

CHAPTER 5

DECK SEAMANSHIP

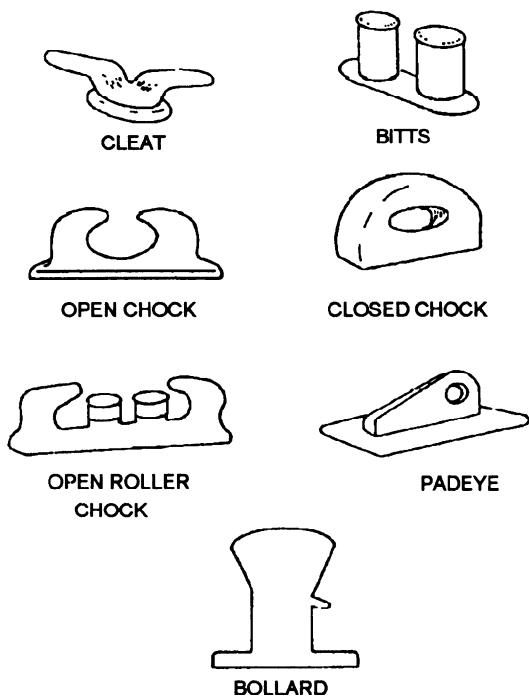
LEARNING OBJECTIVES

Upon completing this chapter, you should be able to do the following:

1. Describe the most common deck fittings used on board ship.
2. Describe the approved rigging and procedures for going aloft and working over the side.
3. Explain the safety requirements for going aloft and working over the side.
4. Describe the use and care of canvas and leather products on board ship. Explain how to sew the different types of stitches that are common to deck force duties.
5. Explain the purpose of underway replenishment and identify the basic rigs associated with underway replenishment.

DECK FITTINGS

Deck fittings are devices attached to the hull that assist in handling the ship. The most common fittings are found around the weather decks. A brief description of some common deck fittings (fig. 5-1) follows.



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Figure 5-1.—Various deck fittings.

CLEAT

A cleat consists of an in-line pair of projecting horns and is used for belaying a line.

BITTS

Bitts are heavy vertical cylinders, usually arranged in pairs, that are used for making fast lines led through chocks. The upper end of a bitt is either larger than the lower end or is fitted with a lip to keep the lines from slipping off accidentally. Since bitts take very heavy loads, extra frames are worked into their foundations to distribute the strain. Usually, there is a set of bitts forward and aft of each chock. When constructed in pairs, each bitt is sometimes called a barrel.

CHOCK

A chock is a heavy fitting with smooth surfaces through which mooring lines are led. Mooring lines are run from bitts on deck through chocks to bollards on a pier when the ship is moored. There are three types of chocks: open, closed, and roller. An open chock is a mooring chock that is open at the top. A closed chock is a mooring chock closed by an arch of metal across the top. A roller chock is a mooring chock that contains a roller for reducing friction.

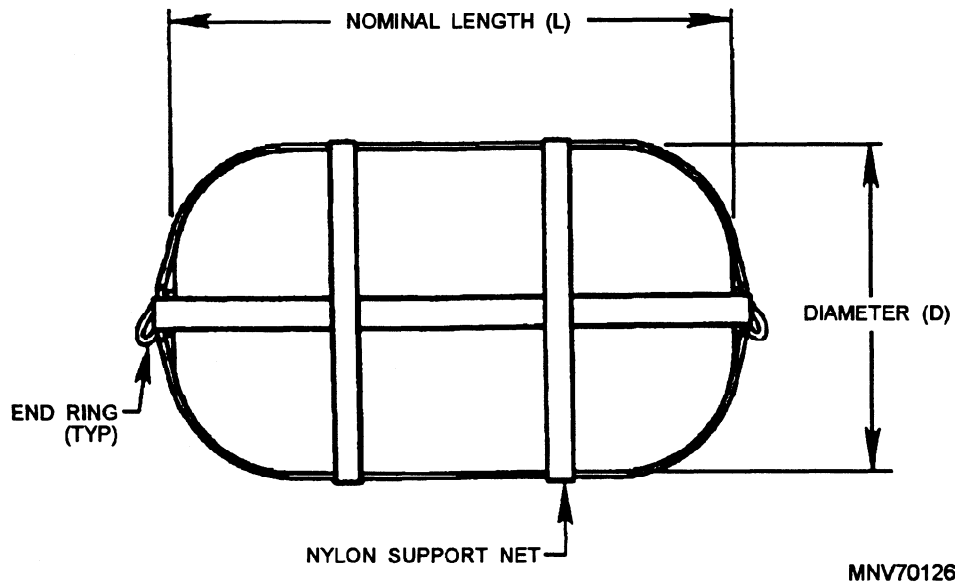


Figure 5-2.—Navy-style foam-filled fender.

PADEYE

A padeye is a plate with an eye attached, welded to the deck to distribute the strain over a large area, and to which a block can be hooked or shackled. A padeye is also used in towing operations.

BOLLARD

A bollard is a strong cylindrical upright on a pier, over which the eye (or bight) of a ship's mooring line is placed.

FENDERS

Fenders protect the ship from contact with the pier or another ship.

The most common ship fender is a pneumatic fender made of rubber, about 4 feet long and 3 feet in diameter. It should be positioned amidships at the extreme beam. This fender is normally the only one the ship rides against when it is alongside another ship. A number of additional fenders, depending on the size and type of ship, are kept ready on the forecastle and on the

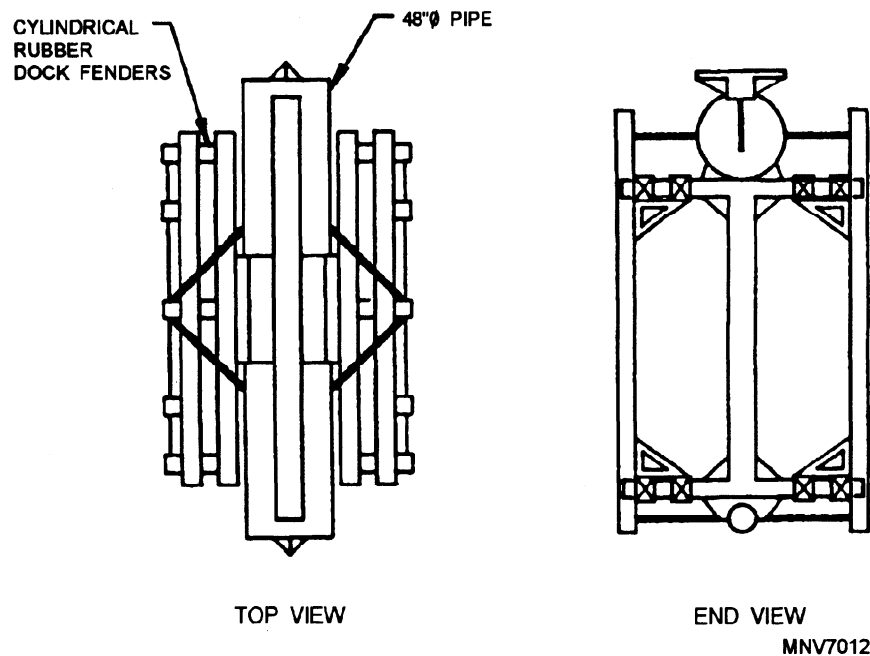


Figure 5-3.—Camels.

fantail. These are normally smaller pneumatic fenders or homemade manila fenders about 4 feet long and 1 foot in diameter. The Navy-type fender is shown in figure 5-2.

CAMELS

Camels are used to protect a fender system from damage due to the motion of moored ships and, where necessary, to provide proper clearance between a ship and a wharf or pier. Camels are floating separators that can be attached to a fender system, the wharf, pier, or the ship itself. The camels that are generally used for mooring a ship are shown in figure 5-3.

THE SEAMAN ALOFT

As a Mineman in the deck division, you will be involved in painting or doing repairs while working either aloft or over the side. To do these tasks safely, you must be able to rig and use both the boatswain's chair and the stage correctly. You must also know the safety precautions involved in working aloft and over the side.

BOATSWAIN'S CHAIR

The boatswain's chair is a hardwood seat attached to a double bridle of stout line, as shown in figure 5-4. It is always bent to the gantline by a double becket. A length of slack line is left hanging, as shown in the figure, for use in securing the chair to a mast, or in staying aloft.

For a straight drop, as when painting down a mast, rig the chair for self-lowering. When you ascend a mast, you will often find that the ladder takes you only to the crosstree. You must be hoisted from there to the truck (top of the mast) by personnel on deck. When there is no way of getting to the truck by ladder, a dummy gantline is usually left reeved from the cross-tree up through the sheave (pulley) at the truck and back to the crosstree. This allows you to attach the chair gantline to the

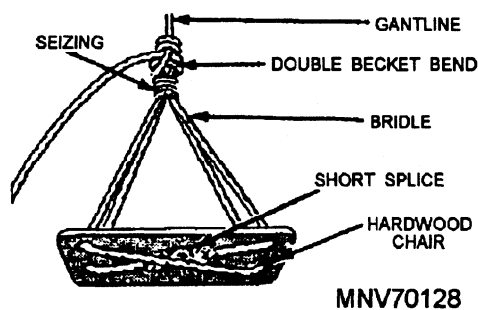


Figure 5-4.—The boatswain's chair.

dummy gantline and then use the dummy gantline to pull the chair gantline through the sheave. If there were no dummy gantline, someone would have to climb the topmast to reeve the chair gantline through the sheave. Never let the end get away from you and reeve out.

A recommended method of securing gantlines is diagrammed in figure 5-5. The end of the chair gantline is secured to the end of the dummy gantline by butting the two ends together and seizing the ends with turns of rope yarn back and forth between strands, so the joint will pass through the sheave without fouling. In use, the chair gantline is hauled up and through by the dummy gantline, the chair is heaved from the deck to the crosstree, and the hauling part is passed down to the personnel or deck crew.

Never let anyone attempt to hoist the chair aloft with the dummy gantline. Be sure all your tools and equipment are attached to the chair so that your hands are free and to ensure the safety of anyone below from falling objects. When you are ready to go up, and the deck crew is ready to heave around, get into the chair and give a signal to be pulled up. Assist the deck crew by hauling down on the hauling part. Keep your hands clear of the part the chair is on or they may get jammed into the sheave when you are two-blocked to the truck. When you reach your desired working height, signal the crew below to "Hold what you got". The deck crew will stop pulling and hold the chair in place. Reach above the double becket bend with your left hand and firmly squeeze the two parts of the gantline together. When you have a good grasp, command the deck crew Up behind. This tells them to let go of the gantline.

WARNING

At this point, your grasp is all that is keeping the chair from falling. With your right hand, pull the gantline through the bridle and squeeze the three parts together just above the double becket bend.

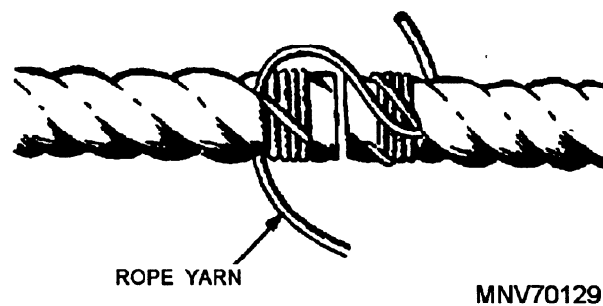


Figure 5-5.—Method of securing gantlines.

Now the strain is on the bridle, as in the first view of figure 5-6.

With your free left hand, pull up some slack from below so you will have enough line to pass over your head, around the chair, and under your feet, as in the second view of figure 5-6. This maneuver is a bit tricky, especially if you have a bucket or two hanging on the chair, but you will not have any trouble if you have enough slack pulled up. Keep hold of the gantline with your right hand until you have worked the hitch up to the apex of the bridle, as shown in the third view of figure 5-6. Then hold the two parts of the gantline above your right hand with your left, and work the rest of the slack down.

You are now in no danger of falling, and all you have to do to lower the boatswain's chair is pull up the

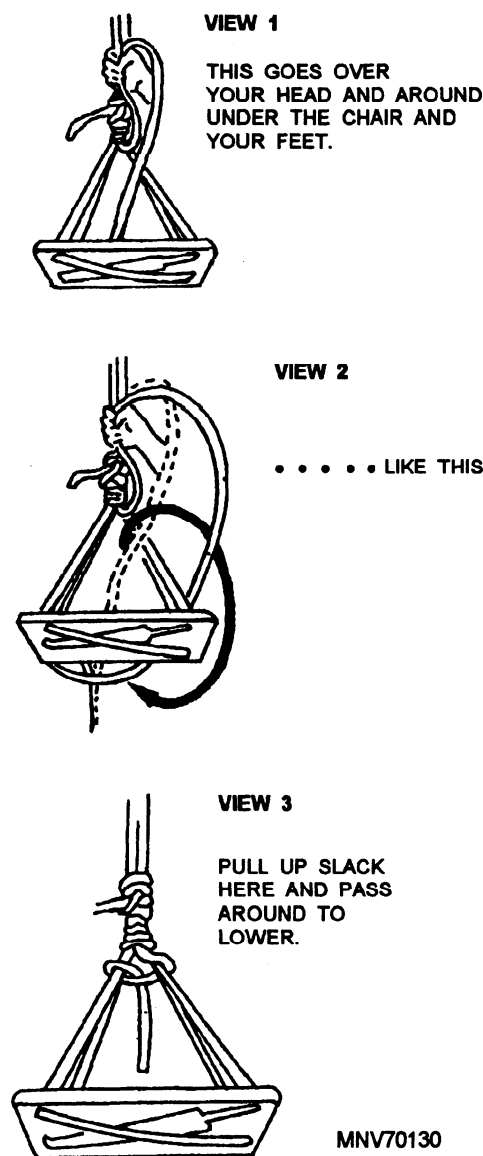


Figure 5-6.—Rigging for self-lowering.

slack and pass it around. Before you go aloft for the first time, practice hanging off deck a few times.

SAFETY PRECAUTIONS

The following are a few safety precautions you must follow whenever you work aloft. Before you go aloft, review all of the safety precautions on working aloft listed in OPNAV Instruction 5100, Vol II, Chapter 8.

1. Be sure you have permission from the officer of the deck (OOD) before you go aloft.
2. Be sure that radio and radar units are OFF and rotatable antennas are stopped and guarded. Ask if the "man aloft chit" has been completed. A man aloft chit is processed to ensure that key personnel are aware of any work being done aloft. The chit is signed by the ship's electrical maintenance officer (EMO), communications officer (COMMO), and command duty officer (CDO).
3. Tie your tools and equipment to the boatswain's chair to prevent them from falling on personnel below.
4. Wear a safety harness and secure it to a fixed object above you once you are aloft.

WORKING OVER THE SIDE

As with work aloft, work over the side has certain rules that must be followed. The following rules are the basic rules for all work over the side.

1. Personnel preparing to work over the side should notify the OOD. Upon securing, they should notify the OOD again.
2. All personnel working over the side of the ship on stages, boatswain's chairs, and on work floats or boats along the side of the ship must wear life jackets and, with the exception of personnel in boats, must be equipped with a parachute-type safety harness with safety lines tended from the deck above.
3. All personnel should be instructed in all applicable safety regulations before they are permitted to work over the side of the ship on scaffolding, stages, or in boatswains' chairs.
4. A competent petty officer must constantly supervise personnel working on scaffolding, stages, and in boatswains' chairs, and personnel must be assigned to tend the safety lines.

5. All tools, buckets, paint pots, and brushes used by personnel working over the side of the ship should be secured by lanyards to prevent their loss overboard or injury to personnel below.

STAGE

The stage is a stout plank, to the underside of which two short wooden horns are attached athwartships, either by nailing or bolting on, a foot or two from either end. When the stage is rigged properly, all the weight comes on the plank. The chief purpose of the horns is to hold the plank off the side.

The gantlines on your stage may be rigged in one of two ways. The first is by means of an eye splice in the end of the gantline (fig. 5-7). Be sure to pass the part between the half hitches under the plank. If you pass it over the plank, there will be nothing holding you up but the horns. The second method of rigging the stage is by means of the stage hitch, shown in figure 5-8. This method is the better of the two because there are two parts of the gantline under the plank instead of one, and there is no need to eye splice the end.

REEVING GANTLINES

The best way to reeve your gantline for lowering is over a smooth surface. Never have your gantlines running over a sharp edge. Place chafing gear wherever the lines from your shackles cross anything sharp.

Be sure to follow these safety precautions whenever you are part of an over-the-side working party:

- Lower one end of your partner's stage at a time while your partner keeps the other side secured.

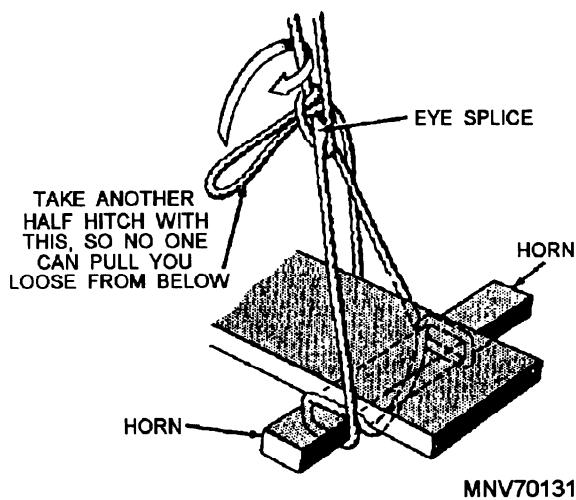


Figure 5-7.—Eye splice rig on a stage.

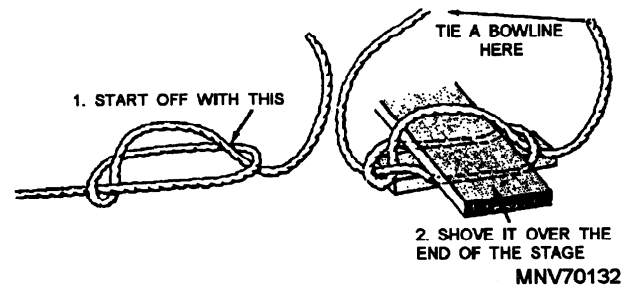


Figure 5-8.—Rigging with a stage hitch.

- Warn your partner before making moves that may jar the stage.
- Always wear a safety harness and lifeline when working on a stage.
- Always wear a life jacket when working over water.
- Keep clear of overboard discharges.
- Do not secure safety lines or gantlines to the stations that hold up the lifelines.
- Do not allow more than two persons on a stage at the same time.
- Secure tools to the stage with small stuff to prevent them from dropping.

TAKING SOUNDINGS

Soundings (measuring the depth of water) are taken when the ship is going into or out of port or approaching an anchorage. The hand lead is the most accurate means for obtaining soundings. It is used in shallow water and when the speed of the ship is slow. Even though ships today have modern depth-sounding equipment, lead lines are a mandatory piece of equipment and are routinely checked during inspections and refresher training periods.

LEAD LINE

The lead line or hand lead consists of a narrow block of lead weighing from 7 to 14 pounds, which is

attached to a marked line (fig. 5-9). With the ship making 12 knots, a good leadsman can get reliable soundings down to 7 fathoms. At slower speeds, of course, the lead has time to sink even deeper before the ship moves up to it. The lead line may also be used for determining the direction in which a ship, practically dead in the water, is moving. Direction of movement is found by placing the lead on the bottom, directly below the leadsman, and noting the direction of the motion of the ship as shown by the change of direction of the lead line from the vertical.

Before you heave the lead, take your station in one of the chains, which usually are platforms projecting over each side at the after end of the forecastle. The lower the lead over the side and support it in the heaving hand by a wooden toggle, inserted in the lead line about 2 fathoms from the lead. Coil the spare line in your other hand, free for running.

To make the heave, start by calling out "Watch-O-Watch," then swing the lead in a fore-and-aft direction

outboard of the chains to gain momentum. When you can swing the lead in a complete circle, and the force is great enough, let go of the lead as it swings forward at a point about level with the deck

As the ship moves ahead, heave in the spare line rapidly. Read the marker when the lead is on the bottom and the line hauled just taut, vertically. You will acquire the ability to heave the lead only by practice. It is necessary to practice with both hands because you will use your right hand for heaving from the starboard chain and your left hand for heaving from the port chain.

A good heave has no value unless you can read the depth correctly and quickly. Learn the markings of the lead line, which are identified in figure 5-9.

Lead lines often are marked at each half-fathom over the range of depth used most and may even have foot markings around the more important depths. Some lead lines are fixed so that you may read the depth at the level of the chains instead of at the water's edge. This procedure makes it easier to take sounds at night. Learn any special markings on the lead line that may be used on your ship.

Report each sounding to the bridge in a sharp, clear voice. When the sounding agrees with one of the marks, report it by mark; such as "Mark 2", "Mark 3", or "Mark 5".

When the sounding falls on an even fathom between marks, report it as "By the deep 4", "By the deep 8", "By the deep 9". If the reading does not give an even fathom, report it as "A quarter less three" (1/4 fathom less than 3 fathoms of water); "And a quarter, four" (1/4 fathom more than 4 fathoms of water); "And a half, four" (1/2 fathom more than 4), and so on. If the lead does not reach the bottom, report "No bottom at (number of fathoms)".

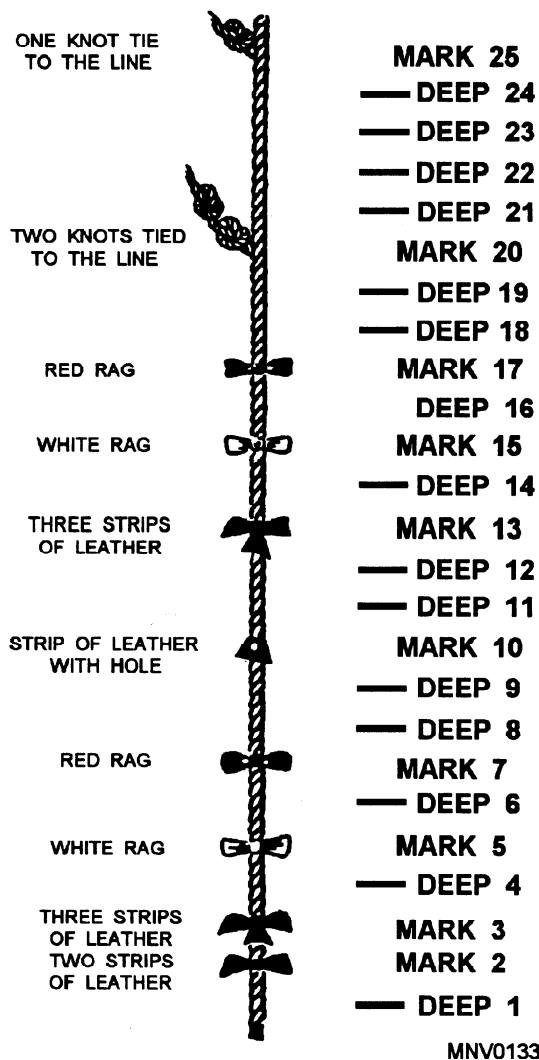


Figure 5-9.—Markings of lead line.

CANVAS AND LEATHER

Canvas and leather have long been important in a Seaman's life. In the next few pages, you will learn how to sew small articles by hand using some of the most common stitches.

Canvas, often called duck, is a general name for a class of strong, heavy, plain cloth woven of cotton or linen. *Numbered duck* is the canvas encountered most often, but occasionally you see the terms *ounce duck* or *army duck*. Numbered duck runs from No. 1, the heaviest, to No. 12, the lightest. Numbers 7, 9, and 11 are no longer issued.

Each number means a certain weight in ounces per square yard of cloth. For example, No. 1 means 28.71 ounces per square yard; No. 6 means 20.74 ounces per square yard; and No. 12 means 11.16 ounces per square yard. Canvas in weights other than those specifically designated under the numbered system is called ounce *duck*. Army ducks are ounce ducks similar to numbered duck, but have finer yarns, higher cloth counts, and usually lighter weights. The following items are a sample of articles made from different weights of canvas.

NO. OF CANVAS	ARTICLE
1	Sandbags
1	Hammocks
2	Hatch paulins
4	Berth bottoms
4	Seabags
4	Gun covers
4	Muzzle bags
6	Large boat covers
8	Hose rack covers
8	Soiled clothes bags
8	General-purpose paulins
10	Shower curtains
12	Destruction bags

Canvas is usually made up in bolts of from 85 to 100 yards, but is issued by the linear yard, in widths from 22 to 72 inches.

Even with the best of care, canvas is relatively short-lived, and for this reason, the Navy is using more synthetic fabrics. Synthetics are not only lighter and easier to stow, but also are rot- and mildew-resistant.

Synthetic fabric, like synthetic line, costs more than natural fabric. Because of this greater cost, you must be more selective in its use.

One type of synthetic fabric used extensively for tarps and awnings and for boat, winch, and reel covers is a nylon cloth with a vinyl film on both sides. (The smooth or face side is the side to expose to the weather.) Two different companies furnish this type of cloth under their own brand names (Herculite #80® and Hypalon®). These white or grey materials weigh approximately 19.6 ounces per square yard and come in

50-inch widths. They are fire-, water-, weather-, and mildew-resistant.

Another type of cloth, a black neoprene-coated material, is less suited for topside use but has many below-deck applications, such as for blackout and welding curtains. This material weighs approximately 2.3 ounces per square yard and comes in a 39-inch width. Generally, you should give synthetic cloths the same care as synthetic lines. When they are dirty, however, you should wash synthetic fabrics with saddle soap or any other mild soap and water; scrub them with a soft bristle brush, using a circular motion; and rinse them with clear water. In some instances, two cleanings may be necessary.

All hems should be triple-folded and sewed, but reinforcing material and other patches may be sewed or cemented in place. When you cement a patch, clean the area with a solvent. Then apply a coat of cement to the patch and to the surface to be repaired or strengthened. Allow these coatings to dry, then apply a second coat to each surface. When these coatings are tacky, position the patch. Rub or roll the patch and make certain that all points make contact.

With synthetic cloth, do not use manila for bolt ropes and lashings, because the manila will stain the cloth. Use cotton line or one of the synthetic lines. The eyelet-and-ring type of grommet has a tendency to slide and pull out of synthetic cloths; therefore, only the spur type of grommet is recommended.

TREATED CANVAS

Much of the canvas issued in the Navy is treated to make it resistant to fire, water, weather, and mildew. Some is waterproof and oil- and gasoline-resistant. Current specifications for building ships require that all topside canvas be treated according to the intended use. Canvas to be used below decks is usually white and untreated. Preservatives are available for shipboard use on untreated canvas or for re-treating canvas.

CARE AND STOWAGE

Canvas is very expensive, so learn to care for it and make sure to never abuse it. New and unused canvas, spare covers, and so on, should be stowed in a clean, dry storeroom. Never store canvas where acid is or has been stowed; acid fumes are detrimental to canvas. Make every effort to provide a space free from rats, mice, and insects. Do not stow wet, painted, or oil-soaked canvas below decks. Occasionally it is necessary to scrub canvas that has become dirty or stained by grease or oil.

Use a mild soap solution, rinse thoroughly, and hang the canvas up to dry.

All covers, awnings, and paulins should be inspected frequently and carefully, and all rips and tom or loose seams should be repaired. If a grommet tears out, sew a patch over the spot and put in another grommet. A larger size grommet may be substituted for one that has tom out if it is in a spot where appearance is unimportant. You can save time and trouble if you file away or enter into a log all information pertaining to renewing canvas articles aboard your ship.

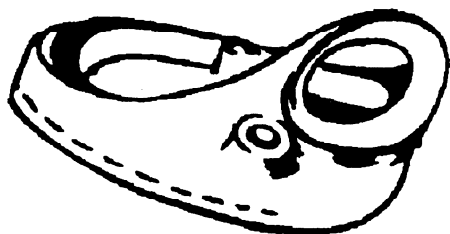
Measuring Canvas

Take great care when you measure and cut canvas—**MEASURE TWICE AND CUT ONCE**. When you measure canvas for items that will be stretched taut (awnings, for example), **DEDUCT** one-half inch for each linear foot in both width and length. If the canvas is to be loose (as for hatch hoods and gun covers), **ADD** one-half inch for each linear foot in both width and length. Use the old article for a pattern whenever possible. When the old article is not available, make a sketch of the item, showing all the necessary dimensions, and work from that.

SEWING CANVAS BY HAND

In most instances when you are required to fabricate articles, you will need the appropriate tools, a few of which are as follows:

- Sail needles. Needles are numbered according to size; the higher the number, the smaller the needle. The heavier the canvas, the larger your needle should be. After being used, needles should be dried carefully and oiled or stowed in a container of powdered chalk to prevent them from rusting.
- Palms. Two types of palms are issued in the Navy; the sailmaker's palm (fig. 5-10) and the roping palm. At first glance you probably see no



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Figure 5-10.—Sailmaker's palm.

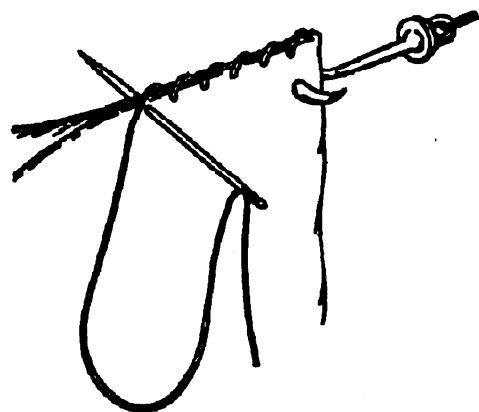
difference, but if you check the metal slug you can see that the roping palm is designed for larger size needles. This is the palm to use when jobs require the largest needles—sewing on bolt ropes, for example. They are designed to be worn in the palm of the hand and are used to aid in pushing a sail needle through the material being sewn.

- Sailmaker's hook or bench hook. This hook (fig. 5-11) has a swivel eye. It is used to hold the ends of two pieces of canvas being sewn together, as shown in figure 5-11.
- Beeswax. This substance can hardly be called a tool, but it is a necessary item. It reduces the wear on the sail twine while sewing is being done, and it retards deterioration. To use it, run the sail twine through the block surface of the beeswax. This gives the twine a waxed coat.
- Sail twine. Many different types of twine are used for sewing, but lacing twine (already waxed) is best for hand-sewing.

Stitches and Their Uses

The following are some of the common stitches that you will find useful in your work:

- Round stitch. The round stitch is the stitch most commonly used for joining two pieces of canvas. Turn back the edges, hold the pieces together, and send the needle through both pieces at right angles to the seam, as shown in figure 5-11.



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Figure 5-11.—Round-stitching a canvas held by a bench hook.

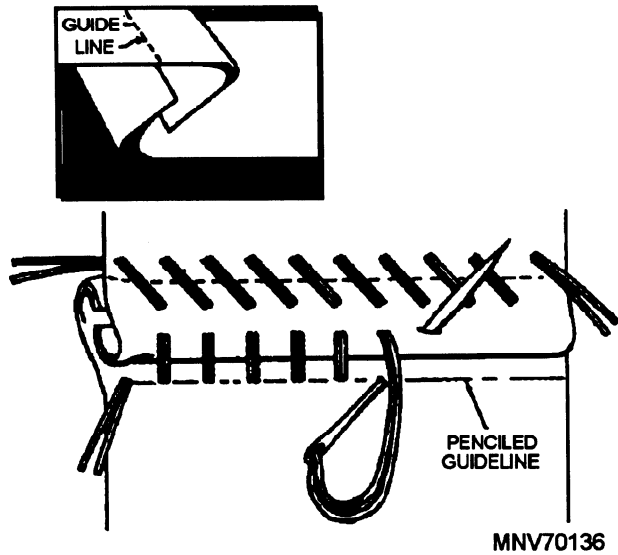


Figure 5-12.—Flat stitch.

- Flat stitch. A flat stitch is used when a strong seam is required, as on a paulin or a sail. Pencil a guideline 1 1/2 or 2 inches from the edge of each strip of canvas, depending on how wide you want the seam. Crease each piece on a line slightly less than halfway to the guideline. Make the folds away from the guidelines and interlock the folds (fig. 5-12). Interlocking the edges forms a watertight seam and keeps a ragged edge from showing. Insert the needle at the guideline, and stitch diagonally so that the stitches appear at right angles to the seam on top but run at an angle on the reverse side. After completing one edge, turn the canvas over and sew the other edge of the seam. Flat stitching also is used for patching.
- Baseball stitch. The baseball stitch is used to mend tears in light and medium canvas. Figure 5-13 shows how it is done. Keep enough tension on the thread to remove all loops and slack

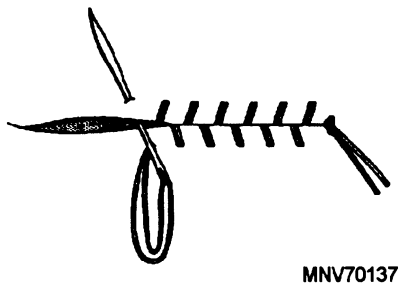


Figure 5-13.—Baseball stitch.

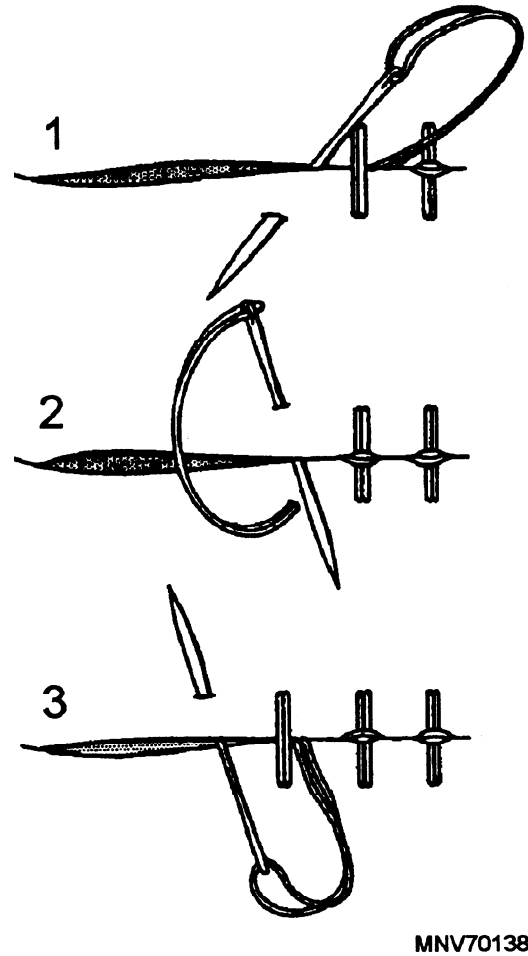


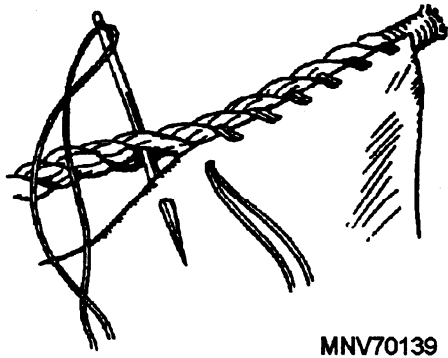
Figure 5-14.—Herringbone stitch.

thread. Do not apply too much tension, however, because this tends to pucker or draw the seam out of line.

- Herringbone stitch. The herringbone stitch is used to mend tears in heavy or painted canvas. Figure 5-14 shows the steps in making this stitch. As you can see from the picture, the herringbone stitch is very strong if applied correctly, as each stitch locks itself as it begins the next.

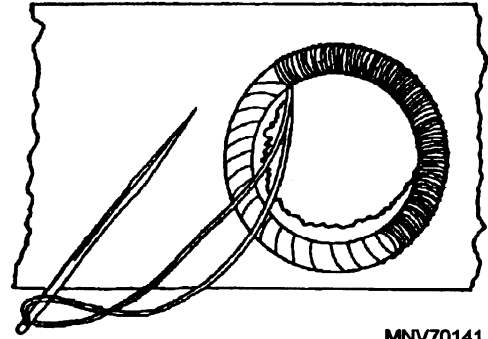
Sewing Bolt Ropes to Canvas by Hand

Bolt ropes are the ropes around the edges of awnings and sails. Their purpose is to take the strain of the stops, clews, reef points, and the like. To sew on a bolt rope, hem the canvas and lay the rope along the edge. Use a round stitch, the size of which is determined by the size of the rope. Sew the rope to the canvas,



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Figure 5-15.—Sewing a bolt rope to canvas.



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Figure 5-17.—Round-stitching a hand-sewn grommet.

strand by strand, as shown in figure 5-15. Carefully observe the following points when you sew on bolt ropes:

- Keep the rope taut and the canvas slack.
- Do not bunch the canvas, but hold your needle at such an angle that it goes through the canvas a fraction of an inch ahead of where it comes out from under the strand.
- Sew each strand to the canvas, making sure the needle goes under, not through, the strands.
- Do not let your stitches start to creep up around the rope, but keep them coming out of the rope in a straight line along the underside. If you let them creep, the canvas begins to curl around the rope.
- **BE SURE YOUR STITCHES ARE TIGHT.**

HAND-SEWING GROMMETS

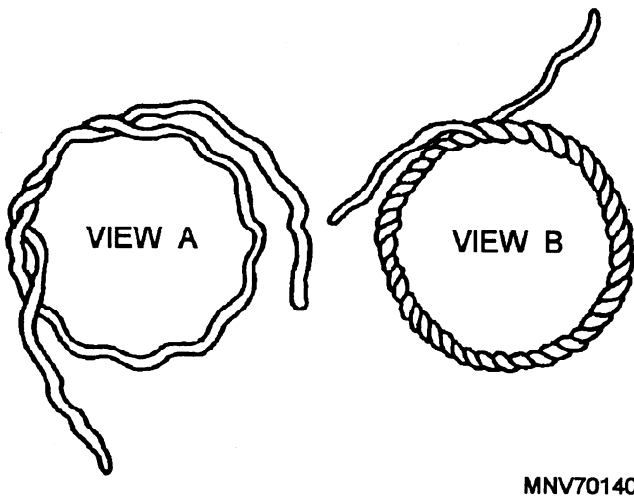
Metal grommets have replaced the hand-sewn type. But if you are ever caught without the proper size of metal grommet, it is nice to know how to make one by hand. Properly made and sewn to the canvas, hand-sewn grommets are almost as strong as the metal type.

The first step is to fashion a two- or three-strand grommet of marline. To do this, form a ring with the marline, of the desired size. Start with an end, laying the strand about itself, as in view A, figure 5-16. Continue laying the marline about itself, as in making a piece of line, until you complete the circle, as in view B, figure 5-16. Half knot the ends and stretch this over a fid to make it round and firm. Next, take your sail twine and double it, then twist the two parts together and cover the pair with beeswax. Then punch a hole slightly smaller than the grommet in the canvas. Sew the grommet using a round stitch; keep your stitches close together to cover the grommet. See figure 5-17. After completing the stitches, shape the grommet again with a fid.

Using Metal Grommets

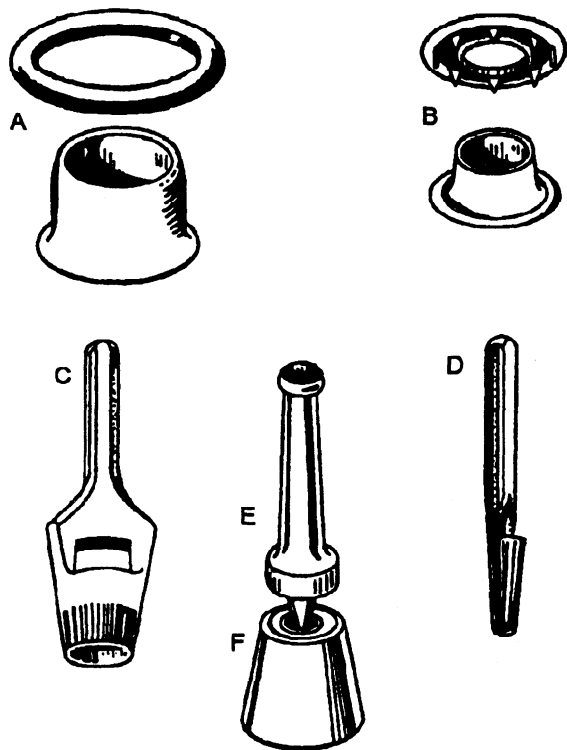
Several different types of metal grommets are in use, but the two that are most familiar are pictured in figure 5-18. The one in view A is called the eyelet-and-ring type, and comes in sizes 6 to 15, inclusive, with inner diameters from three-fourths of an inch to 2 inches. View B shows the spur type. It comes in sizes 0 to 6, inclusive, with inner diameters from one-fourth to three-fourths of an inch,

The cutting punches shown range in diameter from 1 inch down to seven-sixteenths of an inch in the double-bow type (view C), and from three-eighths to one-eighth of an inch in the single-bow type (view D). When you use these to punch holes in canvas, lay the



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Figure 5-16.—Fashioning a marline grommet.



MNV70142

Figure 5-18.—Grommets, cutting punches, and inserting-punch die.

canvas on a piece of heavy sheet lead, and they will cut a neat, clean hole.

The grommet-inserting punches and dies are available in sets in the same sizes as the grommets; that is, from 0 to 15. Use the same size set as the size of grommet. In figure 5-18, view E shows the punch, and view F, the die.

The proper way to insert the spur type of grommet is to push the eyelet part of the grommet through the hole in the canvas. Place the eyelet on the die and, the spur over the eyelet. Fit the punch inside the eyelet and strike the top of the punch with a hammer. This will curl the edge of the eyelet down over the spur. Do not pound too hard on the punch, because that causes the grommet to cut through the canvas, and later it may pull out.

The eyelet-and-ring type of grommet is designed specially for awnings and sails. Properly used, this is the best of all types. First, sew the ring part to the canvas the same as the handmade grommet. Then place the eyelet in the ring and set it with the punch and die.

Sewing Metal Fittings to Canvas

Most metal fittings that must be sewn to canvas are rings of some sort. When you sew them on, as when you

make grommets, use your sail twine doubled and twisted together. Use as many round stitches as you can, stitching through the canvas over as great an area as possible, to spread the strain. Usually O-rings are secured to canvas by placing a webbed strap, folded canvas strip, or even a leather strap through the ring and sewing the strap to the canvas, using a flat stitch.

Awning Hooks

Awning hooks make canvas easy to install and remove. To position these hooks and to prevent them from sliding along the bolt rope, take several crisscross stitches around the hook, as shown in figure 5-19. Put several stitches around the concave pad on each side of the hook to take the strain of the awning lashings.

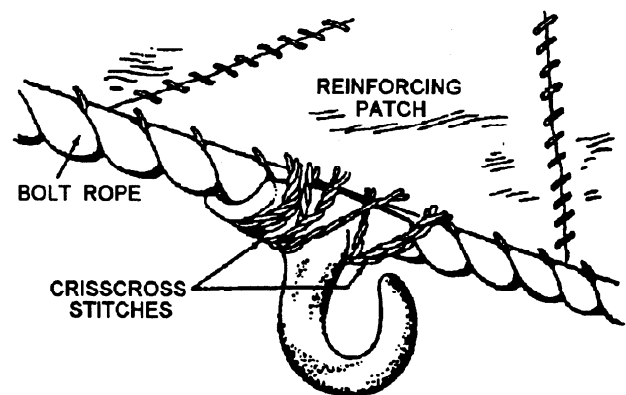
It is a good idea to sew a reinforcing patch over the edge of canvas at every place that you plan to attach a metal fitting.

LEATHER

Hides and skins, being of animal origin, vary in size (area), thickness, and weight. Subsequent tanning and finishing processes further alter these features. The following information concerning size, thickness, and weight is therefore only approximate.

The various types of leather include rigging, harness, shoe, chamois, kid, lacing, belting, and various artificial leathers. Of these, the three you are most likely to need are rigging, belting, and artificial leathers.

Rigging leather is designated by weight as light, medium, and heavy, and ranges from 6 ounces per square foot to over 10 ounces per square foot. It is issued by the pound. There are approximately 20 square feet per hide, and each sixty-fourth of an inch of thickness equals approximately 1 ounce per square foot.



MNV70143

Figure 5-19.—Awning hooks.

Belting is either round or flat and is issued in any desired length by the linear foot. Round belting comes in two widths: one-fourth inch and three-eighths inch. Width is used instead of diameter because, despite the name, round belting is oval rather than perfectly round. Flat belting may be either single- or double-ply. Single-ply belting is available in 1- to 6-inch widths; double-ply, in 2- to 12-inch widths.

The most common types of artificial leathers are used for upholstery and are issued by the square foot.

CARE OF LEATHER

Leather exposed to the elements should be kept well oiled or waxed. Any oil that does not contain harsh chemicals is suitable, but the best is neat's-foot oil. Leather in places such as on lifelines may be kept well preserved by the application of paste wax. Saddle soap, an excellent preservative and cleaner, can be used on holsters, shoes, jackets, and other leather wearing apparel. If leather becomes badly soiled and stained, wash it with a mild soap and water solution, rinse it well, and then dry it in a spot away from intense heat. After it is dry, apply saddle soap or neat's-foot oil to replace the natural oils of the leather.

Leather is especially subject to mildew and rotting. It is also highly susceptible to accidental cutting, gouging, and abrading. Excessive heat causes it to shrink considerably, with subsequent rending and cracking. Acids, corrosives, or their fumes have a disastrous effect upon leather.

To avoid the problems mentioned above when you stow leather, follow the suggestions listed below.

- Stow rolls of leather on top of other materials to prevent crushing
- Stow leather well clear of any liquids or greases that might stain it
- To prevent hides stowed one on top of the other from sticking, place paper between the hides
- Leave original, moistureproof wrappers on as long as possible, to prevent mildew
- Be sure the compartment in which you store the leather is dry and well-ventilated.

SEWING LEATHER

When you need to join two leather edges by hand-sewing, groove the lines along which the stitches will

run to countersink the stitches below the surface. Draw a line parallel and close to the edge first, then make your groove with a grooving tool (a dull knife will do). Use a block of wood for a straightedge. Next, punch holes along the grooves for the stitches.

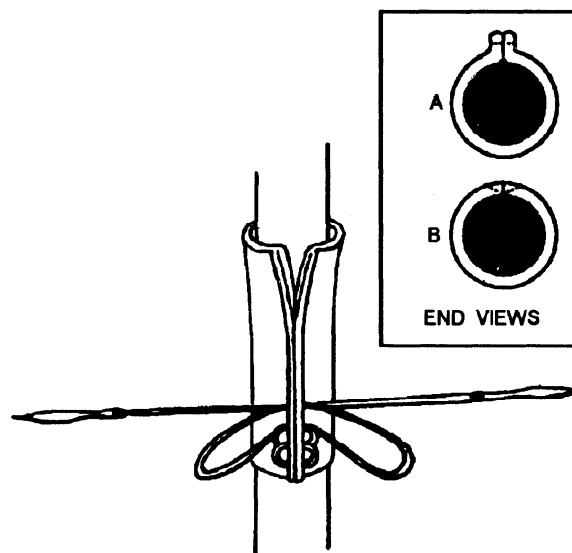
The shoemaker's or cobbler's stitch is shown in figure 5-20. A variation of this stitch is to cut the leather carefully so that the edges abut. Angle the grooves toward the edges of the leather and sew through the edges. Inset A of figure 5-20 shows the end view of the regular shoemaker's stitch. Inset B of figure 5-20 shows the variation.

For easier handling of leather, soak it in a bucket of water for a few minutes. This will soften the leather and make it easier to form.

UNDERWAY REPLENISHMENT

Underway replenishment (UNREP) is a broad term applied to all methods of transferring fuel, munitions, supplies, and personnel from one vessel to another while under way. The term *replenishment at sea*, formerly used in this sense, now applies to all methods except those for fueling at sea.

Before the techniques of UNREP were developed, a ship that ran low on fuel, supplies, or ammunition had to return to port, or the fleet had to lie to while the ship was partially replenished by small boats. If several or all of the ships were in need, the whole fleet had to return to port. The disadvantages were obvious. The effectiveness of a fleet was reduced by every ship that had to leave, and a ship or small group of ships detached



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Figure 5-20.—Shoemaker's stitch.

from a fleet were in greater danger of being sunk or captured. A fleet lying to in order to replenish was more vulnerable to attack, and a fleet heading back to port left the way open for an enemy fleet to accomplish its mission. With UNREP, a whole fleet can be resupplied, rearmed, and refueled in a matter of hours while proceeding on its mission.

CONNECTED REPLENISHMENT

In connected replenishment (CONREP), two or more ships steam side by side, and the hoses and lines used to transfer fuel, ammunition, supplies, and personnel connect the ships. CONREP involves two processes—refueling and resupply. In fueling at sea (FAS), fuel is pumped from a delivering ship, which may be a replenishment oiler (AOR), oiler (AO), fast combat support ship (AOE), or a large combat ship. Other replenishment ships such as the combat store ship (AFS) and the ammunition ship (AE) can deliver lesser amounts of fuel, but their primary purpose is to deliver solid cargo—that is, supplies and ammunition—by the methods now referred to as replenishment at sea (RAS).

The most common refueling rigs are the span-wire and close-in rigs. The span-wire rig has several variations—single hose, double hose, and probe. The span wire may be either tensioned or untensioned. The span wire is tensioned by a ram tensioner. A tensioned span wire, or highline as it is called in RAS, is also used when the standard tensioned replenishment alongside method (STREAM) of transfer is used. STREAM transfer consists of an all-tensioned rig, highline, outhaul, and inhaul.

The illustrations in this chapter and the procedures described are representative only. For example, many items of rigging, such as guys and preventers, have been omitted from illustrations for purposes of clarity. *Standard Organization and Regulations of the U.S. Navy* (commonly called the SORM), OPNAVINST 3120.32, NWP 14 (Series), and *Underway Replenishment Hardware and Equipment Manual* provide the details of rigging and identify the personnel and tools required for each rig. Ship's plans show rigging details, while the SORM affixes responsibility for the various functions to be performed.

Underway Replenishment Hardware and Equipment Manual provides a catalog of the equipment used in the transfer of solid cargo and bulk fluids and a description of the methods used in UNREP. This manual permits the user to identify the equipment and its intended use, and to locate additional detailed

technical information related to the configuration, operation, maintenance, safety features, installation, and procurement of UNREP equipment.

COMMON REPLENISHMENT FEATURES

Many features are common to all replenishment operations. The officer in tactical command (OTC) is responsible for selecting a suitable course and speed, and for taking into consideration the mission of the group and the condition of the sea.

Generally, the delivering ship takes station, and the receiving ship maneuvers to come alongside and maintain position during the operation. During replenishment, individual flaghoists are displayed, as shown in figure 5-21.

Except for gear actually rigged on the receiving ship (such as fairlead blocks and riding lines) and for the distance line and burton whips, the delivering ship furnishes all the equipment.



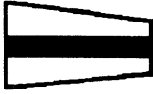

BRIDGE-TO-BRIDGE PHONE/DISTANCE LINE

The bridge-to-bridge (B/B) phone/distance line provides both a sound-powered (S/P) phone circuit and a distance-between-ships visual indicating system. This line is required on all ships. See figure 5-22.

DISTANCE MARKERS

Distance markers on the B/B phone/distance line are arranged as shown in figure 5-23. You make the line up for use as follows:

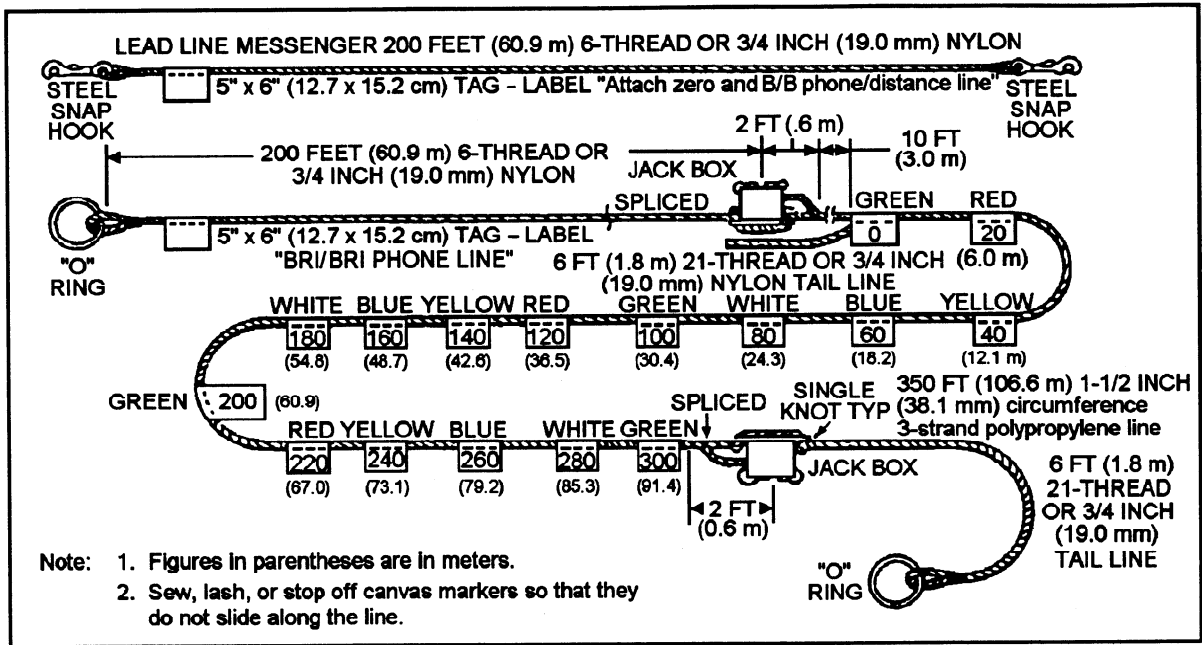
- Day: These markers are colored cloth, nylon-coated fabric, or painted-canvas markers, each 8 inches (20.3 cm) by 10 inches (25.4 cm), spaced at 20-foot (6.0-m) intervals from 0 to 300 feet (0 to 91.4 m). The distance is shown in numerals 5 inches (12.7 cm) high. The markers must be sewn, lashed, or otherwise stopped off in such a way that they will not slide along the line. You must provide grommets, as appropriate, to lash chemical lights for night replenishment.
- Night: Rig chemical lights to the distance line by using two blue chemical lights, one on each side of the 60-, 100-, 140-, and 180-foot (18.2-, 30.4-, 42.6-, and 54.8-m) markers. Lash one red chemical light on the approach-ship side of the other markers. (One-cell, pin-on-type red flashlights may be used instead of red chemical lights.)

VISUAL FLAGHOIST	
 <p>ROMEO DISPLAYED ON FORE YARDARM ON SIDE RIGGED</p>	<p style="text-align: center;">CONTROL SHIP</p> <p>AT THE DIP: AM STEADY ON COURSE AND SPEED AND AM PREPARING TO RECEIVE YOU ON SIDE INDICATED.</p> <p>CLOSE UP: AM READY FOR YOUR APPROACH.</p> <p>HAULED DOWN: WHEN MESSENGER IS IN HAND.</p>
 <p>ROMEO DISPLAYED ON FORE YARDARM ON SIDE RIGGED</p>	<p style="text-align: center;">APPROACH SHIP</p> <p>AT THE DIP: AM READY TO COME ALONGSIDE.</p> <p>CLOSE UP: AM COMMENCING APPROACH.</p> <p>HAULED DOWN: WHEN MESSENGER IS IN HAND.</p>
 <p>PREP DISPLAYED AT THE OUTBOARD YARDARM</p>	<p style="text-align: center;">RECEIVING SHIP</p> <p>AT THE DIP: EXPECT TO DISEGAGE IN 15 MINUTES.</p> <p>CLOSE UP: REPLENISHING COMPLETED; AM DISENGAGING AT FINAL STATION.</p> <p>HAULED DOWN: ALL LINES CLEAR.</p>
 <p>BRAVO</p>	<p style="text-align: center;">BOTH SHIPS</p> <p>WHERE BEST SEEN: FUEL OR EXPLOSIVES ARE BEING RECEIVED.</p> <p style="text-align: center;">APPROACH SHIP</p> <p>AT THE DIP: HAVE TEMPORARILY STOPPED SUPPLYING.</p> <p>CLOSE UP: FUEL OR EXPLOSIVES ARE BEING RECEIVED.</p> <p>HAULED DOWN: DELIVERY IS COMPLETED.</p> <p style="text-align: center;">RECEIVING SHIP</p> <p>AT THE DIP: HAVE TEMPORARILY STOPPED TRANSFERRING.</p> <p>CLOSE UP: FUEL OR EXPLOSIVES ARE BEING TRANSFERRED.</p> <p>HAULED DOWN: DELIVERY IS COMPLETED.</p>

NOTE: AT NIGHT, ROMEO CLOSE-UP MUST BE SIGNALLED BY FLASHING LIGHT.

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Figure 5-21.—Replenishment flaghoists.



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Figure 5-22.—Bridge-to-bridge (B/B) phone/distance line.

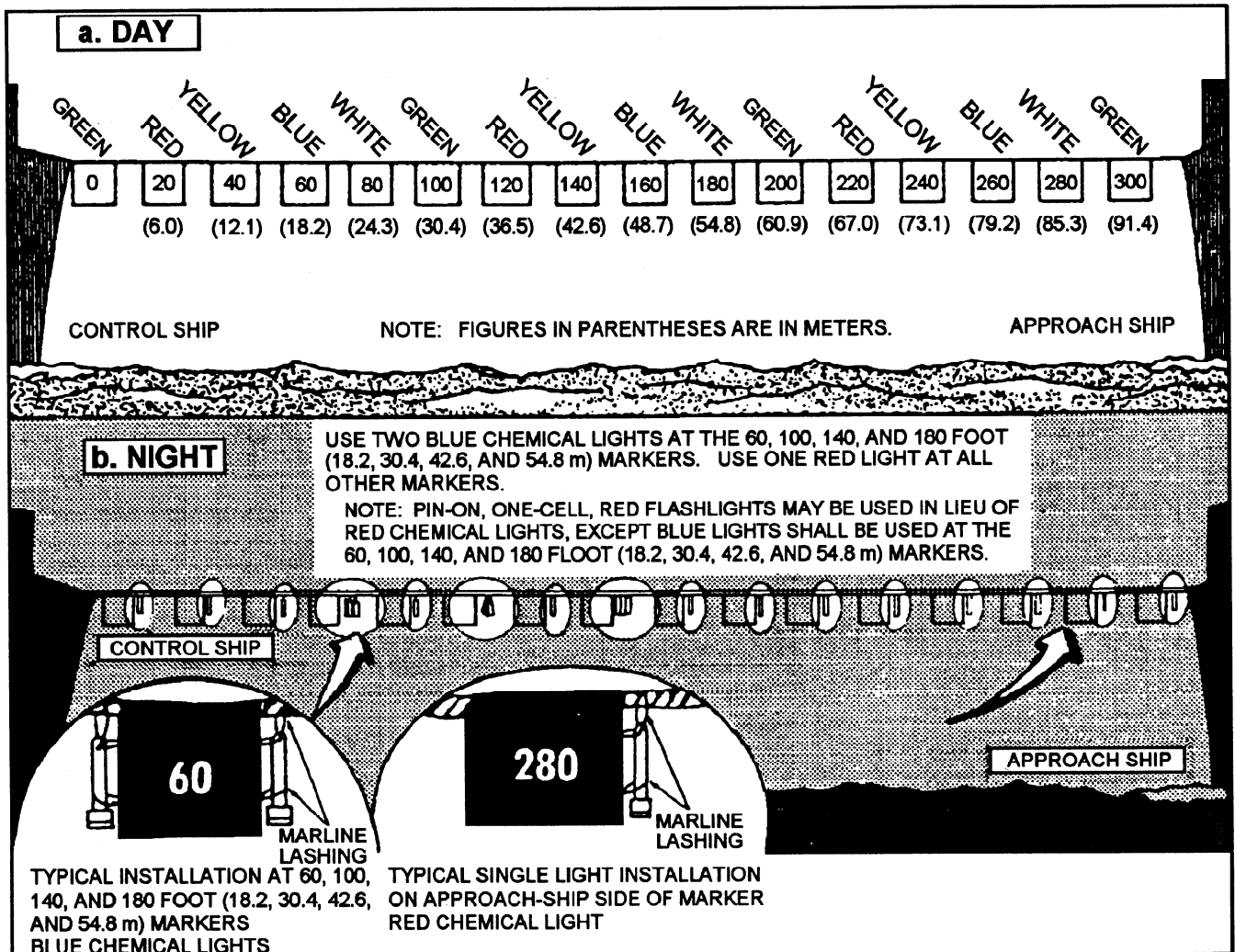


Figure 5-23.—B/B phone/distance line markings.

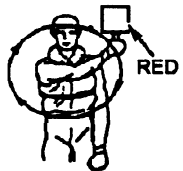

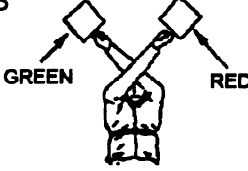
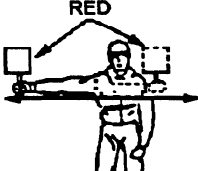
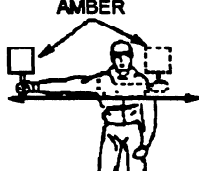
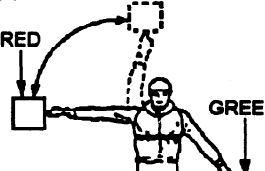
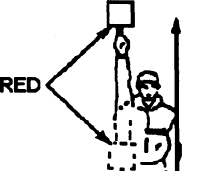

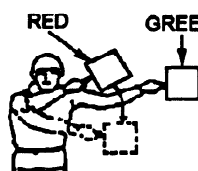
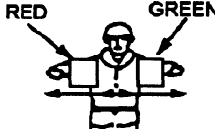

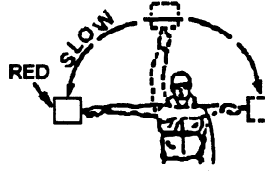

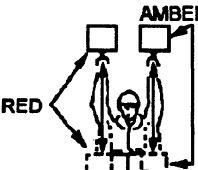
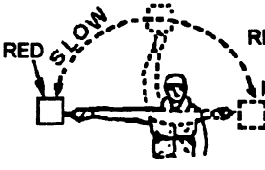
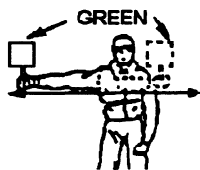
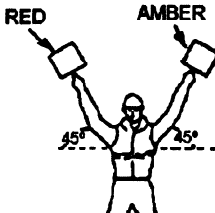
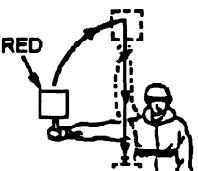
SIGNAL	SIGNAL	SIGNAL	REMARKS
<p>1</p>  <p>HEAVE AROUND</p>	<p>7</p>  <p>START BLOW THROUGH</p>	<p>13</p>  <p>REPLENISHMENT COMPLETED AT THIS STATION. COMMENCE UNRIGGING.</p>	<p>NOTE: RED AND AMBER PADDLES ARE SOLID COLOR. GREEN PADDLES WILL CONTAIN A 1 INCH WIDE WHITE DIAGONAL STRIPE RUNNING FROM UPPER LEFT TO LOWER RIGHT.</p> <p>DAY: COLORED PADDLES NIGHT: FLASHLIGHTS OR WANDS</p>
<p>2</p>  <p>AVAST</p>	<p>8</p>  <p>STOP BLOW THROUGH</p>	<p>14</p>  <p>PELICAN HOOK TO BE TRIPPED</p>	
<p>3</p>  <p>SLACK OFF</p>	<p>9</p>  <p>TEST S/P PHONE LINE</p>	<p>15</p>  <p>TRIP PELICAN HOOK</p>	
<p>4</p>  <p>HOOKED-UP OR CONNECTED</p>	<p>10</p>  <p>REPLACE S/P PHONE LINE</p>	<p>16</p>  <p>PREPARE FOR EMERGENCY BREAKAWAY</p>	
<p>5</p>  <p>START PUMPING OR COMMENCE TRANSFER</p>	<p>11</p>  <p>DETENSION</p>	<p>17</p>  <p>READY FOR BREAKAWAY</p>	
<p>6</p>  <p>STOP PUMPING OR CEASE TRANSFER</p>	<p>12</p>  <p>TENSION</p>	<p>18</p>  <p>EXECUTE BREAKAWAY</p>	

Figure 5-24.—Along side hand signals, standard procedures.

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The zero end of the distance line (fig. 5-23) is secured at or near the outermost rail of the delivering ship, and the other end is hand tended on the receiving ship. Embedded in the polypropylene distance line are the conductors for the S/P telephone line, which provides the communication link between the bridges of the two ships.

Each replenishment station has an S/P telephone line to the corresponding station on the other ship. Necessary commands are transmitted by S/P telephone, and a signalman also gives them by hand or light signals, as shown in figure 5-24. It is a good idea to post these hand signals at the replenishment stations or, better yet, to stencil them on the backs of the paddles.

As the receiving ship completes its approach and steadies alongside, bolos or line-throwing gun lines are sent over from each station on the delivering ship to the opposite stations on the receiving ship. Telephone lines and messengers are sent over by means of these first lines.

MESSENGER

The messenger is the main line used to haul any basic rig between ships. See figure 5-25. The preferred location for handling the messenger and other lines is forward of the rig.

TRANSFER STATION MARKERS

Transfer station markers are (bunting, metal, or painted area markers for day, and red lights for night) to indicate the type of commodity that is to be transferred at the station. See figures 5-26 and 5-27.

FUELING AT SEA

Fueling at sea normally is conducted by using the span-wire method; the hose is carried between ships on a span wire, which may be tensioned or untensioned. Normally, the untensioned span wire is referred to as the

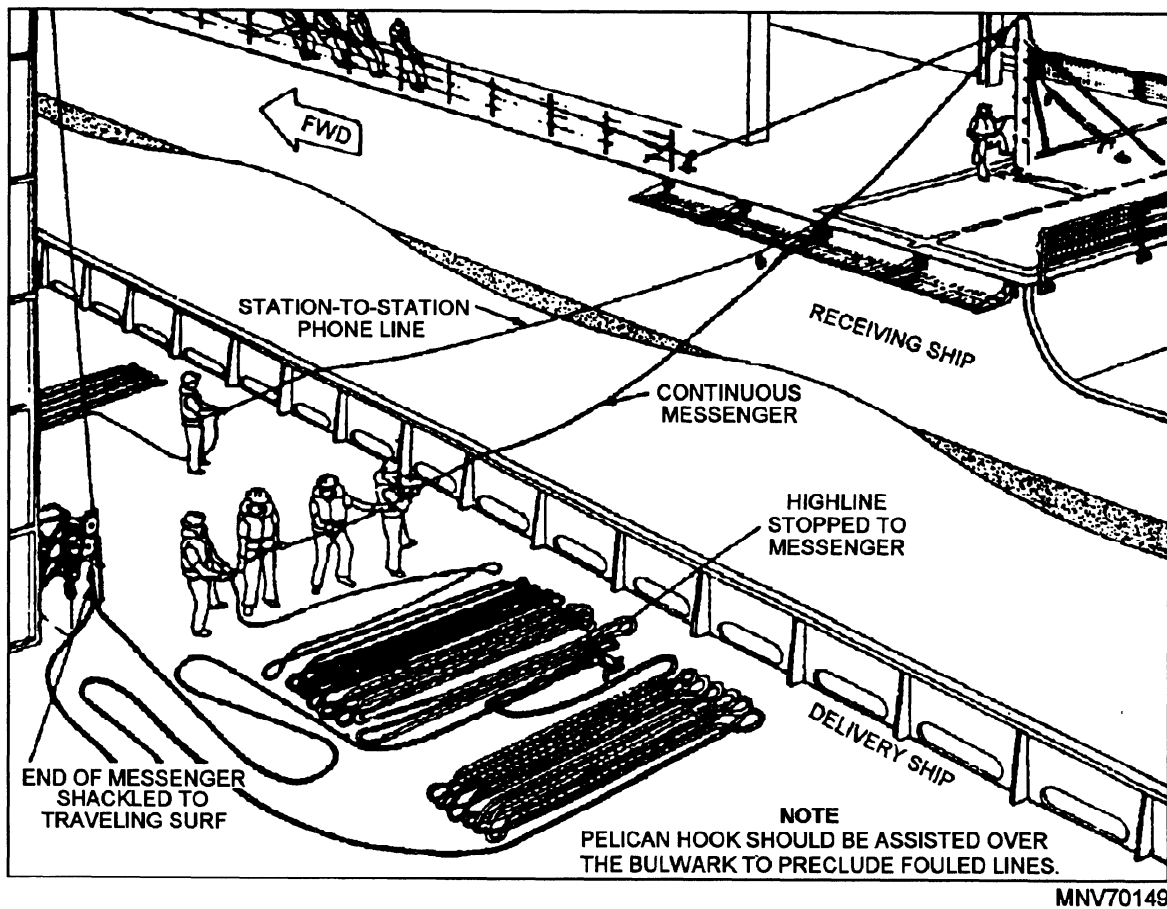




























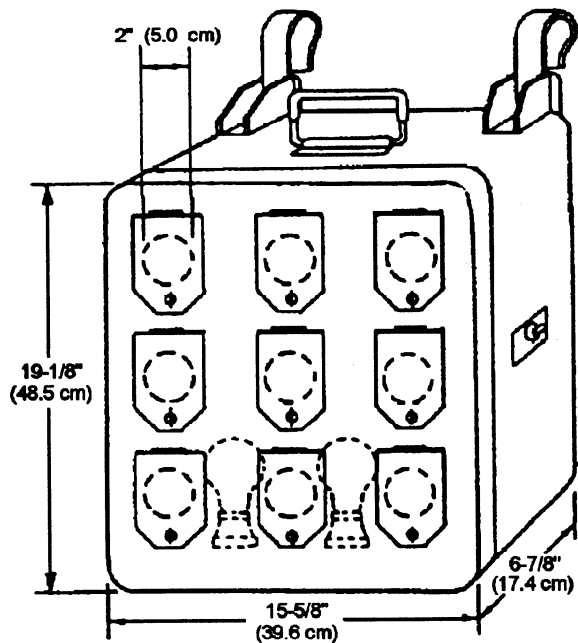


Figure 5-25.—Replenishment-at-sea messenger.

COMMODITY TRANSFERRED	CODE	
	DAY 3 ft ² (91.4 cm ²) BUNTING OR PAINTED AREA	NIGHT LIGHT BOX
MISSILES	INTERNATIONAL ORANGE 	
AMMUNITION	GREEN 	
FUEL OIL	RED 	
DIESEL OIL	BLUE 	
F76	RED & BLUE TRIANGLES 	
F44	YELLOW & BLUE TRIANGLES 	
LUBE OIL	BLACK, YELLOW QUARTERS 	
FEEDWATER	WHITE 	
POTABLE WATER	WHITE WITH BLUE LETTER "P" CENTERED 	
STORES	GREEN WITH WHITE VERTICAL STRIPES 	
PERSONNEL AND/OR LIGHT FREIGHT	GREEN WITH WHITE LETTER "P" CENTERED 	
FUEL OIL AND F44	RED/YELLOW & BLUE TRIANGLES 	
F76 AND F44	RED/BLUE & YELLOW/BLUE TRIANGLES 	
BRIDGE-TO-BRIDGE PHONE DISTANCE LINE	GREEN WITH WHITE LETTER "B" CENTERED 	

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Figure 5-26.—Transfer station markers.



BOX HAS NINE HOLES, EACH FITTED WITH A RED LENS. HAND-OPERATED INDIVIDUAL SHUTTERS HINGE UPWARD. ILLUMINATED BY TWO 25-WATT SHIELDED BULBS (ONE IS STAND-BY).
NSN 6230-00-658-3045.

MNV70151

Figure 5-27.—Station marker light box.

conventional span-wire rig (fig. 5-28). The tensioned span-wire method is referred to as STREAM. STREAM rigs are rigged with four saddles and a hose approximately 300 feet long (fig. 5-29). The hose hangs from trolley blocks that ride along the span wire. Saddle whips position the hose while the ship is being fueled and are used to retrieve the hose after the fueling operation is complete.

The span-wire rig permits ships to open out from 140 to 180 feet. Such distance is reasonably safe and makes it fairly easy to maneuver and keep station. These factors not only allow commanders a wider latitude in choosing a fueling course but also facilitate the use of anti-aircraft batteries, should the need for them arise. Additionally, the high suspension of the hose affords fair protection for it in rough weather.

CLOSE-IN METHOD

As we stated before, the close-in method of fueling is used when the delivering ship is not equipped with the span-wire rig or the receiving ship does not have a pad eye strong enough to hold a span wire.

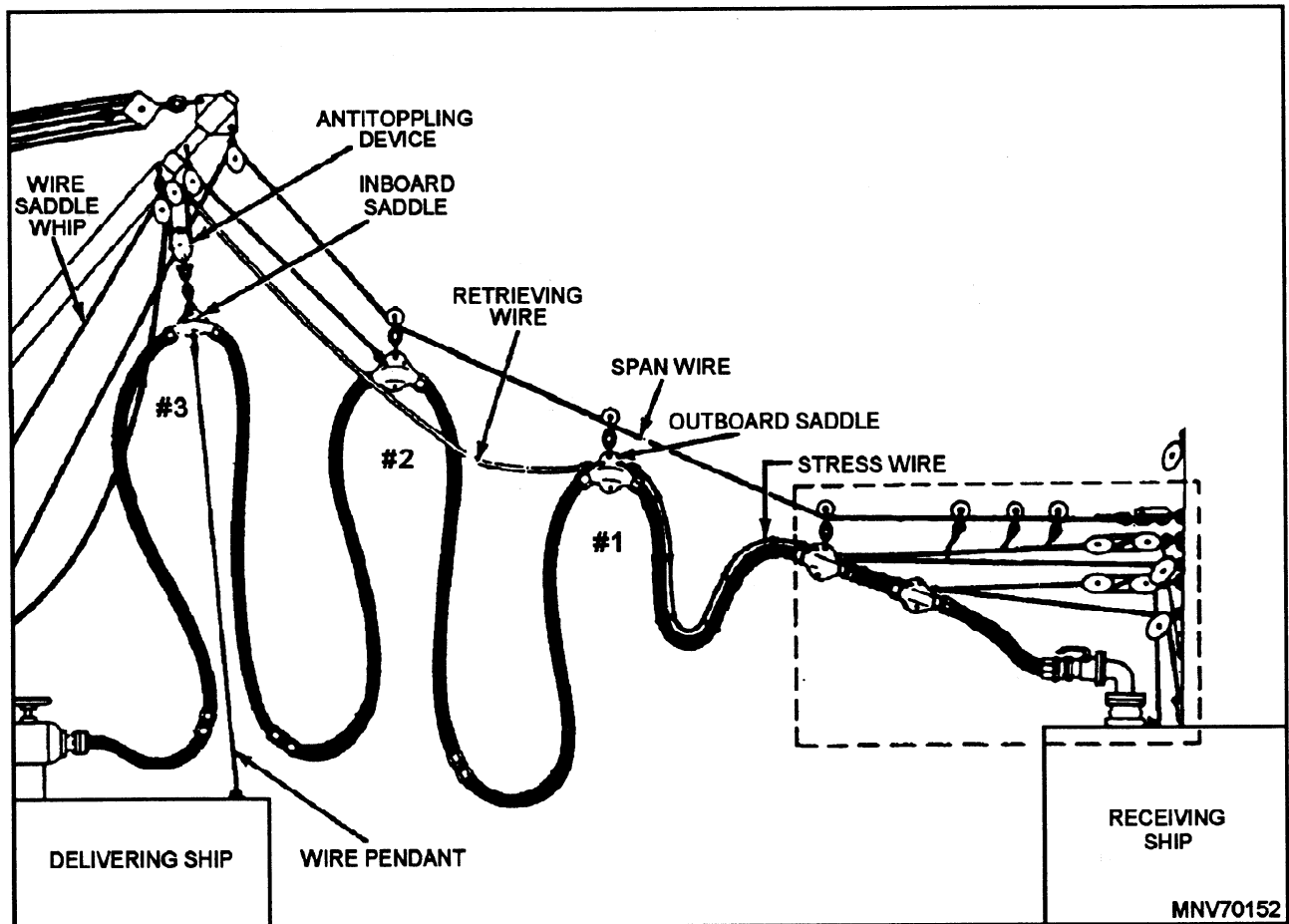


Figure 5-28.—Span-wire rig.

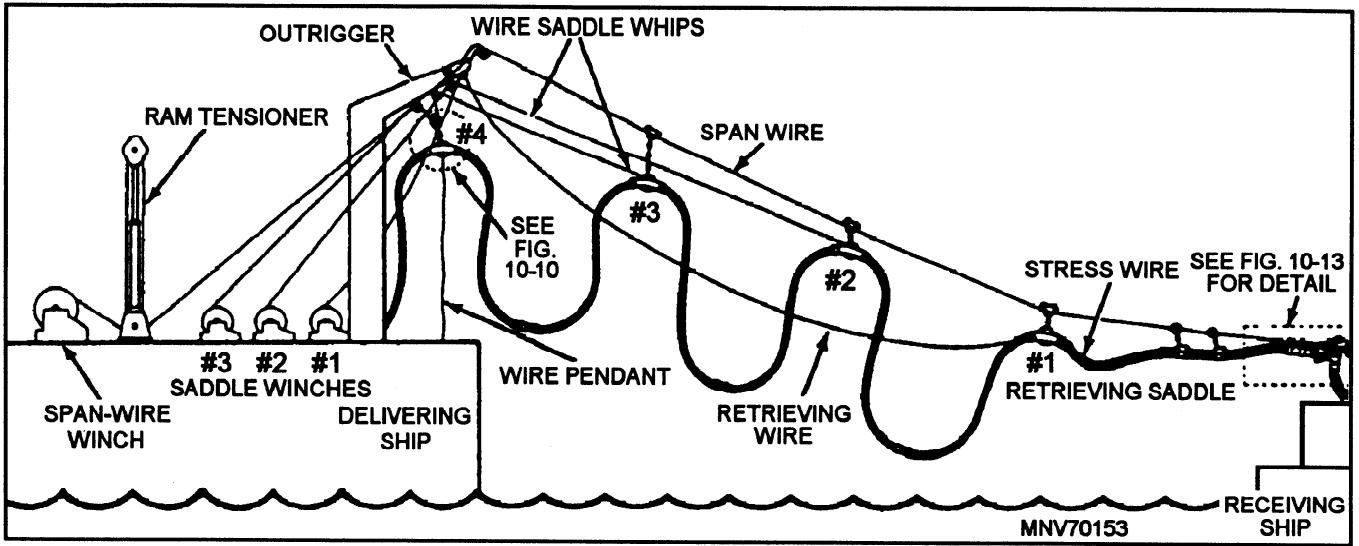


Figure 5-29.—Fuel STREAM.

In the close-in rig (fig. 5-30), the hose is supported by whips leading from the hose saddles to booms, king posts, or other high projections on the delivering ship.

REPLENISHMENT AT SEA

Various methods can be used to transfer provisions and stores between ships. Each has its advantages and disadvantages in relation to the size, structure, and

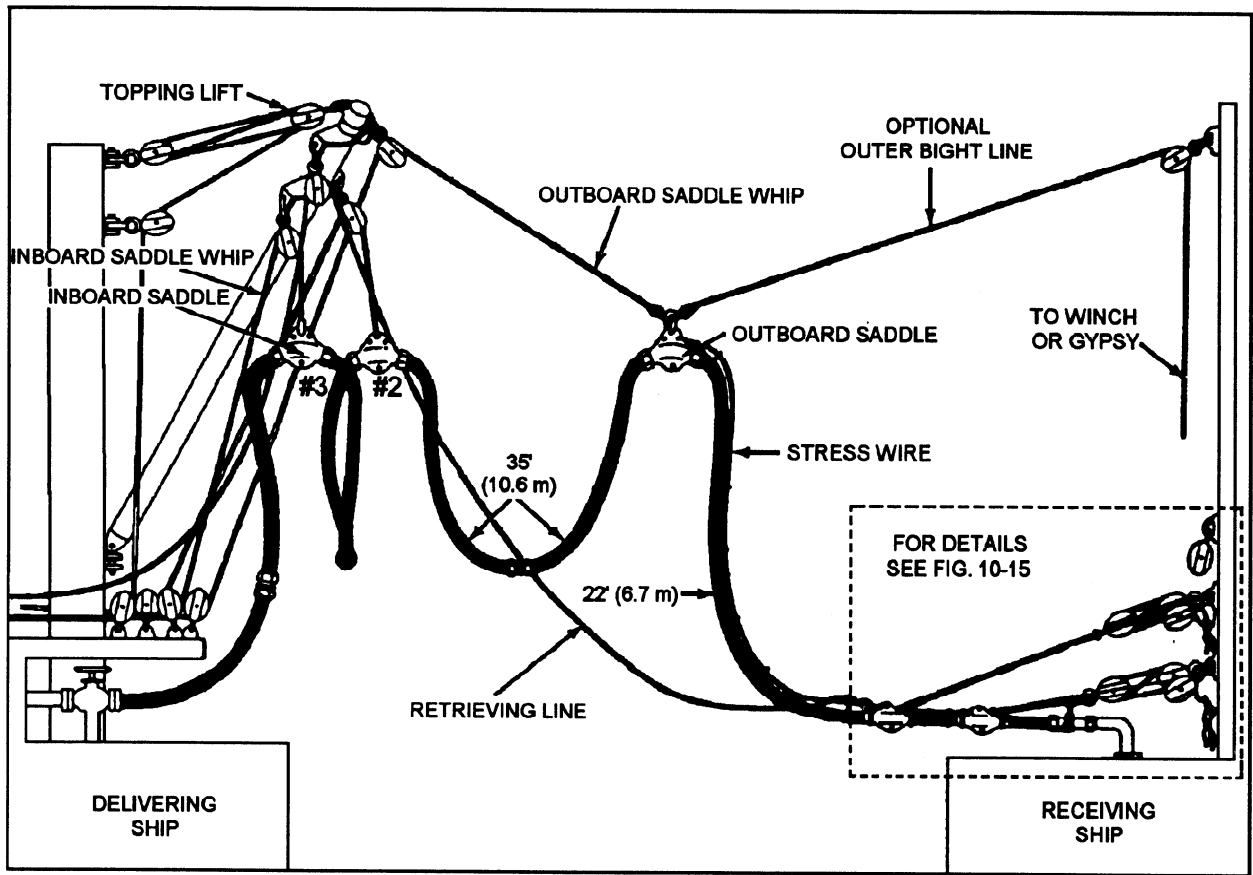


Figure 5-30.—Close-in rig.

rigging potential of the ships involved. The method to be used for a particular replenishment operation is usually selected on the basis of the following:

- Type and quantity of cargo to be transferred
- Capacity of the rig and associated fitting

- Weight and size of the heaviest or largest load
- Type and location of the receiving station

Conventional nontensioned methods of cargo transfer and their load capacities are found in NWP 14 (Series).

