



AVOID LIFE BOAT ACCIDENTS

**A guide for safe launching and
recovery by using fall preventer devices**

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Lifeboat accidents resulting in fatalities and injuries have been occurring for several years despite efforts taken to reduce them. Historically, most of the accidents have happened in boats using conventional davits and on-load release systems. However, in some more recently reported incidents other parts of the suspension and lifting systems have been identified as the points of failure, notably wire rope falls, particularly on larger lifeboats.

The purpose of this guide is to help you decide whether additional precautions in the form of Fall Preventer Devices (FPDs) are appropriate, and if so, when and how to use them safely and effectively. Other failure modes are also addressed briefly. Hooks, even of the latest pattern, remain exposed to human error during operation and care should always be taken.

The use of FPDs is recommended by the International Maritime Organization (IMO) because:

- many accidents have resulted in fatalities and injuries to seafarers
- exposure of seafarers to unacceptable risks calls for an urgent solution to the problem

FPDs are intended to be an interim measure until new, safe, IMO approved systems are available. Development, testing and certification of these systems will, however, take time. So, routine use of FPDs can therefore realistically be expected to be in use for many years.

It is recommended to always use FPDs, if the connection of the boat is considered unsafe. Even a new type of hook may be considered unsafe if its resetting prior to recovery cannot be verified, eg due to movement or conditions affecting the waterborne boat.

Following the agreement of IMO standards, some systems do exist that comply with the standards defined in the International Life-Saving Appliance (LSA) code 4.4.7.6.4 to 4.4.7.6.6. These standards are designed to avoid the accidental activation of the mechanisms and the potential catastrophic consequences. It is unlikely, however, that the potential for human error can be eliminated completely without adding undesirable complexity to systems. Masters will remain responsible for the safety of their seafarers and should, therefore, consider the continued use of FPDs as routine to reduce the risk of a failure of the on-load release system.

It should be noted that several accidents have occurred during the recovery of lifeboats from the water. Various causes have been identified including:

- failure of wire rope falls during stowing due to weakened ropes
- when limit switches fail to operate
- failure to secure the connection properly enabling inadvertent opening of the hooks.

Space limitations, movement of the boat and difficulties in manoeuvring can contribute to an incorrectly secured connection. This may be difficult to detect in a remote location when the boat is still in the water. For this reason, it would be good practice to continue to use FPDs as a secondary safeguard regardless of whether the hook is of an old or new type. Familiarisation training should include how to correctly connect FPDs.

On-load release system

An on-load release system allows the boat to separate from the falls when the full load of the boat is still on the connection device. In most cases, this requires an assembly designed so that when activated, the hook rotates to the open position under the influence of the weight of the boat, allowing the link attaching it to the fall to be released.

Off-load release hook

An off-load release hook is a hook that can only be opened if the load is relaxed from the falls, as would occur when the boat becomes waterborne.

FPD

A fall preventer device (FPD) is a system which prevents the unintentional release of a boat due to failure or misuse of its main method of connection to the fall wire(s). An FPD, contrary to other forms of keeping the boat in place when carrying out maintenance, goes with the boat all the way down to where the boat is intended to be released from the fall(s).

Note: FPDs should only be necessary if the method of connection of the boat to the fall(s) -usually a hook- incorporates an on-load release system.

SSD

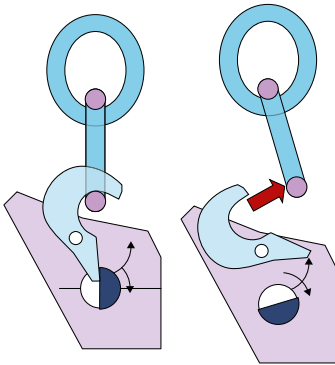
A secondary safety device (SSD) is a mechanical intervention built into the assembly of an on-load release system. The SSD would usually be a pin inserted into the moving parts of the assembly to prevent their movement. Other arrangements are possible such as linkages within the mechanism that block the release capability. SSDs have been classed as a type of FPD in circulars from the IMO in which they are referred to as “pins”. Like FPDs, SSDs should be used as a safeguard against single point of failure when the boat is not in the water.

Identifying on-load release systems

Many designs of on-load release systems exist. If they are not fitted with a built-in SSD, then a sling or strop FPD should be used on each hook.

One very common type of hook uses a rotating cam. Its operation is described below

On-load release cam type: Note that the link is typically offset from the pivot point of the hook, creating an opening effect if the tail of the hook is released.¹



The left image shows the hook engaged. The right image shows the hook released. The cam has been rotated to the horizontal position and the tail of the hook is free. Because the line of upward force exerted by the fall is off-set to the right of the pivot point, this causes the hook to rotate and release the link to the fall.

The rotating cam system shown here is one among many systems used. The on-load release system fitted to the boats should always be studied closely to fully understand how the hook is released safely.

¹ This type of cam using a flat surface is likely to be phased out because of its properties that allow transmission of forces back through the operating system. Its replacements use similar principles of operation that, although the reverse force effects are reduced or eliminated is still able to be inadvertently operated or incorrectly reset.

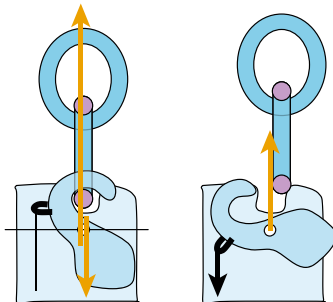
Identifying off-load release hooks



Off-load release. The hook can only be opened if the load is relaxed, as would occur when the boat becomes waterborne.

Off-load release hooks are most often found in open boats constructed before 1 July 1986. The pin, about which the hook pivots, is directly in line with and beneath the position at which the link contacts the hook (see figure “off-load release” below). The weight of the boat, with forces acting in the direction of the orange arrows, prevents an opening force on the hook (left below). The hook can only be opened when relieved of the load when the boat becomes waterborne (right below). Off-load hooks usually have a remote operating connection between the hook and the helmsman but can also be operated locally at the bow or stern of the boat.

Off-load release



FPDs are not required with off-load release hooks.

Are all on-load release systems suitable for FPDs?

Regrettably, the designs of some on-load hook systems are not suited to FPD use. Some boats have hooks with no hanging-off arrangements. These are the connection points, usually situated close to the hooks but separate from those from which boats may be suspended during maintenance of the hooks. Most often these points are padeyes or lugs but can also be separate fixed hooks. If boats are fitted with on-load hooks without hanging-off arrangements, the only method of rigging FPDs is to fit a hanging-off point, which might need to be retro-fitted to the boat. If any such modification is made it should always be done under competent engineering supervision and approved by the flag state.



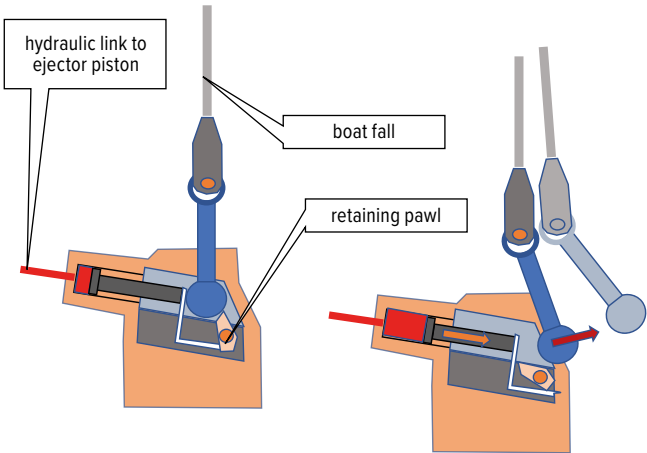
This arrangement, because of the restricted nature of the area enclosing the hook (orange arrows), will be extremely difficult to modify for FPD attachment.

Source: Bahamas Maritime Authority

Alternatives to hook systems

6

A number of innovative methods to connect a lifeboat fall to the lifeboat are available. A good example is the ball and socket system, which is an off-load connection with a hydraulically operated on-load facility. The mode of operation is illustrated below:



The system does not need the use of FPDs. It already possesses a check SSD in the form of the retaining pawl. The pawl operates automatically and returns to what could be described as the “guard” position.

On-load release systems are also used on rescue boats

Most rescue boats are designed for single fall wire launching, for which there is no mandatory requirement for an on-load release capability. Whereas an on-load release capability is a mandatory requirement for lifeboats, which are designed for twin fall wire suspension, off-load release works effectively when it does not have to be synchronised between two falls.

Many single fall rescue boats are, however, fitted with on-load release hooks. It is, therefore, important that you inspect the types that are found onboard your ship and apply FPDs if appropriate.

It is possible to confuse on and off-load systems in rescue boats as some off-load systems are fitted with a spring-loaded mechanism that can “pre-cock” the hook so the load is relieved by the boat becoming waterborne. Some of these systems may be dangerous because the load may be released so that the mechanism is activated when presumed under load. This can take place by a sudden lowering, bouncing action of the lifting gear due to sudden stops or snagging of the craft during descent.

To safeguard against this some designs incorporate an SSD in the form of a pin. If that is not the case, an FPD can be rigged at the same position as the hook but it must be independent of the moving parts of the hook.

What are FPDs?

FPDs may come in two forms:

1. Strops or slings made of synthetic fibre, with a strength of at least six times the safe working load that is assigned to the fall wire connections being protected and arranged to form an alternative load path in the event of failure of the main means of suspension of a boat.

or

2. A mechanical intervention – also known as an SSD – in the hook or other suspension connection on the boat that prevents incorrect operation.

Examples of each type are shown below.

Alternative load path (strops or slings)

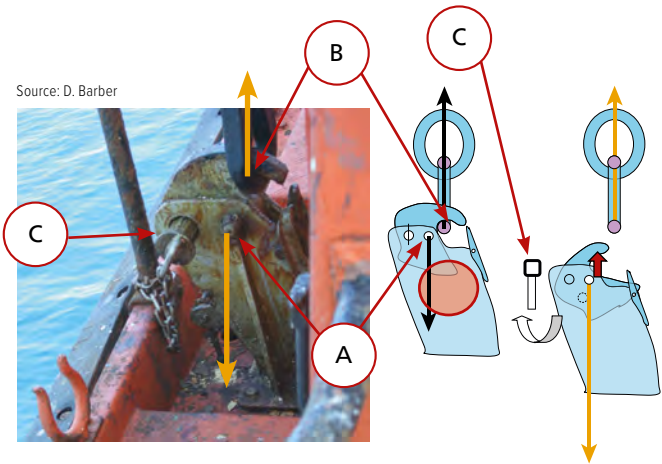
Concept of the alternative load path is best described pictorially:



Alternative load path (arrowed Red) provided by a sling type FPD where disconnection of the main load path (hook and link arrowed black) has taken place.

On-load (with SSD)

The pin (A) about which the hook pivots, is offset from the suspension point (B) of the ring in the hook jaw. If the SSD pin (C) is removed and the hook mechanism released, the hook will rotate under the influence of the weight of the boat.



Source: D. Barber

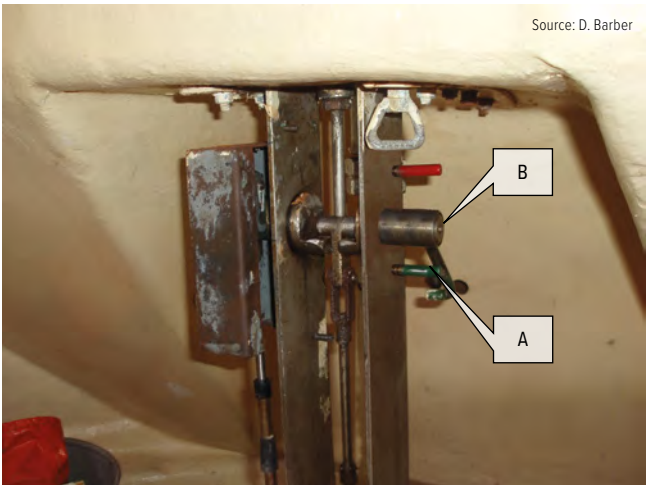
Example showing an on-load hook with pin type FPD/SSD.

In the photograph, the pin has been partially withdrawn to illustrate the ease with which it can be removed if the hook is correctly locked. The diagram (right) illustrates the method of release of an on-load hook with load offset from fulcrum after the SSD has been removed. See detail of the release system (ringed and shaded red).

As long as the pin is in position, the hook cannot operate as an on-load release mechanism. It is, therefore, important that it is removed before the boat reaches the water but not before the boat is within a safe distance above the water (1m or less). It should always be replaced in the reset hook before hoisting.

Under-deck SSD

This type of SSD is positioned below deck. It is of particular relevance on tankers. The advantages of the sheltered environment, however, apply not only to tankers but to any boat, as it protects the crew members from dangerous contact with the heavy connecting links or fall blocks when they are disconnected but not yet clear of the boat.



This arrangement is below decks, making it easy to sight and check that the hook mechanism is set without exposing crew to dangers outside. Pin **A**, attached to the operating mechanism is prevented from moving downwards to its release position when it is blocked by the hook **B** – the SSD – which must rotate upwards (away from the observer) and be clear to allow activation.

Why use FPDs?

You should use a FPD because it protects you if the boat is unintentionally disconnected from the falls.

For that reason, use of FPDs should be part of the training on board and you should be as familiar with them as other parts of the operational equipment in the boat.

Training

Crew training should incorporate operations that have to be carried out at the bow and stern hooks, including FPDs. Hook arrangements always require clearing away when released and the recovery process makes local operations at bow and stern necessary because they cannot be performed remotely.

When to use FPDs?

FPD's should be used when you launch or recover a lifeboat or rescue boat without SSDs:

- if the design of the boat uses an on-load release system for connection to the fall wire(s)
- whenever the boat is not secured in its stowed position
- whenever the boat is not within a safe distance of less than one (1) metre above the water or fully waterborne.

This applies to all non-emergency operations – most typically drills – but also when boats are used as tenders for transferring personnel or during maintenance.

The use of FPDs or SSDs should, therefore, be routine during training and maintenance operations and, subject to the master's discretion, during emergencies¹.

On-load hooks can also be used in boats other than

¹ See also "Should FPDs be used in an Emergency" on page 17.

enclosed or semi-enclosed lifeboats; for example rescue boats.

Source: D. Barber



Above: A rescue boat with an on-load hook using an FPD between the fall and the firm connection below the on-load release hook, by-passing the hook and providing an alternative load path in the event of premature release.

Other hazards

It should be noted that FPDs will not prevent all accidents and it is still very important to check the condition of wire ropes regularly, especially when in use as falls or other lifting arrangements. Wire ropes that are encapsulated in plastic sheathing are particularly prone to undetected internal corrosion. This has resulted in many accidents. Encapsulation should be removed to give a clear view of the wire rope during inspection. An alternative may be to replace such wire ropes (usually in lifting arrangements such as bridles) with a fibre equivalent but any such replacement should only be made with full approval of the flag state.

Limit switches on davits may fail. A system should be devised for accurately testing such switches before any critical stage in the hoisting procedure. This test should be conducted on every occasion that the boat is hoisted into its stowed position, even if only swung out and not lowered.

When not to use FPDs

The need to use FPDs is not universal. Their purpose is to prevent accidents where potential risks exist. They are unnecessary if no such potential risks exist.

Lifeboats with (pre-1986) off-load hooks do not require FPDs because they cannot inadvertently disconnect while loaded.

Rescue boats with off-load hooks also do not require FPDs for the same reason. **It should be noted, that in designs with spring-loaded release pre-sets, these should not be cocked until a safe distance (1m) above the water.**

Similarly, a system of fixed hook and suspension ring does not need FPDs as they, like off-load systems cannot release while loaded.

Should FPDs be used in an emergency?

Views differ as to whether it is wise to use FPDs in an emergency. In deciding which strategy is appropriate, the full risk should be assessed on the basis of the influencing factors, including crew competence.

Against using FPDs	For using FPDs
FPDs are a hindrance during evacuation in an emergency	FPDs are no more a burden than putting the plug in, releasing gripes, starting engine etc.
Most accidents occur during drills	Emergency situations are untested
Failure to disconnect FPD may cause an accident	Failure of unguarded connection will cause an accident
	A heavily loaded boat is more likely to fail
	More people exposed to intolerable consequence (fatality or injury)
FPDs expose crews to fire or dangerous fumes (tankers)	Most evacuations do not involve fire or dangerous fumes

Procedures

Before any lifeboat or rescue boat drill the following should be established:

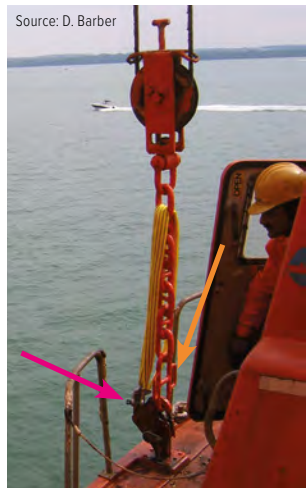
You should thoroughly inspect the FPD attachment points to ensure they are suitable for that purpose. Mistakes can be made and FPDs can be attached to connections not intended to support the weight of the boat.

You should take care not to confuse lifting points with mooring points or guard rails.

Any attachment point should be either part of the main connection assembly or connected through the deck to the keel in the same way as the main connection assembly.

Most hooks have hanging-off points for use when maintaining the hook (magenta arrow below). These attachment points should be identified and clearly understood by all crew trained for the operation of the lifeboats.

The best use of a sling type FPD is to pass the sling through a link of the suspension system and attach both ends to the hanging-off point (pictured on the right). You should ensure that the link bears the full load. Connecting links frequently have hand holds on either side of the main link (orange arrow). These are not intended to support the weight of the boat.



Source: D. Barber

An on-load release hook with FPD attached at hanging-off lug (magenta arrow).

Some boats have more than one point to which FPDs can be attached. The arrangement featured below is highly suitable for FPD use because the attachment points are close to the operator working hatch and away from the main suspension connection.



An on-load release hook with FPD attached to two lugs that are part of the main hook assembly.

Materials

FPDs: Slings and strops

Slings (below) are preferable to strops because they are a loop with limited points of weakness.



A typical sling type is enclosed in a sheathing that protects it from chafe, chemical attack and ultraviolet degradation from sunlight. The latter property allows slings to be left in place rather than stowed in a locker.

If during launching, a hook releases prematurely and the load is taken by the FPD, resilient slings can, when the boat reaches the water, be removed quickly. If necessary this can be done by cutting.

Slings are usually softer and easier to handle than strops.

Strops (below) incorporate splices for the loops at each end. Each splice (arrowed), which may be a sewn joint in a strap type strop, is a weaker point of the whole strop. In addition to this, the loops take up valuable length, which



may be inconvenient in circumstances where the FPD has to be particularly short.

IMPORTANT: FPD slings or strops should not be constructed of wire or chain. These materials lack the elasticity necessary to absorb shock loads.

The following photographs illustrate arrangements that are unsuitable as FPDs:

Source: D. Barber



Inappropriate materials: Strop is made of material with insufficient strength and resilience. The splices are also of an unsuitable type relying on friction hidden within the crimping and with no visible locking arrangement.

Source: D. Barber



Insufficient strength: The strop is constructed from rope that will probably have resilience to absorb some shock loads. BUT the dimension of the rope is too small to withstand the full shock load that might be expected in a failure of the hook.

Wrong purpose: The strop and link being used here is actually a recovery strop for use when the boat is being recovered in adverse conditions. It is constructed of materials that would be of suitable strength but because it is rope, as opposed to a sling, it is larger than is desirable for ease of handling as an FPD. It is also far too slack and it is rigged through the connecting link over a part that is not intended for load bearing.



Source: D. Barber

Sequence of actions (Sling type FPDs):

1 Before starting

While the boat is still in its stowed position, you should ensure that the FPDs are attached, or connected correctly.



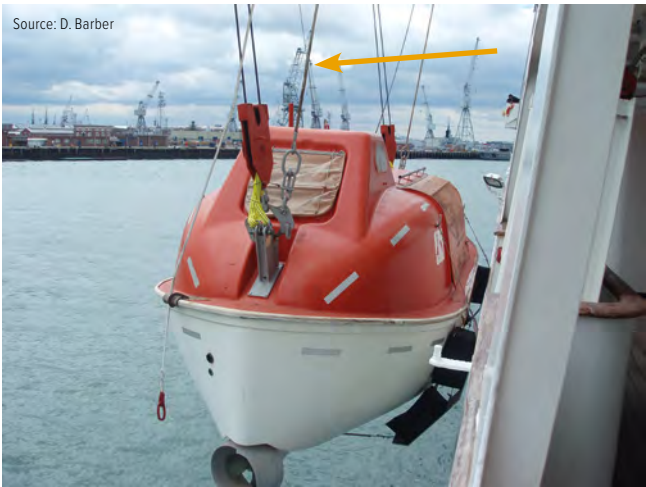
In this arrangement the connection lacks a chain or links between the fall block and the hook. It has been possible, however, to lead the sling through the gap below the block sheave and attach each end to separate hanging-off lugs on the hook assembly.

2

Swing-out for boats with outboard boarding arrangements

The boat is released from constraints such as gripes and swung out.

Tricing pendants (orange arrow) are rare in modern enclosed boats. The boats on cargo ships are normally arranged to be boarded in the stowed position and if so, they would not have tricing pendants. On a cargo ship the boat normally can be lowered without further release actions.



The boat in the photograph is on a small passenger vessel and is therefore arranged to embark in the outboard position with tricing pendants seen sharing the load with the main falls. These must be disconnected before any further lowering takes place.

3

Water's edge

When the boat reaches the water, or is a safe distance (less than one (1) metre) above it, you may remove the FPDs.



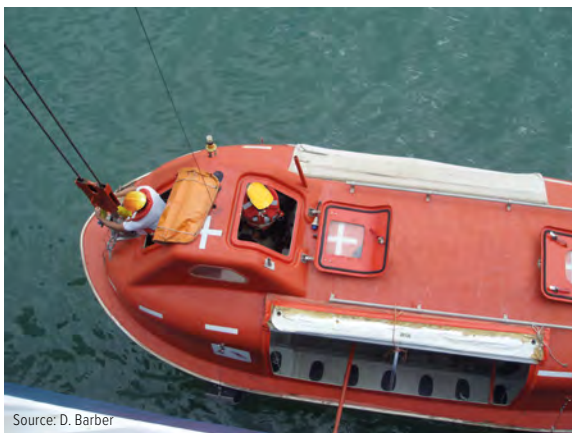
Source: D. Barber

Boat is close to water. FPDs could be disconnected from this position.

4

FPDs disconnected

Once FPDs are removed and the boat is waterborne you can release the hook.

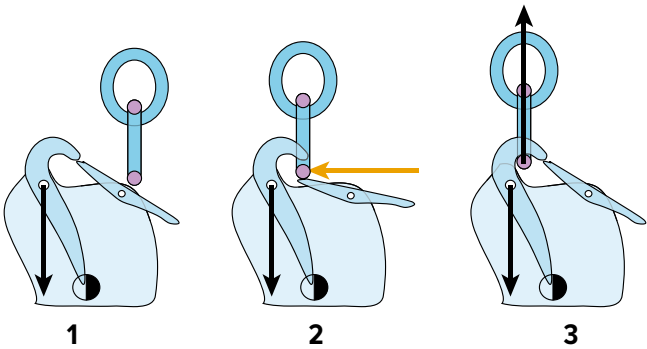


Source: D. Barber

FPDs are disconnected.

IMPORTANT: If the hook releases prematurely, FPDs will be under load and should remain in place until the boat becomes waterborne. They may then be removed as the load is relieved. Disconnection in an emergency could be achieved by cutting the FPD if the load remains, but extra care should be exercised in such circumstances to ensure the boat is waterborne before the FPD is cut.

If SSDs are used, the disconnection will have to await the boat becoming waterborne. Then, if the pin or other device has jammed (if it cannot be withdrawn or disengaged) the release may still be effected by lifting the ring clear through the gate of the hook - the reverse of the insertion process illustrated below. The hook can be treated as though it were a fixed hook. Such close contact with the hook does expose the crew member to potential injury and extra care should be taken.



Gated hooks allow for the hook to be locked securely before engaging the lifting link.

1. On-load hook with gated aperture. Hook locked. Link still free.
2. On-load hook with gated aperture. Hook locked. Link being inserted through gate.
3. On-load hook with gated aperture. Hook locked. Link engaged.

Sequence of actions (Sling type FPDs):

1 Manoeuvre into position



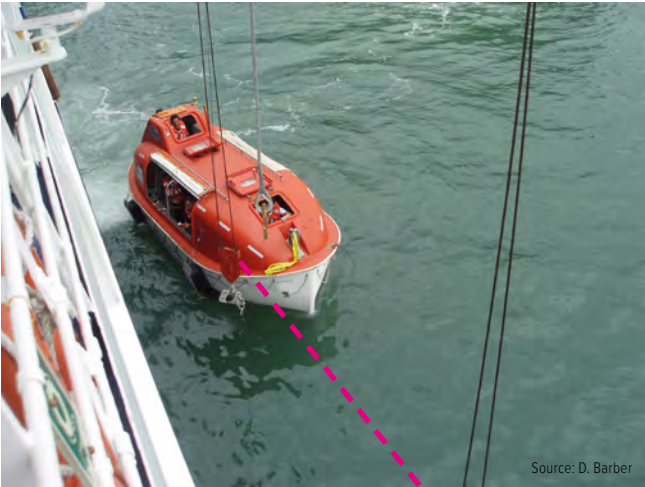
Boat manoeuvring into position below falls.

To make the connection, the boat must be manoeuvred beneath the falls so that they are both within reach of crew members stationed at the forward and after hooks. Effects of wind deflected off the mother vessel's side and currents flowing past the moored vessel can often lead to several attempts to achieve the position and make the connection. Visibility from the helmsman's position (due to enclosed design of boats) is often impeded, which makes the manoeuvre even more difficult.

Handy tip: A useful assistance in the above circumstances can be provided by joining the two fall blocks with a light “capture” line (up to 10 mm in diameter). The line, represented in the figure for

section 2 by a dashed magenta line, allows the boat to intercept both falls simultaneously by capturing the line by any member of the crew within reach. This allows for a certain amount of inaccuracy in positioning the boat. The falls can then be passed to the crew members at bow and stern for connection.

2 Approach to connection



Final approach to falls.

The final approach is the most difficult manoeuvre for the helmsman. In the case pictured above, several attempts were necessary to finally position the boat correctly so that both falls could be reached. If the capture line suggested (superimposed dashed magenta) had existed, it could have been captured by a crew member with a boat hook, eg from the main entrance.

3 Connection



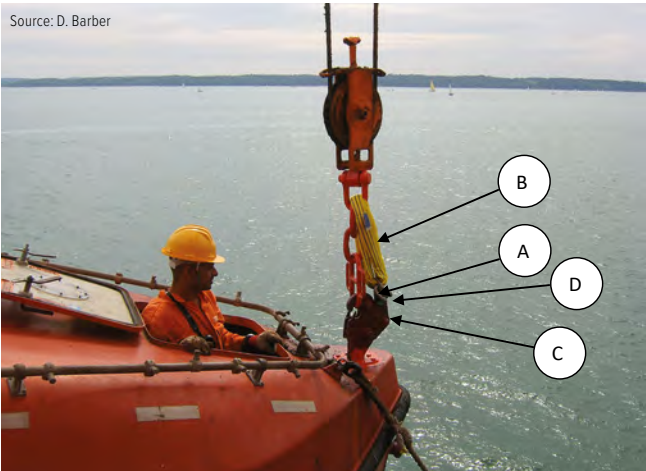
The boat is in position and the main lifting link has in this case been connected. Before hoisting the boat, however, the FPD must be rigged. The FPD is connected to one shackle and its opposite end will be connected by another shackle to the opposite lug (yellow arrow) after being passed through the bottom of the fall block.

IMPORTANT: If you have a cam type on-load release system, it is essential that the cam is set so that the surfaces of the cam and the hook are fully engaged (flat to flat full surface contact). Partial engagement can allow the weight of the boat to override the resistance of the cam and rotate it to the open position.

The process of reconnection will vary between different boats. In the example shown on previous pages, the absence of extra links between the lifting link and the fall block has made it necessary to use the bottom of the fall block itself as the point through which the FPD is led to provide an alternative load path independent of the hook. At this point, if the hook cannot be reset for any reason

(usually motions from waves), the lifting can be achieved by connecting the FPDs to the hanging off points and lifting the boat on the FPDs. Such a move will require the boat to be hung-off when it reaches deck height.

Compare the previous picture with the picture below of another boat:



FPD well rigged, using tested shackle (A) as FPD (B) connected to hanging-off lug (C). No slack in FPD. (Note: Spare shackle (D) is for hanging-off)

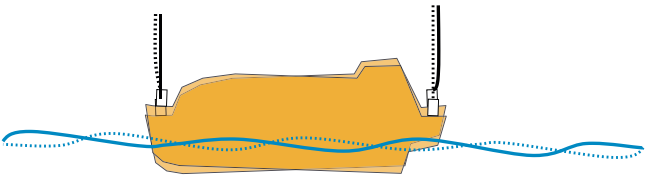
In both cases the chance of a catastrophic accident involving a falling boat is reduced by using:

Fall Preventer Devices — FPDs

Resetting of hooks

During even the smallest movement in the water, resetting a hook with a suspension link in place is almost impossible due to the hook being repeatedly forced open by the lifting action of the link before it has been possible to lock the hook.

(see figure below):



The operation also involves exposure of the operator's hands to potential injuries.

Such difficulty increases the need for an FPD or SSD arrangement to provide an alternative load path (FPD) or lock the hook (SSD) during recovery from the water. If hooks cannot be set with certainty, FPDs/SSDs should be attached/engaged first. It is important that before any boat with on-load release is lifted above a safe distance from the water², the potential for unintentional release of the boat is eliminated by connection of FPDs or locking of the hooks by SSDs. SSDs are best engaged before any load is taken by the falls because if the mechanism has any misalignment they will probably be impossible to engage.

¹ Because of movements due to sea conditions it is probably realistic to connect the boat, lift it clear of the water, stop the hoisting and connect the FPDs. In circumstances where connection proves impossible, FPDs should be connected first using their softer properties as protection of operatives.

Note: It is possible to lift a boat on strops or slings (which may include the FPDs) alone using the hanging-off lugs for attachment. The hooks can then be reset in a more stable location when hung-off (see Maintenance paragraph in next section).

Source: D. Barber



IMPORTANT: If FPDs are subjected to a shock load as in a malfunction of the hook or recovery in extreme sea conditions without hooks they should be replaced.

Maintenance

Poor maintenance is often cited as a cause of failure of on-load release systems and there is some truth in this. Some designs do not allow for easy access to carry out maintenance but it should still be done. The following procedures can assist. Some arrangements (pictured) do not include lugs or padeyes on the davits to match the hanging-off arrangements on the boats. Good seamanship however, using the same materials and principles as the FPD to attach hanging-off slings round the arms, can overcome this difficulty. (see below)

Source: D. Barber



The davits lack a load-tested hanging-off point. A long sling of suitable working load limit however can be rigged around the davit in the fashion shown. See below.



Load taken on hanging-off pendant and hook opened for maintenance (and training). Note position of rigging pendant on davit ensures the boat is “triced” firmly alongside the ship. This forms a stable platform for operations.

BIMCO is the world's largest international shipping association, with 2,100 members in over 120 countries. Our global membership includes shipowners, operators, managers, brokers and agents.

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For more information, contact BIMCO at:

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The logo for BIMCO, featuring the letters 'BIMCO' in a bold, white, sans-serif font. A horizontal line is positioned above the letters 'I' and 'M', extending slightly beyond them on both sides.

BIMCO

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