U.S. Department of Homeland Security

United States Coast Guard

BOAT CREW HANDBOOK – Boat Operations

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B.2. Towing Pendants and Bridles

It is not always possible, appropriate, or safe to attach a towline from the stern of a towing vessel to a single point on the bow of a distressed vessel. For instance:

(01) The distressed vessel's deck layout may not have a single direct run through a bull nose.

(02) There might not be a sampson post or centered bitt.

(03) The towline might be too large for deck fittings.

(04) Deck fittings may be improperly mounted, rotted or corroded where they attach to the deck.

In these cases, a pendant or bridle should be rigged. The pendant or bridle forms part of the tow rig, leading from the eye or thimble of a towline to the appropriate location(s) or deck fitting(s) on the towed vessel. Towing pendants and bridles are made of double-braided nylon or Kevlar. The two most common rigs are a pendant and a bridle.

NOTE

Auxiliary facilities will have a variety of pendants and bridles, not necessarily constructed of double-braided nylon or Kevlar.

When possible, pendants and bridles should be used with breaking strength equal to or greater than the towline.

B.2.a. Pendants

A pendant is used to reduce wear and chafing at the towline end (particularly the eye and its splice). A pendant must be long enough so the towline connection is clear of obstructions on the towed vessel (see **Figure 3-3**).

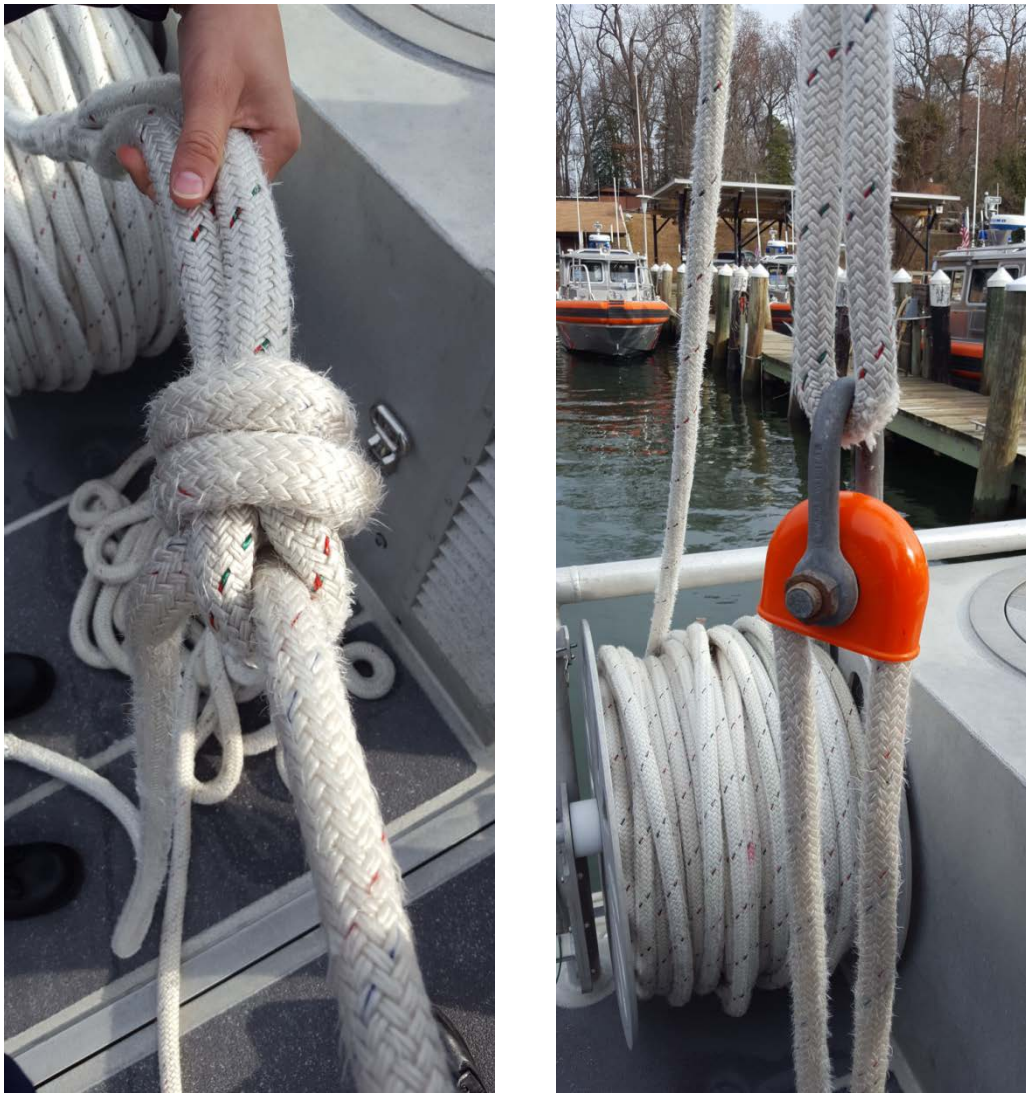


Figure 3-3
Pendant

B.2.b. Bridle

A bridle or "Cats Paw" is used when both legs can be rigged to exert an equal pull on the hull of a distressed vessel, and is preferred for heavy weather towing (**Figure 3-4**). A bridle provides the best results where a towed vessel deck fittings (chocks and cleats or bitts) are not right at the towed vessel's bow (as a bullnose), or where obstructions (bulwark or rigging) on the bow prevents a pendant or towline from making a direct lead back to the towing vessel. Use the following list as a guideline for attaching a bridle for towing:

(01) Use a long bridle when the best attachment points for the towed vessel are well aft to either side of the deck, but maintain a fair lead forward to reduce chafe.

(02) Remember that the amount of tension on each bridle leg increases with the size of the angle between the bridle legs.

(03) Keep the legs of the bridle long enough so the angle of the legs stays less than 30°.

(04) The legs must be long enough to reduce towed vessel yaw.

(05) Protect bridles with chafing gear when necessary.

(06) Use thimbles in the bridle leg eyes where they meet.

(07) When shackled to the towline, remember to mouse the shackle pin.

A bridle is also used by towing vessels without centerline towing capability or with transom obstructions (outboard motors or rigging). The bridle is attached to fittings in a manner to clear the obstructions. Again, bridle leg lengths must be equal to share the strain of the tow.

Figure 3-4
Bridle/Cats Paw

B.2.c. Pendant and Bridle Condition and Inspection

Safe and efficient towing requires undamaged, serviceable pendants and bridles. Crewmembers should inspect pendants and bridles on a regular basis to detect damage and to ensure bridle leg lengths are equal. For nylon pendants and bridles, the towline condition and inspection list provided in **B.1.b. Towline Condition and Inspection** should be used.

NOTE

Inspect towlines, pendants, and bridles after each tow and whenever shock loading has occurred.

Heaving Line

B.3. Description

A towline is too heavy to cast more than a few feet. In rough weather or when impossible to get close enough to throw a towline to a distressed vessel, a heaving line should be used to reach the other vessel. A heaving line is a length of light line used to carry a larger line between vessels.

B.4. Passing a Towline

In most cases, a heaving line or float line will be used to make the initial pass to the vessel in need of a tow. To pass a towline with a heaving line, one end of a small line is attached to the end of the towline and the other end is cast to the other vessel's crew.

The lighter line is used to pull the towline across the distance between the vessels. Sometimes, multiple lines are used as heaving lines.

B.4.a. Heaving Line/Throw Bag

A heaving line is made of light, flexible line with a rubber ball or a monkey's fist at the throwing end. A heaving line must be in good condition, at least 75 feet long, and free of rot or weathering (see **Figure 3-5**).

The bitter end of a heaving line is attached to the towline with a clove hitch, bow line, small carabiner, or snap hook. Slip clove hitches may work best in very cold weather because they are easier to untie. The longest heaves are cast downwind, but this may not always be possible. The throw should be targeted above the center of the vessel so the thrown line crosses over the deck and avoids breaking glass or injuring people.

CAUTION! Always yell "heads up" before throwing a heaving line or ball. They can cause damage to property or personnel.

Figure 3-5
Heaving Lines

B.4.b. Float Line

To reach a vessel beyond the range of a heaving line or in an inaccessible position, a buoyant synthetic line may be floated from upstream or upwind. One end is tied to a ring buoy or float, the other end to the towline, and the float line is thrown downstream in the direction of the distressed vessel. The current or wind will carry the float line toward the other vessel. This method is only effective if the wind or current can get the float within range of the other vessel.

Chafing Gear

B.5. Description

Chafing gear protects towlines, bridles, and pendants from wear caused by rubbing against deck edges, gunwales, bulwarks, chocks, taff rail or tow bars.

B.6. Preventing Chafing Damage

Layers of heavy canvas or leather can be tied with small stuff to the towline, bridle, or wire rope at contact points to prevent chafing damage. Sections of old fire hose also work well as chafing gear, or commercially available products may be used. Crewmembers must make sure the chafing gear stays in place for the duration of the tow.

B.7. Thimbles

Thimbles are designed to equalize the load on an eye of a line and provide maximum chafing protection to the inner surface of the eye. On double-braided nylon, thimbles made specifically for synthetic lines (see **Figure 3-6**) must be used.

Figure 3-6
Thimbles

Deck Fittings and Other Fittings

B.8. Description

Fittings are attachments or fair lead points on vessels for towlines, anchor lines, and mooring lines. Many fishing and sailing vessels have other attachment points for standing and running rigging that could also provide tow rig attachment points or fair leads. For towing, attachment points and fair leads designed for horizontal loads should only be used.

Common fittings include bitts (mooring and towing), cleats, bollards, and sampson posts. Chocks, tow bars, and taff rails act as fair leads redirecting or supporting the towline. Pad eyes, turning and snatch blocks, winch drums, capstans, and windlasses should also be considered as attachment points or fair leads on a towed vessel. Trailerable boats usually have an eyebolt or eye fitting at the bow for an attachment point.

B.9. Condition and Inspection

The following regular inspections should be conducted of towing vessel fittings:

(01) Check for cracks, fractures, rust, corrosion, wood rot, fiberglass core softening, or delamination.

(02) Inspect surfaces that are normally hidden from view, particularly backing plates and under-deck fasteners.

(03) Tow bars are subject to high vibration and may loosen or cause stress fractures around their foundations.

(04) Ensure working surfaces are kept free from paint and relieve any surface roughness. A smooth working surface reduces wear, friction and chafing on lines.

B.10. Skiff Hook

The typical skiff hook has a quick-release safety buckle and snap hook clip that can be attached directly to the boathook handle (see **Figure 3-7**). Skiff hook assemblies are commercially available.

WARNING

Do not over-stress a skiff hook. Never use one for any operation that exceeds the stress load of towing small, trailerable boats.

CAUTION!

Use extreme care when removing a skiff hook from a trailer eye fitting. Even at a dock, crewmembers risk injury from vessel movements.

Figure 3-7
Skiff Hook

B.10.a. Using a Skiff Hook

Perform the following procedures to use a skiff hook:

Step	Procedure
1	Attach the skiff hook line to a towline with a shackle or double becket bend.
2	Use the skiff hook assembly to reach down and place the hook onto a distressed vessel's trailer eyebolt.
3	Pull back on boat hook, releasing snap hook into trailer eyebolt.

Drogues

B.11. Description

A **drogue** is a device that acts in the water similar to how a parachute works in the air. The drogue is deployed from the stern of the towed vessel to help control the towed vessel's motions. Coxswains and boat crews must familiarize themselves with the operating characteristics and effectiveness of available drogues, training with and testing drogues under various conditions to learn drogue capabilities. The time to learn about a drogue is before one is needed to deploy.

B.11.a. Towing Conditions

While trailing a drogue from the towed vessel is not common, it may be useful when a distressed vessel has lost rudder control. Normally drogues are not deployed when well offshore but rather inshore where greater control of the towed vessel is required. If necessary to tow a vessel with large swells directly on the stern, it may be more prudent to alter course or lengthen the towline rather than to deploy a drogue. Drogues are typically used when the tow is shortened as in preparing to tow into a bar or inlet. With a short hawser and large swells on the stern, the drogue is deployed to prevent the towed vessel from running up the stern of the towing vessel or "surfing" down the face of a wave. The drogue keeps a steady strain on the towline reducing shock-loading.

B.11.b. Drogue Size

The idea of the drogue is to provide backward pull on the stern of the towed vessel so that the wave will pass under the boat. It is important to match the size of the drogue to the towed boat, its deck fittings, and its overall condition. Larger, well-constructed cone drogues can exert a very large force on a boat's transom so the towed vessel's stern must be carefully examined.

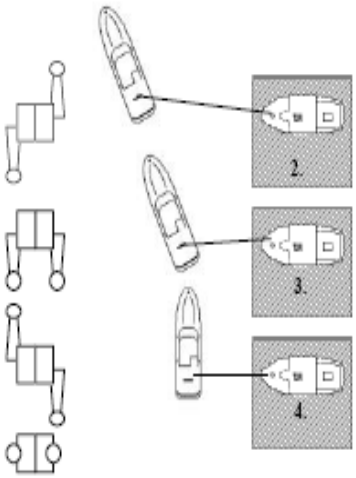
Different-sized drogues are used for different conditions and different vessel sizes. A modern style drogue (**Figure 3-8**) is a synthetic material cone, with the pointed end open. Drogues may have a ring in the base of the cone (the leading edge) to which attaches a four-part bridle. The other ends of the bridle connect to a swivel, which in turn, connects to a line made fast to the stern of the towed vessel. The towed vessel "tows" the drogue. Drogues sometimes have another line (dumping line) attached to the tail end for retrieval.

NOTE

A large drogue can cause stress that will damage a boat. For a boat, the larger the drogue used, the slower the towing speed must be. A slight increase in speed causes a tremendous increase in drogue tension.

Figure 3-8
Modern Drogue Types

C.25. Closing by Quartering



Closing-by-Quartering Procedures	
1.	Notify your crew!
2.	Pivot away from the disabled
3.	With the heaving line tending off quarter back.
4.	When enough line has been and square up.
5.	If you still need to close, close by
6.	Stop the boat in optimum position.

C.26. Connecting the Tow Rig

Methods of tow rig connection (**Figure 3-13**) generally available are:

(01) Tow rig to fittings.

(02) Tow rig to trailer eye.

CAUTION!

Though deck fittings should be checked during pre-tow procedures, do not hesitate to stop the connection if something is wrong. If necessary, recover the rig and transfer a crewmember to the distressed vessel to physically inspect the fittings.

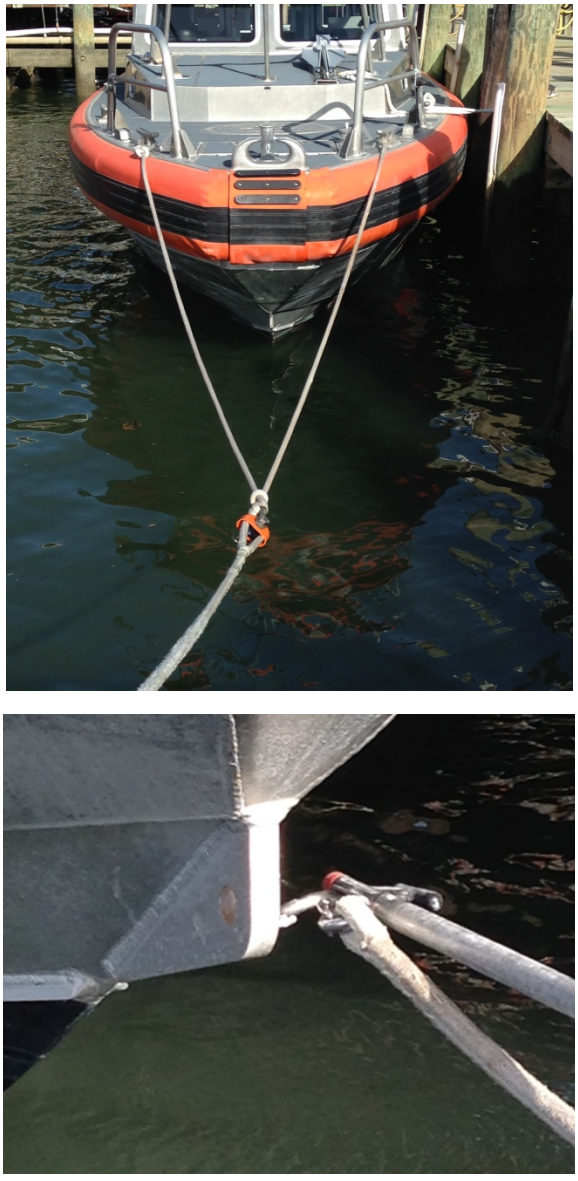


Figure 3-13

CAUTION!

Gradually come to a pay out course. Rapid movements or changes in direction increase the risk of:
(01) Fouling the towline in propellers or on deck fittings.
(02) Shock-loads.
(03) Loss of towline control.

The boat crewmember must have complete control of the towline. Too much towing vessel headway may cause the crewmember to lose control of towline tension, and the towline will start to run out.

WARNING

Crews risk injury from a running towline, with the possibilities of injuring their hands and arms in the tow bitt, tow reel, or in bights of line faked on deck. If the towline starts to run, reduce speed immediately. The crewmember working the tow bitt should regain control of the towline after the line stops running.

C.35. Paying-Out the Tow Line

Paying out towline should be continued until the initial amount of towline scope is satisfactory.

C.36. Making Up the Bitt

Once the desired scope of towline is deployed, the coxswain directs the crew to make up the bitt. Forward motion should be slowed enough to slack the towline, and then the proper turns can be applied.

WARNING

Do not attempt to make up the bitt with a strain on a towline. This increases risk of injury by catching hands, fingers, and arms between the bitt and the towline.

C.37. Setting a Towing Watch

The towing watch has a critical responsibility. In addition to the crewmember assigned, it is a collateral duty for all other crewmembers. The condition of the vessel in tow and the towline must be constantly monitored.

Refer to **Towing Watch** on page 2-24 for further information on tow watch responsibilities.

Underway With Stern Tow

C.38. Description

The best course to safe haven is not always the shortest distance. A course that gives the best ride for both vessels should be chosen. At times, the vessels may have to tack (run a zigzag type course) to maintain the best ride. A firm understanding of the dynamic forces in towing help to ensure a safe tow.

C.39. Briefing the Towed Vessel

The following instructions and information that will apply to each step of the tow astern should be shared with the towed vessel:

(01) General safety (PFDs, staying clear of tow rig, tow rig chafe, location of crew).

(02) Equipment (pumps, drogues).

(03) Steering (whether to man helm or lock rudder amidships, whether to steer on towing vessel stern).

(04) Route to take, expected weather and seas, destination, ETA.

(05) Lighting, sound signals.

(06) Communications (primary/secondary radio frequencies, times of status reports).

(07) Emergencies (breakaways, signals).

C.40. Deploying Drogue

If drogue deployment is necessary, (i.e., to counteract a jammed rudder or other condition), the drogue should be deployed while barely making way before increasing speed to the planned towing speed (see **PART 1 CHAPTER 3Section C Standard Towing Procedures** for more information).

C.41. Maintaining a Catenary

Once underway with a tow astern, a proper length of towline should be maintained as discussed in **Combination of Forces and Shock-Load** of this chapter. Gravity causes a "dip" or downward sag (known as catenary) to form in the middle of the towline as it is lengthened. This catenary acts as a natural shock absorber for a tow rig and is a major factor in counteracting shock-loading (**Figure 3-15**).

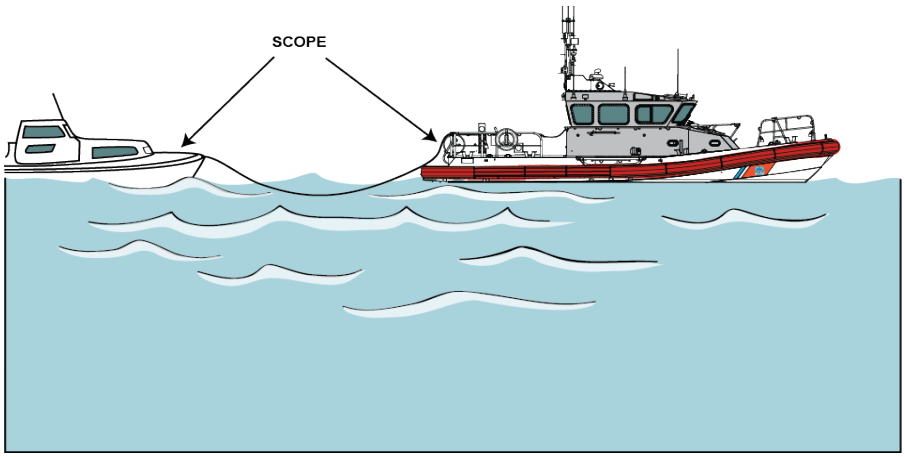


Figure 3-15
Scope of Towline with Catenary

PIW. If the person falls off the bow, the turn should be in either direction to kick the stern clear. If the person falls off the stern, in some cases, the eddy current located off the transom can hold the PIW tight against the stern. Applying additional power while turning sharply to either port or starboard will push the PIW clear.

In some cases, turning the boat is not possible due to vessel traffic or a narrow channel. In these cases, slowing down and stopping are other options. Once the boat has stopped, the PIW may swim back towards the boat for recovery or after slowing to bare steerageway, spin the boat around and recover the PIW.

An increase in speed is not necessary during the turn. Recovering the PIW as soon as possible is important, but sometimes an increase in speed by the coxswain will catch the remaining crewmembers off guard and possibly eject them from the boat. If operating at high speed when the PIW takes place, it might be best to slow down before starting a maneuver. The coxswain should carry out the turn at a safe speed to ensure a more stable platform for the recovery crew.

A.6. Mark Position

Another important step is to record the boat's position by pressing the appropriate button on the Chart Plotter/GPS receiver to mark the exact position (datum) of the distress electronically. This will give a position to return to if unable to locate the PIW and start a search pattern.

All possible means must be used to identify the position (dead reckoning, visual landmarks, radar, etc.), if the vessel is not equipped with a Chart plotter/GPS receiver.

A.7. Alerting Boats in the General Vicinity

Sounding five or more short blasts on the sound signal, horn, or whistle alerts boats in the area that a danger exists (i.e., a PIW has occured). Boats in the vicinity may not be aware of what the signal means but at least they will realize something unusual is happening.

A.8. Deploying a Flotation Device

Any time the "Man Overboard" alarm is sounded, the coxswain shall direct a crewmember to throw the ring buoy with strobe light or anything that floats over the side (see **Figure 4-1**). This flotation device will serve two purposes. First, the PIW may see the flotation device and be able to get to it increasing their chances of being located and providing additional flotation. Second, the ring buoy or any floating object thrown over the side (if a ring buoy is not available) serves as a reference point (datum) marking the general location of the incident and for maneuvering the boat during the search for the PIW.

NOTE

Datum should not normally be removed from the water until the PIW or search object is found. Time and position of datum deployment should be recorded. The longer datum is tracked, the more accurate the search area will be as time passes.

CAUTION!

Do not throw the floatable object(s) directly at the PIW. It could cause injury if it hits the individual.

Figure 4-1
Ring Buoy with Strobe/Throwable Device

A.9. Assigning Crew Duties

Upon hearing the initial "Man Overboard" alarm, the coxswain will assign duties to each crewmember as follows:

(01) A pointer will be assigned to take a position normally used for that boat (if conditions permit). This will normally be the crewmember making the initial report. The pointer will maintain constant sight of the PIW and continually use their hand to indicate the location of the PIW. The pointer will also call out the physical condition of the PIW to affect an appropriate rescue attempt (conscious/unconscious, face up/face down).

(02) A recovery/pick-up crewmember will be assigned to prepare a rescue heaving line to be used in retrieving the PIW. If the PIW is reported to be unconscious, the recovery/pick-up crewmember will assist in dressing out and tending the boat swimmer.

(03) The coxswain will assign a crewmember to deploy a ring buoy. If at anytime the PIW can no longer be seen, the recovery/pick-up crewmember will be instructed to deploy a ring buoy with strobe light (or anything that floats) over the side

A boat swimmer will be made ready if needed, as well as another crewmember on the tending line(if applicable) to the boat swimmer's safety harness, whenever the swimmer is in the water.

NOTE

Review paragraph **A.30. Boat Swimmer Deployment** of this chapter for important information regarding boat swimmers.

A.9.a. The

The pointer will visually search for the person overboard, and when located,

Figure 4-6
Recovering the PIW at the Surface of the Water

Figure 4-7
Recovering a PIW Hands Under Armpits

A.27.a. Freeboard Too High

If the freeboard of the boat is too high to recover the victim safely, perform the following procedures:

Step	Procedure
1	Use a rescue strap/line under the armpits in a horse collar fashion (**Figure 4-7**).
2	The line should cross the chest, pass under each arm, and up behind the head.
3	Use padding for comfort, if available.

A person is light in the water due to buoyancy; however, once free from the water, the person becomes "dead weight." This should be kept in mind and special care should be taken when recovering injured persons.

A.27. PIW Is Unconscious or Injured

In the event that the PIW is unconscious or injured, a direct pick up from the boat may be attempted if on scene conditions permit a safe recovery. If conditions are such that a direct pick up would be unsafe, utilizing a boat swimmer to recover the PIW should be considered.

CAUTION!

An untethered boat swimmer should be deployed only as a last resort! Once deployed, a coxswain has no means to retrieve the boat swimmer should they need assistance.

A.28. Boat Swimmer

Boat swimmers are boat crewmembers who act to assist and recover fatigued, unconscious, entangled or injured survivors from the water. Their use may significantly reduce some of the dangers inherent in maneuvering rescue vessels close to survivors. They are not "rescue swimmers". Their training is accomplished through completion of applicable tasks in Reference (b). A boat swimmer is assigned by the coxswain. Boat swimmers wear the appropriate PPE including a swimming harness with a tending line when available. Another crewmember will tend the harness whenever the swimmer is in the water.

WARNING

Boat crews aboard platforms that do not have tending line and harness shall perform thorough Operational Risk Management (ORM) and exercise extreme caution before putting a swimmer in the water.

NOTE

The Auxiliary does not have boat swimmers.

NOTE

Policy regarding boat swimmers can be found in Reference (a).

A.29. Tending Line Commands

Communication between the crewmembers on the boat and the boat swimmer can be impacted as the distance between the two increase. To compensate, tending line commands are used to avoid the need for shouting. The signals primarily assist with communication but when used can also aid the boat swimmer in the recovery of a PIW. The signals are based on the **OATH** signaling system.

WARNING A Coast Guard boat swimmer shall NOT go under the water and enter a capsized or submerged object.

A.30.a. OATH Signaling System

Meaning	Tugs/Pulls	Swimmer Visual Signal
I am OK / Are you **OK**?	One	Tap top of head
Advance	Two	One arm raised over head
Take in slack / I am ready to return to the boat	Three	One arm waving over head
Help / Do you need help?	Four	Two arms waving over head

A.30. Boat Swimmer Deployment

The procedures for deploying a boat swimmer are as follows:

Step	Procedure
1	The coxswain will designate one of the crewmembers as a boat swimmer.
2	The boat swimmer shall wear the boat swimmer harness (**Figure 4-8**) and tending line on all deployments from platforms equipped with this gear. Platforms that do not have a tending line and harness shall perform thorough Operational Risk Management (ORM) and exercise extreme caution before putting a swimmer in the water.
3	Enter the water feet first.
4	Swim/approach PIW pushing a ring buoy (do not attach strobe light).
5	When the boat swimmer has reached the unconscious or injured victim and has obtained a secure hold on the person (cross-shoulder position), the crewmember tending the harness line will haul both back to the boat (**Figure 4-9**).

Figure 4-8
Boat Swimmer Harness

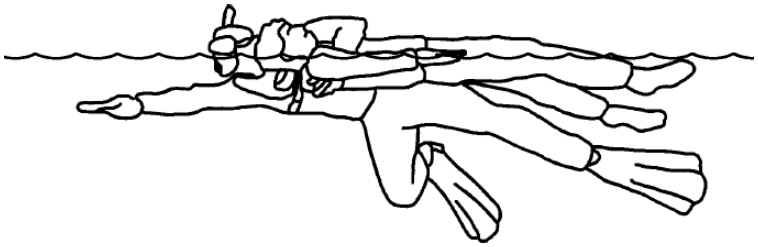


Figure 4-9
Cross-Shoulder Position

A.31. Stokes Litter

The stokes litter (rigid or folding) is a mobile transportation device designed to safely transport non-ambulatory personnel onboard ships and boats (**Figure 4-10**). The basic stokes litter is configured for surface operations.

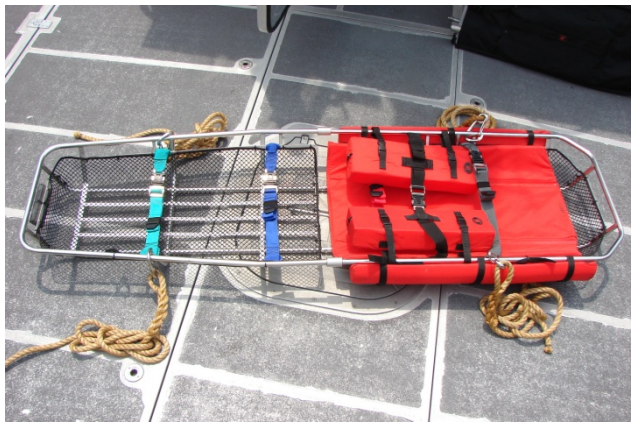


Figure 4-10
Stokes Litter

A.31.a. Application

The basic stokes litter can be configured for hoisting or surface operations. The unit type will determine which Stokes Litter is used (i.e. boat stations will use a surface stokes at a minimum, Air Stations will use a hoisting stokes and a cutter will use a surface stokes at a minimum).

Tending lines and hoisting sling cables shall be kept from interfering with patient restraint straps. The gray, red, blue, and green restraint straps shall be disconnected and secured to the right side of the litter prior to lowering the litter to the water's surface. The black restraint strap with flotation pads shall be buckled.

A.31.b. Flotation Characteristics

When the litter is configured in accordance with the MPC, it will float face-up at a 45-degree angle with the foot end submerged. The top 18 to 24 inches at the head end of the litter will be above the surface of the water. The stokes litter is self-righting.

WARNING

Patients wearing buoyant garments, such as exposure suits or PFDs, will affect and possibly negate the flotation and self-righting characteristics of the litter. Diligent attention to flotation characteristic changes when patients are secured in the litter.

WARNING

If the patient is secured to a backboard or spinal immobilization device, do not remove it.

NOTE

When securing the black restraint strap with flotation pads, difficulty may be encountered with patients wearing buoyant garments. Buoyant garments are not to be removed; instead place as much slack in the restraint strap as possible and attempt to connect the buckle.

A.31.c. In-Water Patient Restraint

Use the following procedure to secure a patient in the litter while in the water.

Step	Procedure
1	Disconnect the litter from the hoist hook, if used.
2	Disconnect the black restraint strap.
3	Guide the patient into the litter with a collar or equipment tow.
4	Pull the gray restraint strap loose from the right side of the litter and route it under the patient's arms and over the patient's chest. Connect the buckle pulling the slack from the strap.
5	Pull the blue restraint strap loose from the right side of the litter and route it over the patient's arms and torso. Connect the buckle pulling the slack from the strap.
6	Secure the remaining restraint straps around the patient, working from head to toe, using the same procedure. Reconnect the litter to the hoist, if used.

WARNING

The in-water patient restraint procedure must be trained prior to use. Crew coordination between the swimmer and deck crew is critical to evolution success. Recurrent training of this procedure is highly recommended.

A.32. Multiple PIW Recovery

For multiple PIWs, the question becomes which person in the water is recovered first. The answer to this requires the coxswain's best judgment. An accurate assessment once on scene will dictate the coxswain's response. Consideration should be given to the following:

(01) Are one or more persons in the water injured?
(02) Which persons in the water have on PFDs and which do not?
(03) How close are the persons in the water to the beach or jetty?
(04) How old are they and what is their physical condition?

described as the split throttle maneuver (Heavy Weather Turn). If the water depth allows, the coxswain continues down swell past the PIW. When passing at a safe distance, an assessment is made as to the condition of the PIW (i.e., conscious and face-up, unconscious and face-down); this will help decide how best to prepare for the final approach.

The split throttle maneuver (Heavy Weather Turn) is discussed in greater detail in Reference (k).

C.3. Spacing

While transiting down swell, you should turn your attention to crew communication, condition of PIW, and spacing of your vessel away from or toward the PIW. A properly executed heavy weather turn will advance the lifeboat approximately one boat length in the direction of the turn and this should be taken into consideration when passing the PIW while traveling down swell. Regardless of weather conditions but with due regard for safe navigation, you should attempt to stay within fifty to one hundred yards of the PIW.

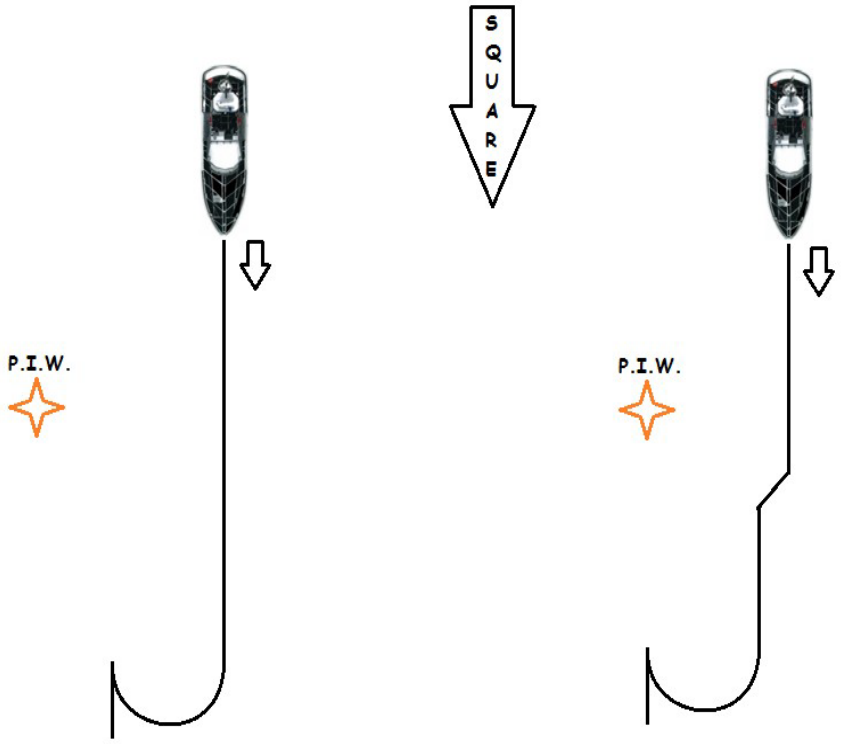


Figure 4-11
Spacing while Traveling Down Swell

WARNING

Initiating a Heavy Weather (Split Throttle) turn on the face of a steep wave can result in a knockdown/ rollover and should be avoided at all costs. Reference (r) contains further discussion of the Split Throttle maneuver.

C.4. Approach

Once the run down swell is completed, the boat must be turned to make the approach. The turn should be made so as to simultaneously put the bow into the surf/swell and have the PIW directly in front of the boat, keeping in mind the turning radius of the boat and the effect strong winds may have, make adjustments as necessary. This may require some lateral movement down swell of the PIW. The pointer must be able to communicate with the coxswain at all times. Positioning the pointer by the open bridge is recommended.

Once down swell, the coxswain must turn the boat quickly and avoid getting caught broadside to the surf/swell. A break taken on the beam may roll the boat.

After completing the turn into the swell or breaks, forward momentum is stopped and, if practical, station keep is commenced by using references on the beach, jetty, and/or adjacent structures. Doing this will give you time to consider the following:

(01) Boat position in relationship to the PIW.
(02) Set and drift of both the boat and the PIW.
(03) Wind direction.
(04) Formation of a window/lull near the PIW.
(05) Reestablishing crew responsibilities (if needed).
(06) Sending a crewmember to the recovery area.

NOTE On a CG standard boat, the crew must stay out of the recovery area until the turn is completed, the bow is back into the swell, and the coxswain gives the command.

WARNING Do not allow any crew to go forward at any time during this evolution. It puts them in great danger and decreases the crew's ability to communicate.

C.5. The Recovery

When making the final approach, the coxswain must adjust the speed to avoid launching the boat off the back side of a wave. He/she should use the bow bitt or other stationary object on the bow as a sight and aim the boat at the PIW. Speed should be reduced to bare steerageway while nearing the PIW. This approach is made so that the PIW is not in danger of being struck by the boat. Timing is essential! If the coxswain is able, he/she should wait for a lull to make the approach.

The crew must keep the coxswain informed of the PIW's relationship to the boat at all times. This can be done by using reference points on the boat and calling distance off the hull.

WARNING A breaking wave or steep swell can surf a PIW into the side of the boat or move them astern of it!

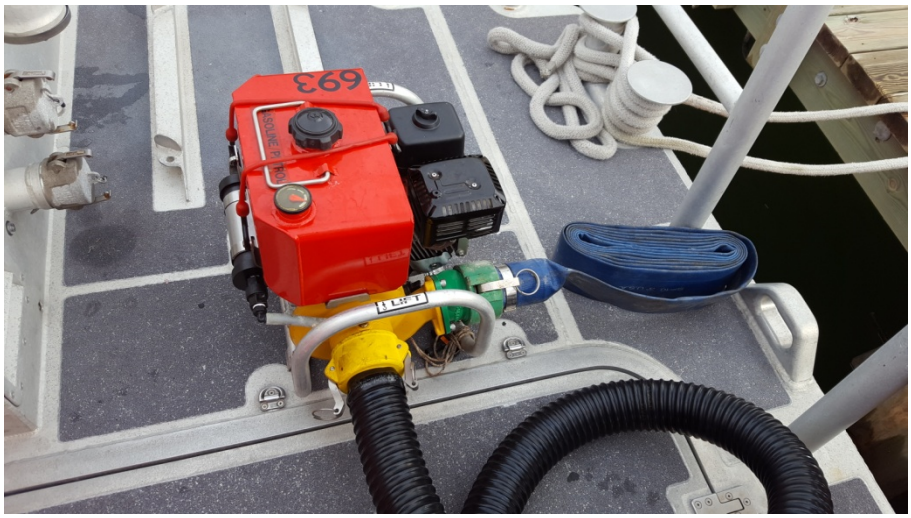


Figure 5-6
Drop Pump Readied for Dewatering Action

B.13.b. Passing a Drop Pump

When secured in its watertight container, a drop pump can be easily passed from one boat to another. There are two methods for passing a pump.

B.13.b.1. Directly Passing a Drop Pump

The easiest method for transferring a drop pump is to pull alongside the flooding vessel and simply transfer the pump to the other vessel. At least two people are always required to move a pump because it is heavy and awkward to carry.

If coming alongside is not a safe option, use the following procedures to directly pass a drop pump:

Step	Procedure
1	Determine the rate of drift.
2	Secure a 2-inch mooring line to a bridle attached to a pump container or pump container handles (**Figure 5-7**).
3	Secure a heaving line to the mooring line.
4	Rig a tending line from the pump to the boat to enable controlling the pump's movement once it is in the water and hauling it back in the event of an emergency (**Figure 5-8**).
5	Cast the heaving line, and direct people aboard the disabled boat to haul it in.
6	Lower the drop pump overboard and direct people aboard the disabled boat to haul in on the line. Pay out the tending end of the line as it is being hauled in.

Figure 5-7
Securing Lines to Drop Pump Container

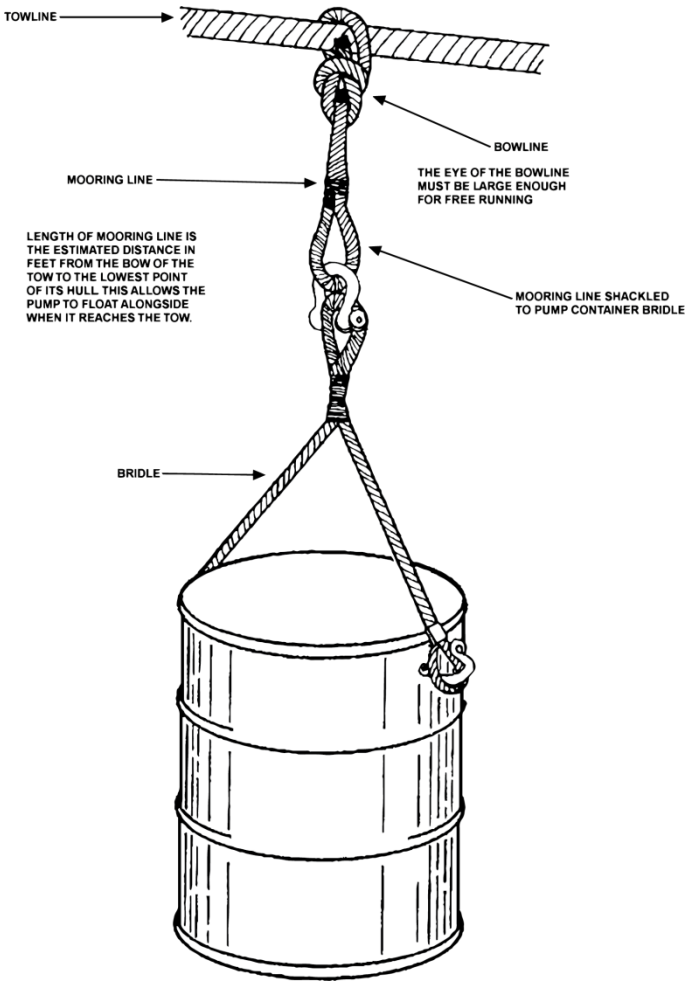


Figure 5-9
Drop Pump on the Towline

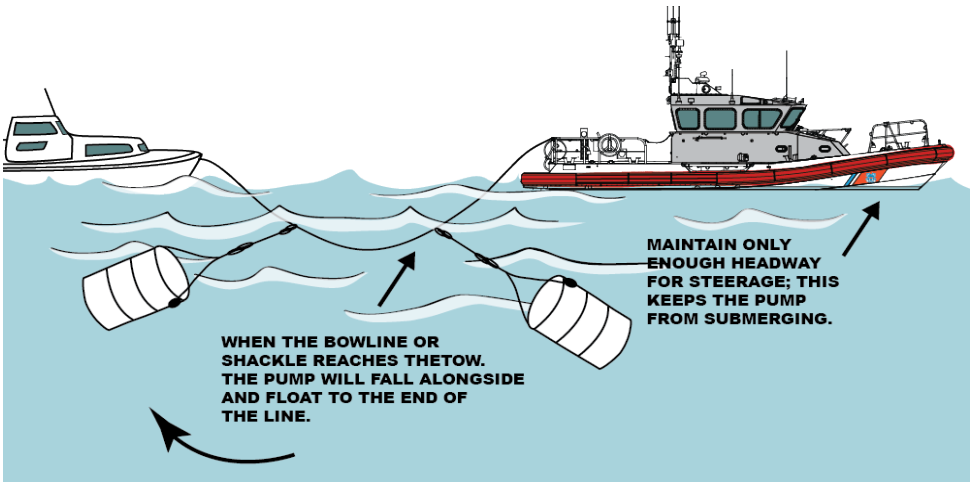


Figure 5-10
Passing a Drop Pump on the Towline

B.13.c. Securing a Pump

There are separate procedures for securing a drop pump depending on whether it is being secured because of an emergency or to be stowed.

B.13.c.1. Securing in an Emergency

Perform the following procedures for securing:

Step	Procedure
1	Turn the engine IGNITION switch counterclockwise to the "OFF" position. If engine fails to secure, disconnect quick fuel fitting from the fuel tank.

B.13.c.2. Securing for Storage

Perform the following the procedures when securing the pump for storage:

Step	Procedure
1	Disconnect the fuel line from fuel tank.
2	If applicable, turn fuel tank cap clockwise to close vent valve.
3	Continue to pump water until the engine stops from lack of fuel.
4	Close fuel valve by pushing it to the "OFF" position.
5	Turn the engine IGNITION switch counter clockwise to the "OFF" position.
6	Disconnect the suction/discharge hoses from the pump. Allow hoses to drain completely.
7	Drain water from the impeller case by tipping the pump towards the discharge outlet.
8	Cycle the hand primer pump to discharge residual water.
9	Check engine oil and fuel tank levels. Refill as required.
10	Allow the engine, pump, hoses, and associated kit components to completely dry.
11	After drying, re-stow all gear in accordance with maintenance procedure card.

motor bearings to overheat, with the same result.

C.6.e. Charging Batteries

When batteries are charging, they emit hydrogen, a highly flammable gas that is potentially explosive. Hydrogen is lighter than air and will rise as it is produced. If sufficient ventilation is not available at the highest point above where a battery is being charged, hydrogen will collect at the overhead. Then, any source of ignition will cause an explosion and fire.

CAUTION!

Battery gases are highly explosive. Never smoke around a battery and never disconnect, change out, or perform maintenance on a battery until the surrounding space has been thoroughly ventilated.

Section D. Fire Theory, Classifications, and Fuel Sources

Introduction

As a boat crewmember, it is important to understand the theory of fire, the different classifications of fire, and the types of fuels that perpetuate fires. This knowledge will enable boat crewmembers to identify the type of precautions, equipment, and extinguishing agents required to successfully fight fires.

In this Section

This section contains the following information:

D.1. Fire Theory

Fire is a chemical reaction known as combustion. It is defined as a state, process, or instance of combustion in which fuel or other material is ignited and combined with oxygen, giving off light, heat, and flame.

D.1.a. Fire Tetrahedron Theory

A theory has been developed to explain fire combustion and extinguishment. This theory can be represented by a 4-sided geometric figure, a tetrahedron (**Figure 5-11**). The base of this figure represents a chemical reaction. The 3 standing sides of the figure represent heat, oxygen, and fuel. Removing one or more of the 4 sides will make a tetrahedron incomplete and cause a fire to be extinguished.

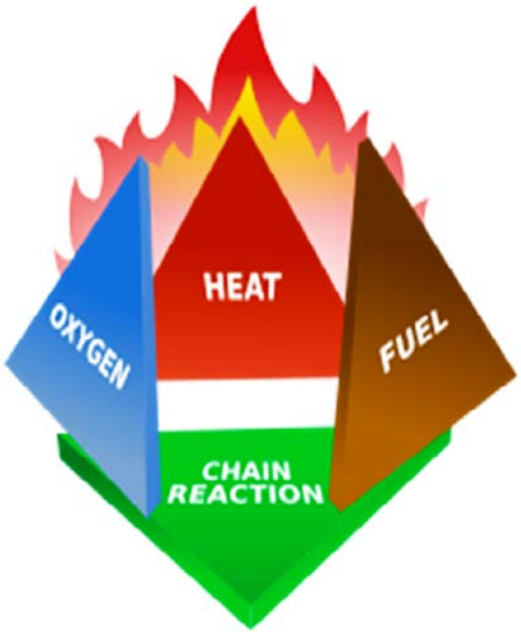


Figure 5-11

charging it. Never leave a charged hose unattended.

E.3. Minimum Operators

A minimum of 2 people is recommended to control a 1½-inch hose.

E.4. Coupling

A fire hose has brass or metal fittings, known as male and female couplings at its ends. This allows one hose to be attached to another or to a fitting. A female coupling connects to a boat's fire main or portable pump. A male coupling connects to a nozzle or to a female coupling on another length of hose. To connect lengths of fire hose, crewmembers take half a turn to the left on the female coupling to set the threads and then turn to the right until the connection is tight. Fittings should be hand tight.

Figure 5-12
Fire Fighting Hose with male and female couplings

Spanner Wrench

E.5. Description

Spanner wrenches are very important when working with fire hoses. As mentioned before, when connecting fire hoses to fittings or another hose, connections should be hand tight, allowing for an easy disconnect. Sometimes tightening connections only hand tight is not enough. This is where a spanner wrench helps out. Spanner wrenches are also useful if a fire hose is unable to be disconnected from a connection because it has been put on too tight.

A spanner wrench is adjustable so that is can be used with all standard sizes of fire hoses. A range of adjustment is indicated on the handle of a wrench. A curved tip on the working end of a wrench is made to fit all notches in a coupling.

E.6. Safety Precautions

Spanner wrench safety precautions are as follows:

(01) As with using any wrench, be careful not to get fingers or other objects caught between the wrench and the coupling.

(02) Ensure the working end of the wrench is in the notch before applying heavy pressure.

E.7. Operation

On properly maintained hoses, connections may be effectively tightened by hand. However, if there is water leakage at a connection, a spanner wrench (**Figure 5-13**) may be used. Once a wrench is adjusted, the tip of a wrench is inserted into the notch and the wrench handle pulled to the right.

Figure 5-13
Spanner Wrench

Vari-Nozzle

E.8. Description

The vari-nozzle can be used for fighting all classes of fires. In the fog position, it can also be used for personnel protection by creating a shield of water spray.

A Navy vari-nozzle is fitted with a pistol grip handle on the underside of the nozzle and a two-position bail handle on the top that operates the nozzle. The vari-nozzle's spray pattern is adjusted by rotating the variable pattern tip and can range from a 90° wide-angle spray to a narrow straight stream as well as intermediate patterns between these extremes.

E.9. Operation

This nozzle (**Figure 5-14**) is used with AFFF for extinguishing Class B fires.

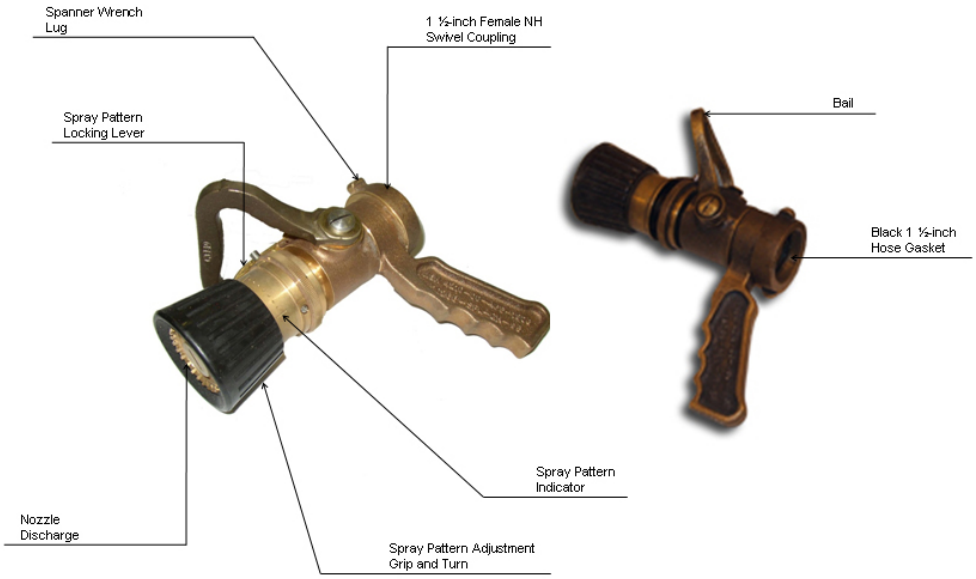


Figure 5-14
Vari-Nozzle

CG-P6 Portable Dewatering Pump with Attached Fire Fighting Hose and Nozzle

E.10. Description

The CG-P6 portable dewatering pump with attached fire fighting hose and nozzle is used to suppress fire aboard vessels. Coast Guard personnel shall not engage in independent fire fighting operations, except to save a life or in the early stages of a fire to avert a significant threat without undue risk.

E.11. Minimum Operators

The CG-P6 portable dewatering pump with fire fighting hose and nozzle is operated by a minimum of two boat crew members; one to operate/monitor CG-P6 and one to control and direct the hose and nozzle.

WARNING

Coast Guard personnel shall not engage in independent fire fighting operations except to save life, or in the early stages of a fire to prevent a significant threat without undue risk. *See Reference (m) for additional policy guidance*.

E.12. CG-P6 Dewatering Pump

The CG-P6 portable dewatering pump consists of a 6 ½ horsepower, 4-cycle gasoline driven engine with a rated output of 250 gallons of water per minute at a 12-foot suction lift. Under load this pump will operate for approximately 4 to 5 hours on a full tank of gasoline. Refer to Chapter 5, Section B.13 for procedures on operating the CG-P6 Portable Dewatering Pump.

E.13. Fire Fighting Hose

A 50’ fire fighting hose (**Figure 5-15**) with a 1 ½” male coupling (attached to nozzle) and 1 ½” female coupling (attached to black outlet adapter) that is connected to the CG-P6.

Figure 5-15
Fire Fighting Hose

E.14. Fire Fighting Nozzle

A 1 ½” fire fighting nozzle (**Figure 5-16**) is attached to one end of the 50’ fire fighting hose. The nozzle has a rated output of 75 gallons per minute (GPM).

Figure 5-16
Fire Fighting Nozzle

E.15. Quick Connection Coupling (Applicable Assets)

A 6’ by 3” suction hose (**Figure 5-17**) for connecting the CG-P6 to an installed standpipe is available on certain boat types (e.g. MLB, RB-M).

Figure 5-17
Suction Hose

E.16. CG-P6 Discharge Outlet Adapter

A 3”color-coded coupling (**Figure 5-18**) attached to the discharge outlet of the CG-P6 to allow the attachment of the 50’ fire fighting hose.

Figure 5-18
Color-Coded Coupling

E.17. Fire Fighting Hose and Nozzle Operation

All crewmembers should become familiar with these instructions and practice operating the CG-P6 with fire fighting hose and nozzle attached.

The following procedures outline the basic steps for setting up and operating the CG-P6 pump with fire fighting hose and nozzle attachments (**Figure 5-19**).

NOTE Refer to the manufacturer instructions for specific information on pump operation and maintenance.

WARNING Breathing exhaust fumes can be dangerous. Do not attempt to start or operate a pump while it is in a container. Once a pump is started, ensure sufficient ventilation is present to allow exhaust gases to dissipate into the atmosphere. Do not operate a drop pump below deck.

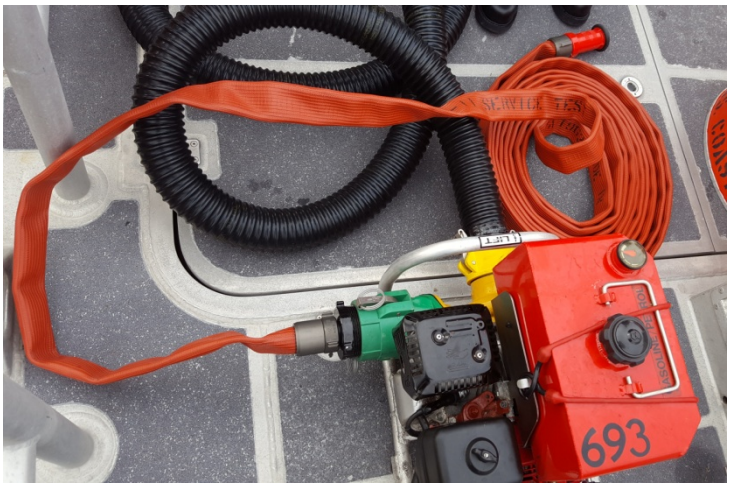


Figure 5-19
CG-P6 Pump With Fire Fighting Hose and Nozzle Attachments

A.1. MH-65 Dolphin

The MH-65"Dolphin" has two turbine engines that will produce a maximum airspeed of 175 knots (see **Figure 6-1).** The normal crew is one or two pilots and a flight mechanic. For rescue missions, a rescue swimmer is normally carried in addition to the three crewmembers. The flying pilot during hoisting operations sits in the right seat of the cockpit. Other general information includes:

(01) Maximum endurance with a crew of two pilots and one crewmember is approximately three hours.

(02) Maximum of four passengers or survivors (besides crew) can be carried.

(03) Hoist capacity is 600 pounds and the external cargo sling limit is 2,000 pounds.

(04) It will not land on the water except in an emergency. It will float if it is not badly damaged and the flotation bags are deployed.

Figure 6-1
MH-65(Dolphin) Helicopter Right Side View

A.2. MH-60 Jayhawk

The MH-60 "Jayhawk" has 2 turbine engines that, depending upon the gross weight of the helicopter, will produce a maximum airspeed of 180 knots (**Figure 6-2**). Although equipped with two engines, the MH-60 can normally maintain hover with one engine (the loss of one engine is considered an emergency situation). The normal crew is two pilots and two crewmembers. For rescue missions, a rescue swimmer is normally carried in addition to four crewmembers. Other general information includes:

(01) Maximum endurance of the aircraft with maximum fuel and crew is approximately six hours.

(02) Hoist capacity is 600 pounds and the external cargo sling limit is 6,000 pounds.

(03) The MH-60 is not capable of landing on the water and is not equipped with flotation bags.

Figure 6-2
MH-60 (Jayhawk) Helicopter

A.3. Helicopter Equipment

Hoists by Coast Guard helicopters will normally be done with the following rescue devices and equipment.

A.3.a. Rescue Basket

The multi-jointed (M/J) rescue basket is the primary device for hoisting survivors from land or sea during helicopter rescue operations. It provides protection for the individual being hoisted from dangers, such as striking vessel rigging. It has the capability to float. Hinged at all four corners, it folds inward (**Figure 6-3** and **Figure 6-4**). The basket is employed for personnel transfer in any weather condition.

Figure 6-3
M/J Rescue Basket Unfolded Position

Figure 6-4
M/J Rescue Basket Folded Position

A.3.b. Stokes Litter

The stokes litter is a stretcher with a flotation collar and chest pad for buoyancy. A 5-pound ballast weight located at the foot end provides stability. A permanently mounted hoisting sling attaches the litter to the helicopter hoist cable. For restraining patients, five securing straps, including chest pad, are supplied.

The stokes litter is used to transfer an injured or unconscious person in any weather condition. It is generally used when the patient's condition prevents use of the basket. When the patient is placed in a litter, a crewmember must tighten all straps to keep the person securely bound to it. There are five straps, as shown in **Figure 6-5**.

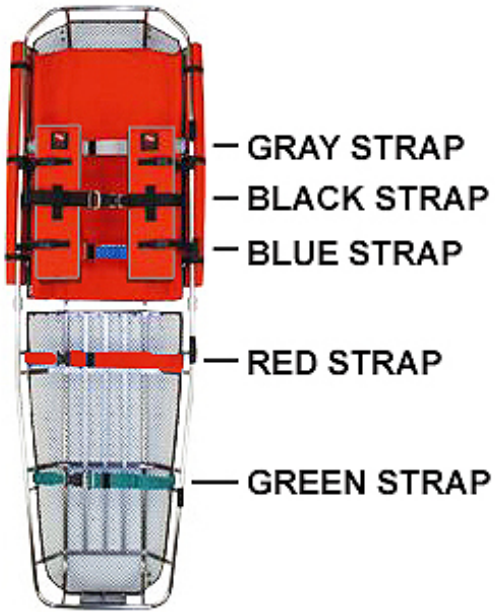


Figure 6-5
Stokes Litter

A.3.c. Rescue Strop

The rescue strop (**Figure 6-6**) is used only to rescue persons familiar with its proper use, for example, a military aviator. It can handle one survivor wearing the usual flight gear and PFD.

NOTE

Use of chest retainer strap is mandatory during use of the rescue strop, except when hoisting rescue swi

Figure 6-6
Rescue Strop

A.4. Trail Line

Use of a trail line minimizes the time a pilot must maintain a precise stable hover without a reference point. The trail line consists of 105 feet of orange polypropylene line with a weak link and snap link at one end, and a snap hook at the other. A 5-pound (or heavier) bag is attached to the trail line snap hook for ease in delivery of the trail line. When used, the trail line will:

(01) Stabilize a rescue device to prevent sailing, swinging, and possibly becoming fouled.

(02) Reduce the time a pilot must maintain a precise hover.

(03) Reduce time on-scene.

(04) Allows the flying pilot to offset laterally and maintain a visual reference with the boat.

A.5. Weak Link

The weak link (**Figure 6-7**) is a safety device between the trail line and hoist hook, which protects the helicopter by not allowing more than 300 pounds of force to be applied to the hoist. If more force is applied, the weak link will part. If the weak link parts, crew members should be prepared for a portion of the trail line to "snap back."

WARNING

The weak link is not designed to protect crewmembers from injury. 300 pounds of force is more than sufficient to cause severe injury or death.

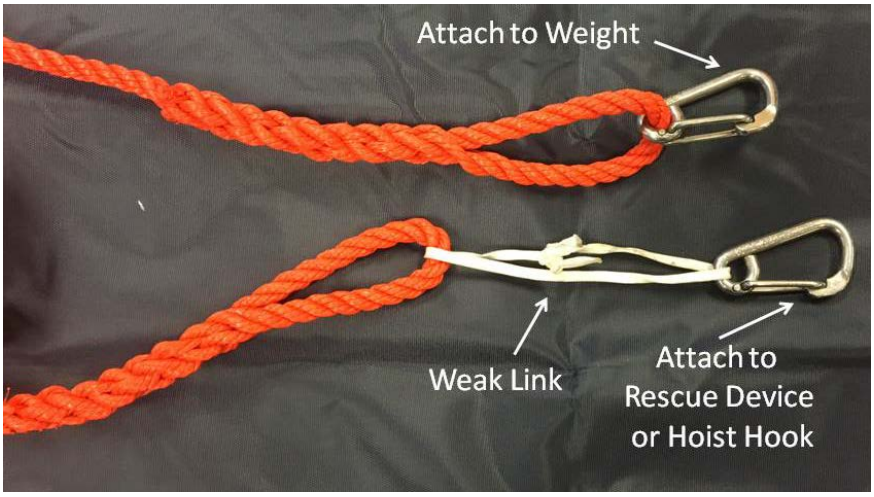


Figure 6-7
Trail Line's Weak Link

A.6. Dewatering Pump Kits

Dewatering pumps provide emergency dewatering for boats in danger of sinking. Under a load, the pump will run 4 to 5 hours on one gallon of gasoline. The pumps are designed to fit into a standard round aluminium container and it is deployable.

WARNING

Coast Guard dewatering pumps will not be used to pump flammable liquids.

B.3.c. Communications

Communications are established with the helicopter as early as possible to exchange information and instructions. This includes:

(01) Use of primary and secondary working frequencies.

(02) On-scene weather (estimated wind speed and direction as well as sea state).

(03) Exact position.

(04) Condition of persons, if any, requiring medical attention.

(05) Any information to aid the pilot in selecting the rescue device.

(06) Total number of crew and other persons onboard the boat, and total number onboard the helicopter.

(07) Conduct hoist briefing with the helicopter pilot.

Communications between crew members is difficult due to the noise created by the helicopter. When possible, use of a boat crew communication system (BCCS) is highly encouraged. When use of a BCCS is not possible, crew members will find themselves having to yell to communicate with each other due to the noise from the helicopter.

B.3.d. Protective Gear

All protective gear is properly worn, including:

(01) Head (helmet), eye (goggles) and hearing protection shall be worn.

(02) Protection for hands (gloves) is optional. If worn they should be as form fitting to the hand as possible to reduce the possibility of becoming fouled with any of the hoisting equipment.

(03) PFDs, anti-exposure coveralls, and dry suits (depending on weather conditions).

B.3.e. Loose Gear

All loose gear is stowed or secured on deck (e.g., hats, cushions, life rings, etc.).

B.3.f. Snag Hazards

Snag hazards are locations on boats where the hoist cable, trail line, or rescue device can be caught during hoisting operations. Since snag hazards are present on every boat, they present a significant challenge to safe hoisting evolutions. Examples of snag hazards include deck fittings, goosenecks, handrails, tow bitts, antennas, masts, etc. Prior to commencing any hoist ensure all antennas, booms, rigging, and flag staffs are secured and any covers or guards designed to prevent snags are secured in place.

B.3.g. Hand Signals

One boat crewmember is designated to give hand signals to the hoist operator. Communication between boat crewmembers on deck should occur prior to giving a hand signal to the helicopter. For example, once a rescue device is on deck, prior to giving the thumbs up signal for device removal, check with other crewmembers to make sure they are ready to proceed. The hand signals authorized for communications between the boat and helicopter are below (**Figure 6-8**, counter clockwise, starting from top-left):

(01) Ready to Proceed.

(02) Unsafe Condition.

(03) Not Ready.

(04) Intention to jettison device.

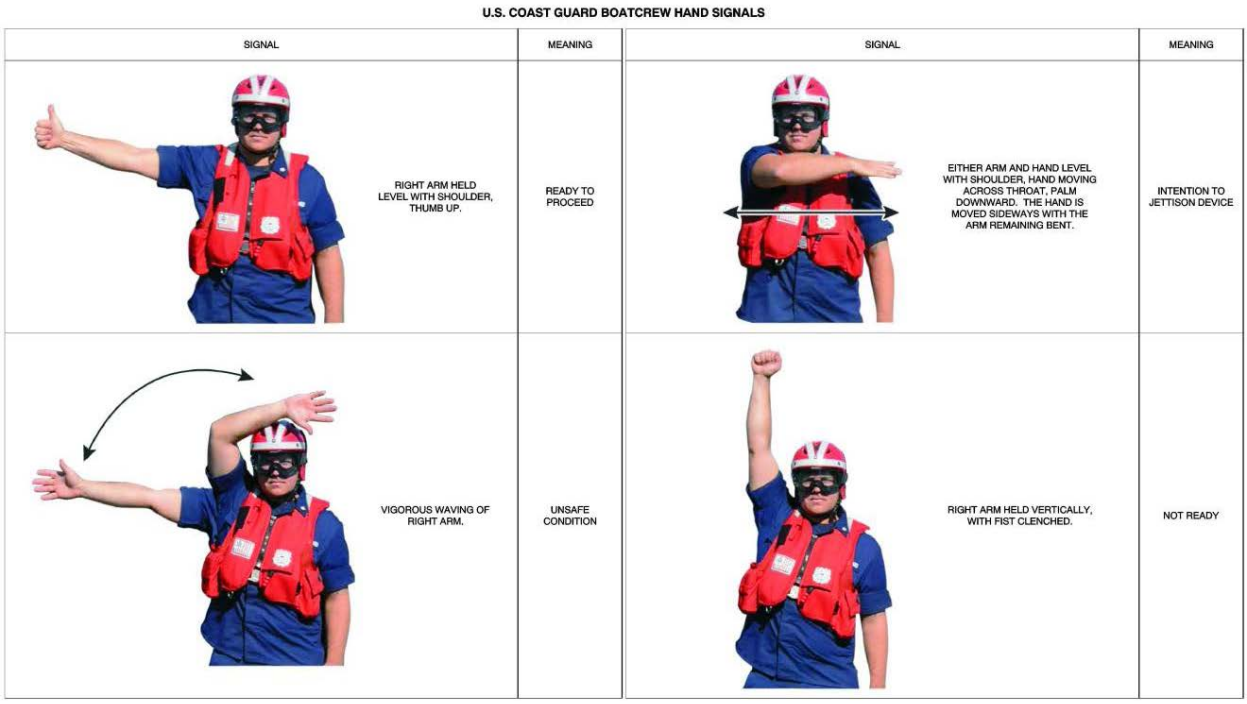


Figure 6-8
Hand Signals Between Boat and Helicopter

B.3.g.1. Hand Signals – Ready to Proceed

When ready to proceed, the boat crewman designated to give hand signals shall raise their right arm level with the deck and extend the "thumbs up" to the hoist operator. The crew member should check with other crew to ensure they are ready to proceed. Examples of when to use this signal are as the helicopter approaches the boat to signal "ready on deck" and to inform the hoist operator that the device can be retrieved from the deck of the boat

B.8. Nonstandard Boats

Hoisting from nonstandard boats for training is not preferred and presents potential issues for the helicopter and boat. Hoists from non-standard boats, Auxiliary craft or OGA's may require a different technique. The helicopter will maintain a steady course and speed while lowering the rescue device to a point below the aircraft near the surface. The boat should approach and maneuver under the hoist for delivery. This method of conducting a hoist should be done only in an emergency situation and must always be discussed between the boat operator and aircraft commander prior to execution.

B.9. Helicopter-Boat Configuration

The rescue device will be lowered from the right side of the aircraft. The helicopter will approach the boat from astern (downwind) and hover off the stern/port side. This method of approach allows the pilot and hoist operator (located on the right side of the aircraft) a full view of the boat during the evolution (**Figure 6-10**).

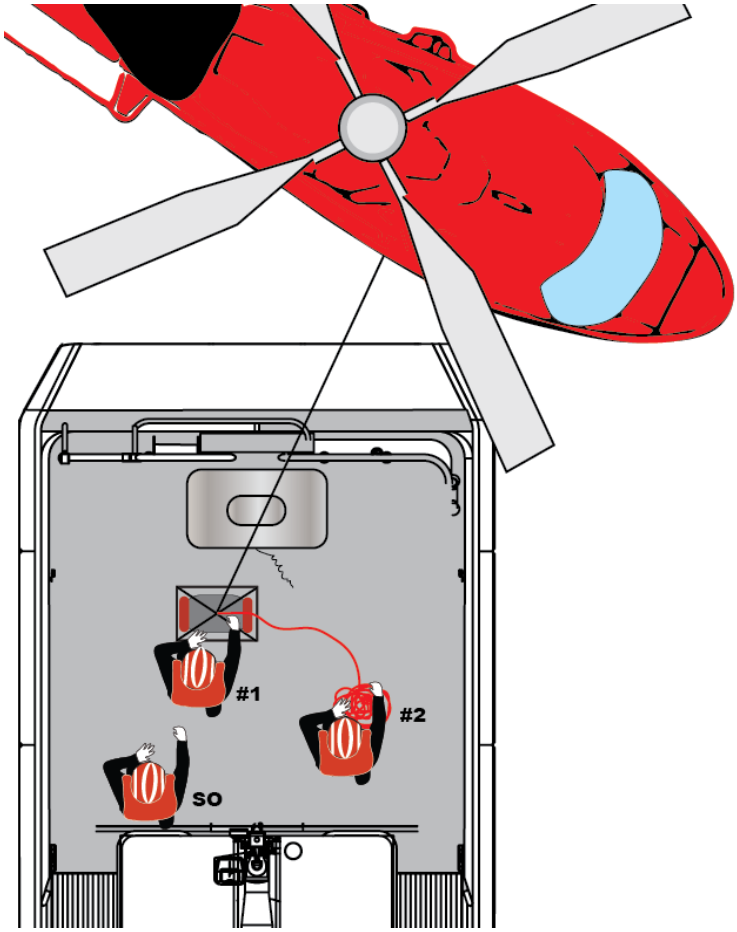


Figure 6-10
Overhead view of deck personnel, with M/J basket and trail line

B.10. Dead-in-the-Water

When a boat is dead-in-the-water (DIW), the helicopter may approach the boat's bow or starboard beam (**Figure 6-11**). Due to the downwash, the boat will almost always turn clockwise and the aircraft will maintain visual contact by turning in the same direction during the hoist. On smaller platforms, the helicopter will have some control over the vessel by using its rotor wash.

Coast Guard helicopters use different approaches for different styles of vessel if they are DIW. The approach will also vary depending on where the working deck will be. Most Coast Guards boats will work off the stern while some fishing vessels might work off the bow since their stern area contains equipment that could foul the hoist cable. Boat crews must always communicate with the helicopter before a hoisting evolution to ensure both parties know the plan. Once hoisting has begun, the helicopter will almost always remain off the starboard side of the boat.

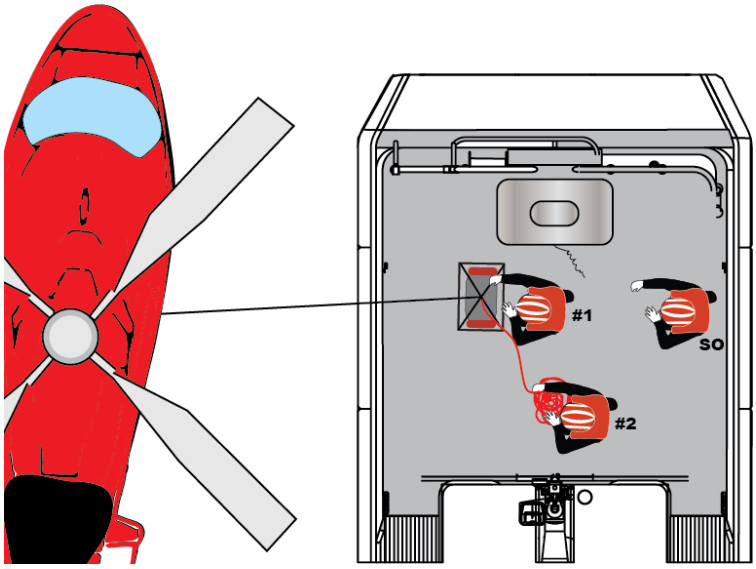


Figure 6-11
Overhead View of Crew Positions During DIW Hoist

Delivery of the Rescue Device

B.11. Description

Delivery of a rescue device from the helicopter to a vessel in distress or for training will be accomplished by one of the following three methods:

(01) Direct delivery.

(02) Trail-line delivery.

(03) Indirect delivery.

After the rescue device is delivered (and if previously agreed to in the aircraft brief), a boat crewmember will disconnect the hook before moving away from the delivery/hoisting location. The cable may be re-attached to the device at a time agreed upon with the helicopter pilot.

WARNING Never attach the hook to any part of the boat.

B.12. Direct Delivery

During direct delivery, the rescue device is lowered directly to the deck of the vessel. The boat crewmember tending the lowered piece of equipment should allow the hoist operator to keep the hoist cable as plumb as possible to avoid swinging of the rescue device

B.13. Trail-Line Delivery

During trail-line delivery, a 5-pound or heavier weight bag is attached to the trail line and lowered from the helicopter to the vessel. The helicopter will then back off to a safe hoisting distance while paying out the trail line. The non-weighted end of the trail line is attached to the rescue device (weak link first) and lowered to the vessel (**Figure 6-12**). Boat crewmembers will tend the trail line by hand-over-hand method, exerting enough strain to guide the rescue device to the delivery point on deck. Too little strain causes the device be lowered nearly vertical (plumb) which makes device management more difficult for both the hoist operator and crew on deck. The crew on deck then have to work harder to pull the device toward the boat. Placing enough strain on the trail line allows for the device to be tended more diagonally and allows for an easier evolution. As the hoist operator pays out slack, continue to haul in on the trail line to avoid the device from being lowered vertically. A second crewmember (Crew 2) will assist the crewmember (Crew 1) hauling in the trail line by coiling the trail line in a safe place on deck ensuring the line does not get fouled around an object or get blown overboard.

Figure 6-12
M/J Rescue Basket Going Down

B.16. Basket Hoist

Every person transferred must wear a PFD and head protection, if available. The person must be positioned in the basket with hands placed palms up under the thighs. This position will keep the arms tucked in close to the body and inside the basket. The crewmember assisting the person into position must ensure that no part of the person's body is outside of the basket and that the basket does not hang up on equipment attached to the boat. When the individual to be hoisted is in the proper position, the boat crewmember will give the "thumbs up" to the hoist operator, who will commence the hoist (**Figure 6-15**). If a trail line is used, it should be tended hand-over-hand over the side. When the end is reached, the weighted bag is gently released.

Figure 6-15
M/J Rescue Basket with Person Properly Positioned and Ready for Hoist

B.17. Stokes Litter Hoist

The Stokes litter used for hoisting will be provided by the helicopter. When the victim is placed in the litter, a boat crewmember must tighten all restraining straps around the person. There are four straps and one chest pad. The crewmember tending the litter must make certain it does not get hung up on boat equipment. When the person is to be hoisted, boat crewmember 1 will give a "thumbs up" to the hoist operator, who will commence the hoist. If a trail line was used, the crewmember (usually crew member 2) tending the line will keep a steady strain in an attempt to prevent the stokes litter from spinning as it rises to the helicopter.

B.18. Rescue Strop Hoist

The strop will only be used to transfer trained, uninjured military personnel in fair weather. The strop is basically a collar which has one end attached to the hoist cable. When the person to be hoisted positions the collar under the armpits, a boat crewmember must ensure the safety straps are fastened. The end of the collar opposite the hoist cable has a v-ring that attaches to the hook. **Figure 6-6** shows how the strop looks when properly connected. This device is not likely to hang up on attached equipment as easily as the other rescue devices.

B.19. Hoisting of Equipment

All attachment points and the equipment must be secured and monitored to keep it from catching or snagging.

B.20. Commencing Hoist

When a person or equipment is secured in the rescue device, the designated boat crewmember will give the hoist operator a "thumbs up" hand signal. The hoist operator will then commence lifting the rescue device. During this procedure, the boat crew must ensure the rescue device is not caught on anything attached to the boat.

B.21. Casting Off

When a trail line is employed, a boat crewmember shall tend it until he or she reaches the weighted end. Then the crewmember should gently release the weighted bag over the side of the boat on which the hoist was conducted (normally the port side). The bag should never be thrown upwards towards the rotors.

B.22. Post Hoist

Once the trail line is cast off, the coxswain will maneuver to starboard and away from the helicopter unless there is another hoist to be conducted

B.23. Fouled Cable/Equipment Procedure

If the cable or hoisting equipment becomes fouled it is critical that boat crew members immediately communicate this unsafe condition to the flight crew and coxswain and attempt to clear the cable or device if injury or damage is not imminent.