear and highest corrosion around sheaves and saddles will move. The opened lay (over or around turns where corrosion first starts deep in the lay), closes back up and is then more resistant to the elements. It is these opened lays in difficult to inspect locations where the corrosion is fatal. Periodic inspection of the adjusted wire may not be effective because the lay has then closed and buried the corrosion within. The older the wire, the more this is hidden from view during every inspection.

- In special cases, cropping both ends by one metre may be preferable. Remember the intent is to move hidden areas around pinch points where the lay will have been opened. Managing hard ferruled eye ends may need to be considered.

The message is clear – the frequency and severity of incidents shows that the regulatory five-year life cycle is inherently flawed. Consideration should be given to renewing competitively – why not do it every two years and order in advance with extra length in order to be able to crop annually? Some forward-thinking ship operators do indeed crop falls at regular intervals, and renew at intervals well inside the five-year cycle.

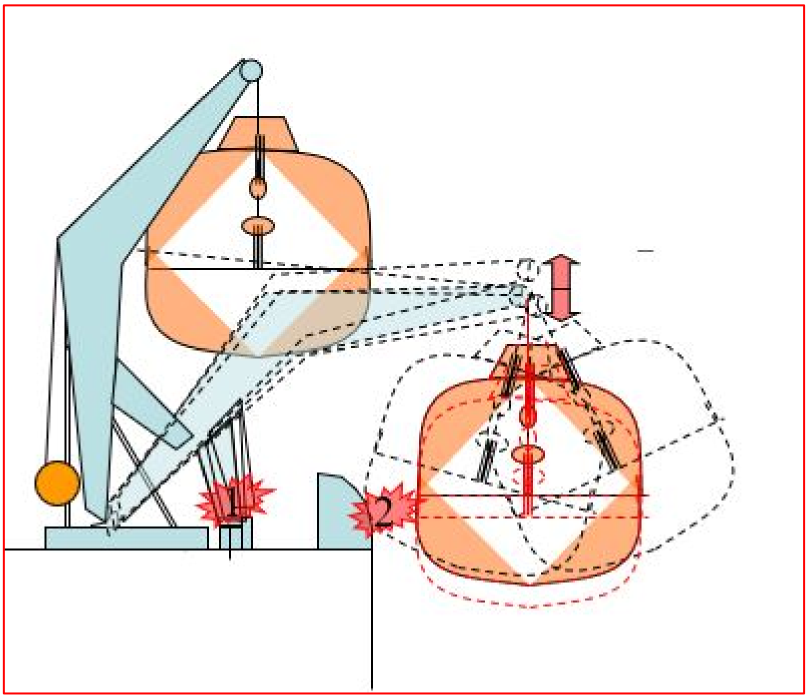
Davits

One method of easing the stresses around a sheave is in the process of securing the lifeboat. The boat is hoisted to the limit switch cut out (or just prior to the blocks if there are no limit switches). The boat is manually wound up to the blocks and then the gripes are secured, which on many designs also engages a securing arrangement for the davit arm itself. Finally, the brake is released, easing the fall blocks on to horns at the davit head, which eases tension in the wire and alleviates crushing pressure on the wire at the sheave. This should ensure that the boat's weight is taken by the davits with no weight on the wire. For this to be effective the davits must be fitted with horns to support the fall blocks. The alternative is for the weight of the boat to be constantly supported by the wire during which time it will also be exposed to vibration from the ship's propulsion and movement in a seaway, all of which contributes to fatigue.

Operation

A state of relaxation of the fall wires is often not fully achieved. It is a failing associated with many modern davit designs. The modern tendency is to use rigging screws to terminate the inboard end of a fall at each davit arm This arrangement requires a cumbersome adjustment of the rigging screw by crewmembers to correct any mismatch between the two davits that may occur during hoisting. Mismatch may occur due to wires not stowing on drums tightly enough before the full weight of the lifeboat is taken. Older designs of davits tended to join the inboard standing ends of the two falls by leading them through friction inducing fairleads. Correction of mismatch was then enabled by the sliding of the conjoined falls through the friction fairleads until both davit arms were fully home. Only when davits are both fully home can the falls be relaxed after gripes are secured and the fall blocks lowered onto the horns at each davit head. The mismatch referred to can occur because the two wire fall ropes are stored on the two hauling drums but they are often coiled in opposite senses. One will be wound onto the drum right handed, while the other will be left handed but the normal convention dictates that both ropes are right handed. Any trained seafarer should be able to identify that the left handed coiling will oppose the stowage and will tend to open each turn of the coil by its internal anti-rotational properties when there is little or no load (at the point where the boat is still afloat prior to being lifted). This in turn will induce gaps in one of the storage layers into which "wedging" of subsequent layers can occur. The end result is the davits reaching their inboard stowage points at slightly different positions, one of them stopping short when the other is "close up".

Wire falls failures may also occur when the davits touch the stands on the main deck during lowering. This initial swing-out phase has a tendency to induce extreme oscillations in the boat if the operation is not conducted continuously. Manufacturers often recommend that the brake is lifted completely clear in order to avoid interim braking that causes the oscillation. The only braking that may occur during this phase therefore is applied by the centrifugal brake, which is designed to limit the rate at which the boat descends to the water. On the initial swing-out this brake will not engage until the full descent rate has been achieved, which in turn means that the davits will contact the deck chocks at full lowering descent rate, or a speed close to it. This in turn imposes a sudden impact as the function of the fall wire is transferred from luffing the davit to lowering the boat. One investigation of deformed lifting rings measured the dynamic shock load on a gravity davit and boat system with an accelerometer. It was found that negative acceleration was able to reach in excess of 1.3g at this stage of the lowering operation, i.e. the weight of the boat more than doubled momentarily. Seafarers may instinctively anticipate this impact and try to cushion its effect by applying the brake early. Whilst this action may alleviate the impact it is also likely to intensify oscillation of the boat and, with it, impacts of the boat on the side of the vessel. It has even been known for a fall block to disconnect from the davit horn when this extreme oscillation occurs. Freeing of the fall block in this way can then cause luffing-in of the davit arm from which it has been freed if the latter is not fully located in its outboard position.



Swingout impacts – (Picture courtesy D. Barber)

Limit Switches

The limit switches referred to in the 'Davits' paragraph above are often magnetically activated proximity switches. Older designs of davit would have been fitted with mechanical switches which could be manually overridden at the beginning of the hoisting operation. The magnetic type, however, are often activated by a plate attached to the davit arm which cannot be operated independently of the davit. This in turn prevents it from being tested when the boat is at a safe height close to the water. In effect there can be no test for such a design of switch. The operator must hope it will operate as the davit ships home or he/she must cease the operation of hoisting upon their own judgement. The operation becomes subject to an untested single point of failure if the operator is slow in their reaction. These limit switches could have activation plates mounted on arms that swing independently of the davit but are brought home by the davit at the final section of the hoist. The independence of the arm supporting the activation plate however would enable a similar manual test at the water's edge as is possible with the older type of mechanical switch. If activation plates are fixed to the davit arms it should be possible to modify the arrangement and introduce an independent arm to support the plate, but any such modification must inevitably be approved by or on behalf of the flag administration.

Hooks

Hook failures have attracted much attention in recent years following an unacceptably large number of incidents, many of which resulted in both fatalities and life-changing injuries. The focus of attention fell on on-load release hooks, which were the normal cause of such catastrophic events. The Industry Lifeboat Group (ILG) was formed over ten years ago and was supported by all the main shipping company organisations, all the seafarer organisations and all the principal P&I organisations. This group, which represents competent industry operational experience, campaigned for a review of on-load hooks but also introduced the concept of the Fall Preventer Device (FPD) as a safety back up, at least during drills. IMO issued a number of lifeboat safety circulars but perhaps the most significant was MSC Circular 1327 in June 2009, which outlined guidelines for fitting FPDs.

Subsequently the IMO Maritime Safety Committee (MSC) revised the requirements for on-load hooks. A new paragraph 5 in SOLAS Regulation III/1 came into force on 1 January 2013. It required on-load release hooks to meet a new standard, which was aimed at achieving designs that do not open inadvertently, a difficult standard to achieve, but many manufacturers have now introduced revised or new designs that are identified as meeting this standard. The changeover for all ships should be completed by 1st July 2019 and until then, FPDs are recommended for drills. Hook integrity may have improved but there is still a human element involved in their resetting. See below.

It should be noted that boats have a centre of gravity biased towards the stern to induce a slight stern trim to improve manoeuvrability. This would result in the load on the after fall being taken before that of the forward fall. The load on the after fall will, because of the centre of gravity bias, be constantly greater than the forward fall. A large proportion of lifeboat suspension accidents initiate at the after fall. It is possible that connection problems may be more likely in that position for a variety of reasons and weight bias would cause a greater opening force on the hook.

Two examples of Freefall Preventer Devices – (Photo's courtesy D. Barber [MCA/BMA])

It is noted that most failures occur during recovery of boats and it is generally accepted that incorrect re-setting of hooks is a common cause of such failures. Seafarers will know that even in the smallest of dock waves it is difficult and often hazardous to effect such resets and reconnection to the falls. It is therefore imperative that FPDs are attached before the hoist continues from a safe distance just above the water. Once safely stowed all hooks can be checked for correct re-setting. Even if the new pattern of hooks are fitted, masters may feel that it is still safer to incorporate the back-up of the FPDs. It is still possible to re-set even the new designs incorrectly and the in-water position is far from the ideal environment to effect this important operation. It should be remembered that the lifeboat is primarily designed for escape but during drills the recovery is an additional activity that is not covered in detail in SOLAS regulations. It is for the master to operate the system effectively and safely. He/she has the responsibility. He/she also has the authority to enforce any additional measures considered necessary at the scene. Whilst it may be acceptable to reduce the connection of the lifeboat to a single action of disconnection in an emergency, this level of exposure to risk would normally be considered unacceptable, even reckless, in routine operations. Even though the possibility of inadvertent opening is supposedly reduced in the new pattern hooks, why rely on the single connection? The pair of hooks jointly make up a single suspension system; they cannot support the boat in individual isolation. A second level of safety is provided by FPDs, but providing an alternative load path or pins or similar method of securing the release mechanism closed would be a wise precaution during drills, especially for recovery - which is a routine, not emergency, operation.

Another type of preventer is the pin type that locks on-load hooks closed – (Photo courtesy D. Barber)

In September 2017, BIMCO reissued their pamphlet "Avoid Lifeboat Accidents" as a free resource. Amongst other things it features a detailed guide relating to the use of FPD's, and is recommended reading to complement this paper.

Summary

Many incident reports tend to either blame the crew for a lack of greasing or maintenance, and attribute the cause directly to human error or simply focus upon the wire/hook failure. This is unfortunate since it diverts attention away from serious design issues that will, if left in place, continue to maim and kill until the true root causes are recognised and acted upon.