MARLOW-HUNTER, LLC

Chapter 12

Sails and Rigging

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Hunter's continuous design goal for the sail and rigging layouts is maximum performance with safe and undemanding management. The conventional or optional furling rigs, the design of the sails, deck layout/hardware placement and an organized and clutter free line management all work together to provide a fluid and exciting sailing experience. Hunter has and continues to be on the industry's leading edge of sail and rigging innovation.

If this is your first boat of this type or are changing to a new and unfamiliar boat, please ensure you obtain handling and operating experience before assuming command. The information in this chapter is not intended as a course on boating safety or seamanship. To gain sailing experience and knowledge, your dealer, national sailing federation or yacht club will be pleased to advise you of local sea schools and/or competent instructors.

As always, never underestimate the potentially dangerous power of wind, tide and the sea. Ensure there is sufficiently trained and proficient crew on board to handle the boat and its operating systems even in adverse conditions.

⚠ WARNING ⚠

Refer to the Boating Safety, and the Getting Underway chapters for safe boat handling information.

The rig of your boat refers to the mast, boom, rigging and integrated hardware (Fig. 12.14). This chapter will specifically discuss the following rig and sail categories:

1. Mast
2. Standing Rigging
3. Boom
4. Mainsail
5. Head Sails
6. Running Rigging
7. Rigging the boat
8. Sail Reefing and Stowing
9. Supporting Hardware

12.1 Mast

Your main and most vital rig component is the mast, also referred to as the main spar. It carries the sails and is supported by the standing rigging (see section below on Standing Rigging). Hunter provides a conventional mast as standard allowing full control of mainsail management to the sailer. Hunter also offers an optional roller furling mast providing easier mainsail stowage and deployment by rolling the mainsail in or out of the mast. (The choice between conventional or in-mast furling will also impact the boom, running rigging and the mainsail - all discussed in subsequent sections.)

The mast also provides the perch for navigational and deck lighting along with weather instruments.

Attaching the mast is referred to as stepping the mast and is part of the commissioning process. Your Hunter is a deck stepped mast. The mast base is positioned onto a receiver, or mast step (Fig. 12.1), located on the deck. Mast stability and support is provided by the standing rigging (strategically placed cables and hardware) and the compression post, which provides deck support beneath the mast's position. Stepping the mast will require the assistance of a crane and should only be done by trained and experienced riggers.

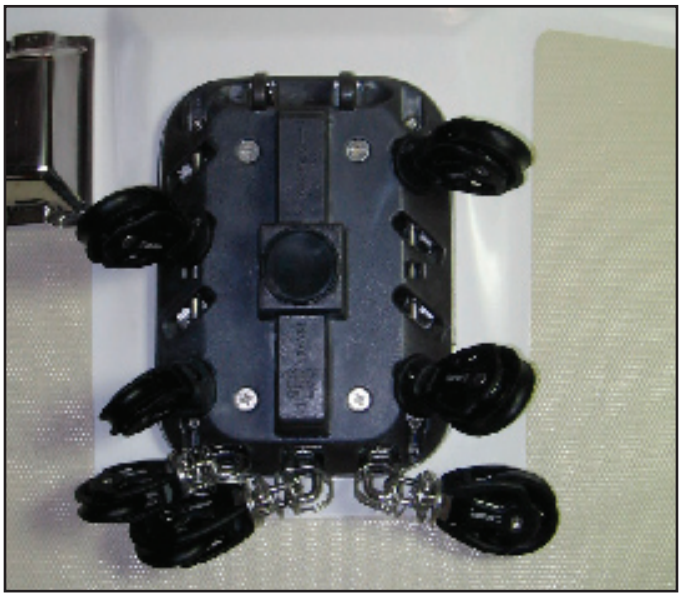

Figure 12.1

Your Hunter is considered a fractional rig. This refers to the positioning on the mast of the support cables (stays/shrouds) below the top of the mast (masthead).

The mast features a double swept-back spreader arrangement. Spreaders are horizontal spars used to spread the supporting mast shrouds to provide the desired stability and strength to the mast. This rig arrangement, known as the B&R rig (named after its designers Lars Bergstrom and Sven Ridder), sweeps the spreaders aft 30 degrees,

thereby creating an equidistant 120 degree angle between each rigging point. This tripod arrangement is the same as used with radio towers, providing excellent strength and stability without the need for an aft stay (backstay). The elimination of the backstay allows a more efficient mainsail shape utilizing a full roach design.

After the mast has been stepped and standing rigging installed (see below), it should be properly tuned before serious sailing begins.

12.2 Standing Rigging

Standing rigging is the collection of fixed cables and hardware which provide stability and strength to the mast. Cables can be either stays or shrouds. Stays run fore and aft from the mast to the hull. Your Hunter only uses the forestay and is integrated into the roller furling jib (see sections on the Jib and Running Rigging below). Shrouds run symmetrically port and starboard of the mast. In addition to vertical and diagonal shrouds, the B&R rig includes reverse diagonal shrouds which allow a mast prebend providing additional rigidity. Shroud connection points can be either the mast or a spreader and terminate at the deck chainplates. Chainplates are substantial metal components tied into the hull with attachment points extending into the deck. Chainplates can be classified as outer or inner, depending on their hull attachment point.

Refer to Figures 12.16 and 12.17 for the location, description and specification of individual components of the standard rigging. Refer also to the Rigging the Boat section below for installation instructions. Finally, refer to the rigging manufacturer's OEM manual for further details on standing rigging installation.

NOTE: Standing rigging will stretch slightly when initially loaded. Therefore, the rigging may have to be further tensioned slightly after a few sails in a strong breeze to compensate for this initial stretch. Once the mast is tuned and initial stretch is taken out, the rig should need retuning only at the beginning of each season.

12.3 Boom

The boom is a horizontal aft-facing spar attached to the aft mast. It provides control of the shape and angle of the mainsail and provides points of attachment for control lines.

The boom is attached to the aft mast at the gooseneck. The end-cap of the forward boom has a casting (Fig. 12.2) which is bolted into the mast fitting (Fig. 12.3). This hardware configuration will allow the boom to pivot port and starboard (and up and down) allowing the mainsail to harness the wind power.

The type of boom on your boat will correspond to the type of mast, either the standard conventional mast or the optional in-mast roller furling mast. Both booms will have common and some unique control points for the corresponding lines used. The conventional boom will have a slot on the top where an optional sail cover can be installed. The roller furling boom will use the slot on the top as the traveling path for an outhaul car used to facilitate the furling process.

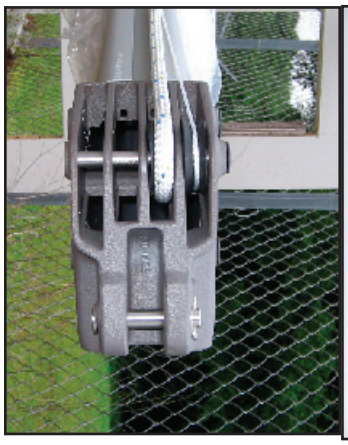

Figure 12.2

Figure 12.3

12.4 Mainsail

The mainsail is a triangular shaped sail located behind the mast and is the largest sail on your boat and main source of propulsion by wind. Hunter provides the conventional mainsail as standard and the in-mast roller furling mainsail as optional. The shape of the respective sails will be slightly different. The conventional mainsail will have a larger sail area than the roller furling mainsail and will include a larger roach. The smaller size of the furling mainsail derives from the constraints of the furling method and corresponding mast weight (see Figures 12.4 for general sail terminology and 12.15 for sail specifications).

When strong winds exist one can decrease the sail area by reefing (see the Sail Reefing and Stowage section

below) the mainsail to provide more stability and less risk. Reefing the conventional mainsail involves lowering the sail to predetermined levels, called reef points (Hunter sails usually consist of 2 reef points). Along these reef points are a pair of cringles. These cringles are used by the reef lines (part of the running rigging) to pull the sail down to the reef point. Reefing the in-mast furling mainsail simply involves furling the mainsail within the mast until the sail area is considered safe and effective.

12.5 Headsails

Hunter provides a jib headsail as part of the standard sail configuration. Also available is the rigging and hardware necessary to fly an optional spinnaker headsail (sail not included).

12.5.1 Jib

The jib is a triangular shaped sail located forward of the mast and is your boat's main headsail. The jib's main role is to provide overall stability and performance. Given its sail area, its direct contribution to propulsion is secondary compared to the mainsail (see Figures 12.4 for general sail terminology and 12.15 for sail specifications).

The standard jib is a roller furling arrangement. It is integrated into the forestay which swivels and rolls up when furling or reefing the sail. The jib is raised by using the jib halyard (see Running Rigging section below). The jib is unfurled and trimmed by using the jib sheets (see Running Rigging section below).

12.5.2 Spinnaker

The spinnaker is a more specialized sail designed for sailing off the wind (reaching to running) and is significantly larger than the jib. The spinnaker option includes the hardware and rigging necessary to support an asymmetrical spinnaker. The styling of the sail is often a reflection of the owner or operator and, as such, is generally best served through direct sourcing by the owner or operator.

The sail is arranged with the tack attached to the forward facing eye on the stem plate. The sail is raised by the spinnaker halyard (see Running Rigging section below). The clew is managed by port and starboard sheets terminating in the cockpit and served by the helm winches.

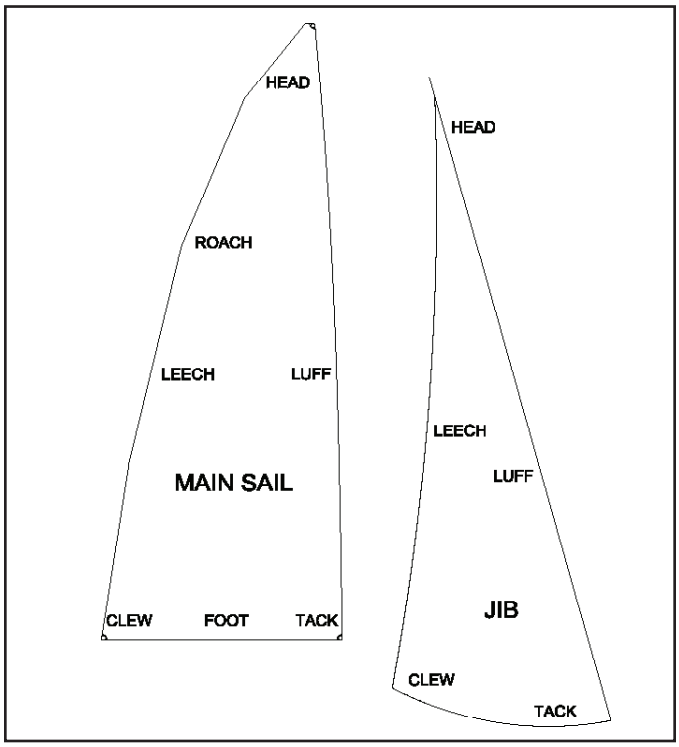

Figure 12.4

12.6 Running Rigging

Running rigging consists of lines used on your boat to raise, lower and control the sails. They will vary in length, thickness and color, depending on their purpose. Your Hunter features control of all running rigging (except the topping lift and, depending on your model, the vang line) from the cockpit. The running rigging includes the following lines as specified in Fig. 12.18 and discussed in subsequent sections:

1. Main halyard - raises the mainsail
2. Jib halyard - raises the jib
3. Topping lift - supports/raises the boom
4. Main furling line - used to furl the mainsail into the mast with the in-mast furler system
5. Outhaul - pulls the mainsail along the boom
6. Mainsheet - used to control lateral movement of the boom and thereby controls the clew of the mainsail
7. Jib sheet - set of two lines, one port, one starboard, used to control the clew of the jib
8. Traveler - set of two lines, one port, one starboard,

which facilitates the movement (travel) of the boom

9. Vang - a block and tackle assembly attached to the boom (and mast) and controls the mainsail leech tension; an optional solid vang is reinforced with tubes, similar to a shock
10. Spinnaker halyard - raises the spinnaker (optional sail)
11. Reef line 1 - lowers the mainsail to the first reef position
12. Reef line 2 - lowers the mainsail to the second reef position
13. Spinnaker sheet - set of two lines, one port, one starboard, used to controls the clew of the spinnaker

12.6.1 Main Halyard

The main halyard raises the mainsail. For the conventional mast, the mast end of the halyard is shackled externally to the head of the sail. The line then rises to the masthead and over a sheave (pulley). It then travels back down the mast internally to an exit point on the starboard side. From there it continues to the mast base where it runs around a block (pulley) to the starboard organizer. It continues from the organizer to under the sea hood and to the sheet stopper (jammer). From the sheet stopper the line can then be used by the winch for additional torque when raising.

For the furling mast, the main halyard path is similar, however, the mast end is attached internally to a swivel. This swivel travels up and down the furling foil (which holds the mainsail luff and revolves when furling or unfurling). From the swivel, the halyard runs up to the mast head and over the masthead sheave. It then continues the same course to the cockpit as the conventional main halyard.

12.6.2 Jib Halyard

The jib halyard raises the roller furling jib. The mast end is attached externally to a swivel. This swivel travels up and down the jib furling foil (which revolves when furling or unfurling) and is integrated within the forestay. The halyard rises up to a sheave box, first box below the forestay attachment, and over the sheave. It then travels back down the mast internally to an exit point on the port side. From there it continues to the mast base where it runs around a block to the port organizer. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when raising.

12.6.3 Topping Lift

The topping lift supports or raises the boom. The mast end of the topping lift is shackled to the aft end of the boom. It then rises to the masthead and over a sheave. It travels back down the mast internally to an exit point and lashed to a cleat on the mast.

12.6.4 Main Furling Line

The main furling line furls the mainsail (see the next section on Boom Outhaul, which unfurls the mainsail) within the optional in-mast roller furler and does not exist with the standard conventional mainsail. This continuous line (ends spliced together) forms a loop. At the mast, the line is saddled over the reefing winch with both sides traveling down to the mast base where they run around a mast block to the port organizer. Both lines continue from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the lines can then be used by the winch for additional torque when furling. After the winched line passes around the winch it exits the winch and begins it journey back to the mast.

12.6.5 Mainsail Outhaul

The outhaul pulls the mainsail aft along the boom and controls the shape of the curve of the foot of the sail. If the rig is for a conventional mainsail, the mast end of the boom outhaul is attached to the mainsail clew and travels toward the aft boom cap.

If the rig is for a in-mast furling mainsail, the mast end of the boom outhaul line is knotted to the forward slider position on the outhaul car. It travels up and around the mainsails clew sheave and down and around the outhaul car's aft block toward the aft boom cap.

The line enters the boom by traveling down and around a boom end cap sheave and forward toward a sheave near the mast. It travels around the sheave and exits the boom near the gooseneck. It continues down to a farilead (ring) mounted on the mast and on to the mast base where it runs around a mast base block to the starboard organizer. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when pulling.

12.6.6 Mainsheet

The mainsheet controls the lateral movement of the boom and thereby the mainsail clew. The amount of tension on the mainsheet determines the extent of the boom's lateral movement or travel. This travel is facilitated and controlled by the mainsheet traveler assembly located on the top of the arch (see Traveler section). The mainsheet is a double open ended line which starts and ends in the cockpit. The "end" of the line runs through a sheet stopper positioned on the port arch rail's inboard side down to and around the block on the cockpit coaming and leads to the port helm winch. From the sheet stopper it travels up and around the arch's port over-the-top block and travels inboard to the arch's center stand-up block. The line continues around the center stand-up block to and around the aft boom's bottom aft block and back toward the traveler. It then is routed around the traveler car block and back to the boom. It continues around the aft boom's bottom forward block and enters the aft boom. The line travels forward to the sheave near the mast and continues around the sheave. It then exits the boom near the gooseneck down to the mast base where it runs around a block to the starboard organizer. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when trimming.

12.6.7 Jib Sheets

The jib sheets are a pair of lines that control the jib clew and the shape of the sail. One of which is used at a given time. Each line is attached to the jib clew with one line running around the inner shroud to the port jib track sheave car and the other to the starboard. Each line then travels aft to a turning block in the aft cockpit and ends at a helm winch which can be used for additional torque when trimming.
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12.6.8 Mainsheet Traveler Lines

The mainsheet traveler lines are a pair of lines that control and facilitates the lateral movement of the boom. Both line ends are located within the cockpit. Both lines originate from the arch top and are generally mirrored port and starboard. The line arrangement exists to control the movement of the traveler block car as it travels on its track. Each line is attached to the traveler end block and travels inboard to the traveler car's aft control sheave. It travels around the control sheave and back to and around the end block to the traveler car's forward control sheave. It continues around the control sheave and outboard to and around the over-the-top or under-the-top block down to the cam cleat mounted to a plate or rail on the inboard arch leg.

12.6.9 Vang Line

The vang line is used to apply downward force on the boom and thus the shape of the sail. The vang is attached to the base of the aft mast and to the bottom of the boom, generally forming a 45 degree angle. The standard vang is a block and tackle arrangement. The optional rigid vang (standard with the in-mast furler) is a piston arrangement controlled by the vang line. From the vang, the line exits the assembly from the top boom end and travels to the mast base where it runs around a mast base block to the port organizer for the standard rig and to the starboard organizer if a furling rig. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when tightening.

12.6.10 Spinnaker Halyard

The spinnaker halyard raises the optional spinnaker or reaching sail. The mast end is shackled to the head of the spinnaker and travels up to the forward mast sheave box located above the jib sheave box. It passes over the sheave and down the mast internally to an exit point on the port side. From there it continues to the mast base where it runs around a block to the port organizer. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when raising.

12.6.11 Reef Line 1

Reef line 1 lowers the mainsail to the first reef point. The line exists for the standard conventional mainsail only. The sail end of the line exits the top of the aft boom from the end cap sheave and travels up and through the first cringle near the clew. It travels down to the boom where it is looped around the boom and knotted. The other end, which emerges from within the forward boom, travels up from the forward boom sheave to and through the lower forward cringle near the tack and down through an eyelet immediately above the gooseneck on the mast. It then travels down to the mast base where it runs around a block to the starboard organizer. It continues from the organizer to under the sea hood and to the sheet stopper. From the sheet stopper the line can then be used by the winch for additional torque when reefing

12.6.11 Reef Line 2

Reef line 2 lowers the mainsail to the second reef point. The line arrangement is the same as Reef Line 1 (above) except for the reef points are at the second cringle and the line is routed port side.

12.6.12 Spinnaker Sheets

The spinnaker sheets are a pair of lines that control the spinnaker clew and the shape of the sail. One of which is used at a given time. Each line is attached to the spinnaker clew with one line running around the outer shroud and lifelines aft to the spinnaker block located on the aft cockpit toerail. The other sheet is routed around the forestay, outer shroud and lifelines to the opposite spinnaker block. Each line ends at a helm winch which can be used for additional torque when trimming.

12.7 Rigging the Boat

Your new Hunter boat will be fully rigged by your dealer during the commissioning process. This includes stepping the mast with standing rigging in place, attaching the boom, installing sails with running rigging in place and tuning the mast.

Stepping and unstepping the mast will inevitably be part of sailboat ownership. Seasonal or long term storage, bridge clearance or repairs may require de-rigging the boat. The following will discuss the process of rigging the sailboat. De-rigging the boat will essentially be the reverse process. Please refer to the rigging manufacturer's OEM manual for additional details on stepping and tuning the mast.

12.7.1 Prep the Rig

1. Lay the mast onto two trestles or other appropriate support with luff groove (aft mast) face up. Place the boom and optional solid vang onto two other trestles or supports.
2. Verify or mount the mast spreaders (see the spar manufacturer's OEM Operational Manual). Ensure the mast is elevated enough so spreaders are off the ground.
3. Wash mast, boom and optional solid vang with a mild detergent solution. Lubricate moving parts (i.e. sheaves, etc) with a silicon spray lubricant.
4. Check halyard installation based on the type of rig (conventional or in-mast furling) and optional sails (spinnaker).
5. Verify halyard control ends exit the mast either port or starboard as noted in Figures 12.19 and 12.20. Clean and lubricate any shackles.
6. Verify and test electronic components (anchor light, steaming light and optional wind instrument) installed on the mast are wired properly. Use a 12V battery to test.
7. Verify or install any non-electrical components to the mast-head (i.e. windex, aerials, etc).
8. Clean and lubricate all standing rigging turnbuckles.
9. Verify or attach all standing rigging (Figures 12.16 and 12.17). All adjustable shrouds should be slack. The lower ends of the V1s and D1s will be loose (later installed to the chainplates after stepping).

12.7.2 Pre-Bend the Mast

NOTE: Never use anything more than a pair of wrenches to tighten your rigging. Using an extended piece of pipe on the handle of a wrench can over-tighten the rigging and possibly damage the mast or rigging.

1. Tighten the reverse diagonals RD1 followed by RD2 by the same number of turns to induce the mast bend.
2. Measure the bend by tensioning a line or the main halyard between the masthead and the gooseneck. The maximum amount of bend should be no more than 6" to 8" for the standard mast and 2" to 3" for the furling mast as measured perpendicular from the face of the mast to the halyard at the deepest part of the bend. It can measure less, based on the sail shape and your own preference.
3. Ensure the bend is evenly distributed along the mast to give a smooth shape.
4. Ensure the mast is also straight from side to side. Tighten or loosen the RDs to achieve this. (Note: Always maintain loose D2s until the mast is stepped (see below) and subsequently adjusted from the bosums seat.)
5. Lash the V1s and D1s to the bottom of the mast to prevent their swinging when craning the mast.
6. Attach the jib furler assembly to the mast forestay fitting.
7. Attach a line to the jib furler drum. This line will be used to minimize swing when craning.
8. Lash the halyards to the bottom of the mast to prevent swinging and intertwining with the shrouds and stay.

Note: Pre-bending the mast is generally performed by an experienced commissioning agent.

Figure 12.5

12.7.3 Stepping the Mast

1. Ensure the boat is moored securely and positioned under the crane or gin pole.
2. Man the craning procedure with at least 3 persons. One person will hold the lower end of the mast to guide it into the mast-step.
3. Lift the mast using a lifting strap and revolve and lower the base into the mast step. One person should be holding the jib furler line and controlling its movement during this procedure.
4. Once positioned on the mast step, attach the outer shrouds.
5. Attach the jib halyard to a cleat on the bow to support the mast in a raked position where the masthead is approximately 18" behind the step.
6. Attach the inner shrouds.
7. Hand tighten the outer shrouds.
8. Tighten the jib halyard until you can attach the jib furler/forestay to the stemplate. Release the jib halyard.
9. At this point, the masthead should be raked so that a weight hung on the main halyard hangs about 12" behind the mast step.
10. Tension the jib furler/forestay by adjusting the forestay rigging screw (see jib furler manufacturer's OEM manual)
11. Using a tension gauge (Fig. 12.5), tension the outer shrouds to 20% of their breaking load.
12. Disengage the crane strap (may require going aloft).
13. Relocate the boat away from the crane work area.

12.7.4 Tuning the Mast

1. Using a halyard, check that the mast is centered from side to side by pulling it tight to one side and marking the halyard next to the outer chainplate shroud.
2. Move to the opposite outer chainplate shroud and verify the mark is the same as the first.
3. If not, tighten or loosen the intermediate shrouds equal amounts until the mast is centered.
4. Using a tension gauge, tension the V1s to 20%, D1s to 15% and RDs to 12%-15% of their breaking load.

Note: Tuning the mast is generally performed by an experienced commissioning agent.

12.7.4 Boom Installation

1. Man this procedure with at least one person on each end of the boom.
2. Position the boom on the deck with forward end cap immediately aft of the mast with aft end resting on the arch (with traveler car track or sail cover slot facing up).
3. Shackle the topping lift to the aft boom end cap and raise the boom slightly. Verify or route the topping lift as described in the Running Rigging section above. Ensure someone holds the aft end of the boom to stabilize against any sway.
4. Raise the forward boom cap to the gooseneck and attach the boom to the mast with the clevis pin and split pin.
5. Temporarily tie the boom's aft end to the arch with enough slack to allow installation of the vang.

12.7.5 Boom Outhaul Installation

1. Verify or route the boom outhaul line as described in the Running Rigging section above (see also Figure 12.21 for furling rig and Figure 12.26 for standard rig).
2. The outhaul should be routed through the inboard starboard sheave position within the boom.
3. Lash the sail end of the outhaul to the aft boom end until the mainsail is ready for installation.

12.7.6 Traveler Lines Installation

1. Verify or route both traveler lines as described in the Running Rigging section above (see also Fig. 12.22).
2. Route the each line's control ends through the port and starboard cleat block.

12.7.7 Mainsheet Installation

1. Verify or route the mainsheet as described in the Running Rigging section above (see also Figures 12.21 and 12.22).
2. The mainsheet should be routed through the outboard starboard sheave position within the boom.
3. Route the control line through the single sheet stopper located on the port arch rail.

12.7.8 Vang Installation (Conventional & Solid)

1. Place the vang on the deck immediately aft of the mast. Position the end with the vang cable facing aft.
2. Refer to Fig. 12.23 and attach the vang hardware as directed based on the type of vang (rope or solid).
3. Route the vang line as illustrated in Fig. 12.23.
4. From the mast base block, the line continues to the port organizer for a standard rig or the starboard organizer for a furling rig. From there it travels under the sea hood and on to the sheet stopper.

12.7.9 Mainsail Installation

NOTE: Raising the mainsail should not be done with the wind astern.

For the standard rig mainsail, complete the following steps:

1. Lower the main halyard and attach the halyard shackle to the clew of the mainsail head.
2. Provide some slack to the mainsheet.
3. Open and remove the inspection port cover near the sail feeder.
4. Insert the first mainsail slider into the aft mast grove.
5. Continue feeding the mainsail sliders into the groove while rasing the main halyard until all sliders are installed..
6. Back the remaining luff down the grove until it can be connected to the tack hook).
7. Replace the mast inspection cover.
8. Route the halyard control line down to the mast base block and continue as described in the Running Rigging section above.
9. Position the foot of the sail along the boom and attache the boom outhaul to the clew as described in the Running Rigging section above.

For the furling rig mainsail, complete the following steps:

1. Open and remove the 2 inspections covers on the mast's port side (press button, push up or down, lift opposite end and remove).
2. Locate the sail feeding location on the luff extrusion from the top inspection opening.
3. Feed the head of the sail through the mast slot and into the main foil (Fig. 12.6).
4. Lower the main halyard and attach the halyard shackle to the strap sewn onto the mainsail head (Fig. 12.6).
5. Continue feeding the mainsail into the extrusion while rasing the main halyard until the luff is fully inserted into the extrusion.
6. Back the remaining luff down the extrusion from the sail entry location until it can be connected to the tack hook through the lower inspection port (Fig. 12.6).
7. Replace the mast inspection covers.
8. Route the halyard control line down to the mast base block and continue as described in the Running Rigging section above.
9. Position the foot of the sail along the boom and attache the boom outhaul to the clew as described in the Running Rigging section above.

12.7.10 Main Furling Line Installation

1. Place a loop of the furling line around the furling winch (Fig. 12.7).
2. Route both sides of the loop to the mast blocks. Remove the sheaves from the blocks and position the lines around the sheaves and replace in the blocks.
3. Continue the lines as described in the Running Rigging section above. The organizer and sheet stopper will also have to be partially disassembled to allow proper positioning of this continuous line.

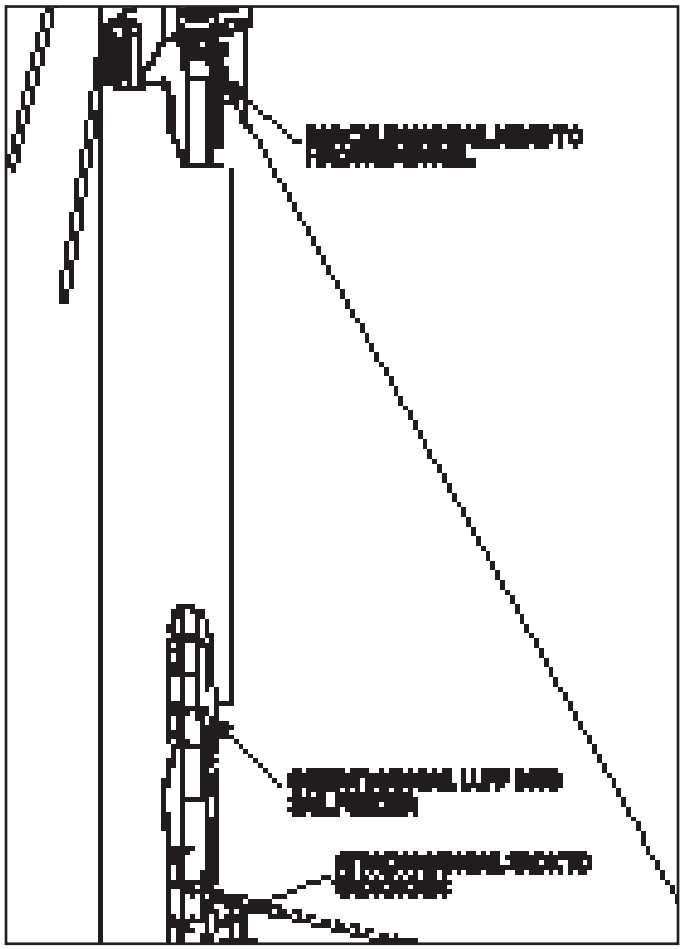


Figure 12.6

Figure 12.7

12.7.11 Jib Furler And Sail Installation

The jib furler (Fig. 12.8) will be assembled by your dealer during the commissioning process. Depending on you purpose, removing or reinstalling the jib furler simply involves detaching it from the upper mast and stem plate (see Stepping the Mast above for details on stepping the mast with the jib furler attached).

Please refer to the jib furler manufacturer's OEM manual for details on assembling, disassembling, adjusting and maintaining the furling system as well as jib installation.

Once the furler and jib are assembled, raised and furled, verify or route the jib sheets as described in the Running Rigging section above (see Fig. 12.24 for overall layout). Finally, verify or route the jib furling line as described in the Running Rigging section above.

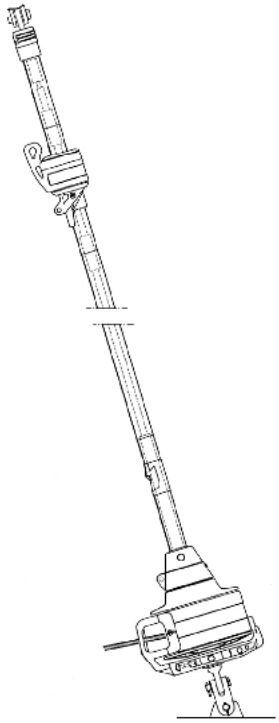


Figure 12.8

12.7.12 Spinnaker Installation

Refer to Fig. 12.25 for the spinnaker layout.

1. Attach the single block to the forward facing eye of the stem plate.
2. Attach the tack line to the spinnaker tack and route it through the block and cleat it off on the forward port

cleat.

3. Attach the halyard to the head ring of the sail.

4. Attach a sheet to the clew ring of the spinnaker and ensure the line is led aft outside the shroud and lifelines to a stand-up block just aft of the arch legs.

5. Run it to the helm winch allowing total slack in the sheet.

6. The sheet that is not being used, the lazy sheet, should also be attached to the clew of the spinnaker and led forward in front of the headstay, and then back on the other side of the boat, outside the shroud and lifelines, to another stand-up block positioned just aft of the arch legs.

7. Take that sheet and lead it to a winch, leaving some slack.

12.7.13 Retuning the Mast

The final step is to check your settings by sailing in 10-15 knot winds (see the Getting Started chapter in this manual for details on an initial excursion):

1. Sail upwind and check if the shrouds on the leeward side are slack. If so, tighten them to remove approximately half the slack - keep track of the number of turns.

2. Tack and repeat for the other side.

3. Continue until you are satisfied with the tension where the leeward side does not get loose when the boat is heeled.

4. Sight up the mast and verify it is still straight from side to side and adjust the appropriate rigging to correct, if necessary. (Keep in mind it is possible to overtighten.)

5. Tension the jib furler/forestay by adjusting the forestay rigging screw (see jib furler manufacturer's OEM manual).

6. Ensure the mast is tuned to a 6" to 8" bend on the standard mast and 2" to 3" bend on the furling mast (discussed previous). Adjust the bend as required.

12.7.14 Rigging Review

Once the rig is tuned, you should make sure to add the cotter pins to all the rigging, bending back the ends and taping them to prevent snagged lines, sails, and fingers.

In general, tie figure eight knots in the end of sheets to prevent them from running back through the stoppers or cars.

12.8 Sail Reefing & Stowing

Reefing the sails reduces the area of the sails. This can improve the boat's stability and reduce the risk of damaging the sails or boat hardware in strong winds. Reefing is a subset of stowing the sails. In other words, stowing the sails fully reduces the sail area of the sails.

12.8.1 When to Reef

When determining your sail configuration, wind strength will be a key factor. Figure 12.9 provides apparent wind speed (AWS) levels and the suggested sail configuration. It is critical to maintain sail discipline at these levels for the safety of those on board and the protection of your vessel.

APPARENT WIND SPEED (AWS)	MAIN	HEADSAIL REEF
8	FULL	FULL
12	FULL	FULL
15	FULL	FULL
17	1ST REEF	FULL
18	1ST REEF	1ST REEF
23	2ND REEF	2ND REEF
MODERATE GALE	2ND REEF	3RD REEF
GALE	NO MAIN	4TH REEF

Figure 12.9

As a rule of thumb, consider reefing whenever the boat heels to 22 degrees or more (an inclinometer will assist in determining the degree of heel).

NOTE: Excessive sail area or modifications to the original sail and/or rig design can cause unsafe conditions including knockdown/broach.

NOTE: The wind strengths tabulated above include a margin for the effects of gusts. If violent winds or confused or breaking seas exist, additional caution should be exercised.

NOTE: Remember:

1. *In the event of a severe gust, FREE SHEETS;*
2. *If wind is closehauled, LUFF UP;*
3. *If wind is abeam, FREE SHEETS;*
4. *If wind is abaft the beam, BEAR AWAY.*

NOTE: Special care should be taken when turning from a fol-

lowing wind onto a beam reach, because both the apparent wind speed and heeling effect will increase. Such turns should not be made rapidly, and consideration should be given to a reduction in sail before such a maneuver.

It can not be stressed enough, that vigilance, common sense and a cautious mindset will be strong allies for safe sailing. The forces of nature can and will be unpredictable at times and your sail configuration will be a central factor on sailing success or disaster in response to these forces. Always err on the side of caution.

12.8.2 Conventional Mainsail

The standard rig comes with a dual-line reefing system on the conventional mainsail. The decrease of sail area is vertical, or the foot shifts up on the sail to the new reefing point. Stowing the sail involves lowering the sail to the boom and lashing it down, wrapping it with a sail cover or lowering it into an encasing sail cover.

12.8.2.1 Reefing System Installation Instructions

Installation of your reefing system involves the following steps:

1. Run both reefing lines as illustrated in the Generalized Reefing Layout illustration (Fig 12.26). The shorter reef line will be used on the first reef (starboard side, white w/ green flecks). The longer reef line will be used on the second reef (port side, white w/ red flecks).
2. Ease the mainsheet.
3. Lower the mainsail to approximately the first reef position.
4. Take up the slack in the first reef line until the tack and the clew are down to about 2” above the boom.
5. Adjust the main halyard so that the tack reef point is not contacting the goose neck and is applying tension to the luff of the main above the reef, not below. There should be approximately 6” (150mm) of stretch in the main luff when the reefing line is tensioned, so, ensure this is considered when adjusting the main halyard to locate the tack reef.
6. Confirm that the tack reef point is still clear of the tack shackle and that only the main luff above the reef cringle is tensioned, not the luff below the cringle. Ease the reef line and readjust the halyard if necessary.
7. After the halyard has been stretched, mark it at the stopper with a 1” (25mm) single band of indelible marker ink. By dropping the halyard to this mark every time, positioning is made easier. The halyard is automatically in the correct position for the reef. Similarly, mark the reef line in the same fashion for a consistent correct position.
8. Repeat the procedure for the second reef, using double bands to mark the halyard and reef line in the correct position.

12.8.2.2 Reefing Instructions

1. Head up into the wind.
2. Ease the mainsheet.
3. Check the topping lift for adequate boom support.
4. Lower the main halyard to the appropriate mark and snub the line with the stopper.
5. Tension the reefing line with the self-tailing winch until the reef clew is brought down to the boom. Apply stopper and tension the main halyard back up, ease the topping lift (if needed).

12.8.2.3 Shaking out a Mainsail Reef Instructions

1. Head up into the wind.
2. Ease the mainsheet.
3. Release the line stopper and remove reef line from winch.
4. Tension the main halyard to raise sail, making sure reef lines run freely while sail is being raised. Apply stopper to main halyard.
5. Re-tension mainsheet, ease the topping lift (if needed).

12.8.2.4 Stowing the Mainsail

Stowing the mainsail involves lowering it fully to the boom and lashing it down. Lowering the mainsail is assisted and simplified by lines termed lazy jacks. This element of running rigging consists of a network of lines attached to a point on the port and starboard upper spreaders to a series of connections on either side of the boom. These lines form a cradle which helps provide an organized folding as the mainsail is lowered.

However, given the negative impact of UV rays on sails,

it is recommended to cover the lowered mainsail. Hunter offers an optional stack-pack sail cover. This sail cover is installed within a groove on the boom top and is opened up to receive the lowered sail and closed and zipped for stowing. The sail cover is integrated with the relevant running rigging. The reef lines pass through the sail cover through small slits which allow line movement. The lazy jack system can be attached to the sail cover. Review Figures 12.27 and 12.28 for details on the lazy jack and sail cover layouts and installation instructions.

12.8.3 In-Mast Furling Mainsail

The optional in-mast furling rig comes with an infinite reefing system. Sail area is decreased horizontally, or the luff shifts to the right on the sail. Stowing the sail involves furling it within the mast through the roller furling mechanism. Reefing and stowing the roller-furling mainsail is accomplished by the opposing main furling line and mainsail outhaul line.

12.8.3.1 Furling Instructions

1. Ensure the vang is sufficiently slackened.
2. Ensure the leech is freed up by adjusting the topping lift as required.
3. Take up the main furling line while keeping slight tension on the outhaul; continue to furl until only the UV protected portion of the sail is visible (Fig. 12.10).

12.8.3.2 Reefing Instructions

1. Ensure the leech is freed up by adjusting the topping lift as required.
2. Set the reefing winch setting to “FREE”.
3. Take up the main furling line while keeping slight tension on the outhaul line.
4. When reaching a desired reef point, mark the main furling line at the stopper with a 1” (25mm) single band of indelible marker ink. By taking up the main furling line to this mark every time, consistent positioning is made easier. Similarly, mark the outhaul line in the same fashion for a consistent correct position.
5. Repeat the procedure for the second desired reef point, using double bands to mark the main furling line and outhaul in the correct position.

12.8.3.3 Unfurling Instructions

1. Ensure the vang is sufficiently slackened.
2. Free up the main furling line.
3. Take up the outhaul line while providing backtension on the main furling line (to avoid line gnarling)

Figure 12.10

12.8.4 Roller Furling Jib

Control of the headsail sail area is also through a roller furling system and, hence, an infinite reefing system. Stowing the headsail involves furling it within its roller furling mechanism.

12.8.4.1 Furling Instructions

1. Ensure the windward sheet is running freely.
2. Take up the furling line while slightly releasing the leeward sheet. Keep some tension on the sheet to allow a tight and even furl (Fig. 12.11).
3. Tie the furling line to the starboard cleat.

12.8.4.2 Reefing Instructions

Same as the furling instructions.

12.8.4.3 Unfurling Instructions

1. Release the furling line and windward sheet.
2. Place a turn of the furling line around the cleat or winch to produce some drag.

3. Place a turn of the leeward sheet around a winch and unfurl the sail by drawing in the sheet.

4. Place a few more turns of the sheet around the winch.

12.9 Supporting Hardware

Please refer to the Boating Safety chapter in this manual for the deck hardware layout illustration.

Figure 12.11

12.9.2 The Traveler/Tracks

The mainsheet traveler is located overhead on the arch. The traveler provides controls on the range of motion for end boom sheeting. The helmsman can easily adjust the mainsheet traveler, the jib sheets, and the mainsheet (see Fig. 12.21 and 12.22). The setup allows short handed sailing with only a couple of people in the cockpit or with autopilot steering.

These tracks allow cars to travel forward and aft providing control on the range of motion for the jib to be able to adjust the lead position.

12.9.3 Winches

The winches (Fig. 12.12) perform the heavy lifting with working sails. They provide the extra purchase needed when trimming. Your boat comes standard with 2 coach roof self tailing manual winches and 2 cockpit self tailing manual winches. Two manual winch handles are included in loose gear. Hunter offers optional electric self tailing winches as an upgrade. Rather than hand cranking the winch, one simply activates the winch by depressing the winch power button (Fig. 12.13) located in close proximity to the winch.

Self tailing winches allow winching by one person rather than two. Generally, standard winches would require one person to winch and another to pull the “tail”. The self tailing method involves a feeder arm which guides the line into a groove in the crown of the winch. When winching, the line rotates around to the feeder arm which then redirects it off the winch.

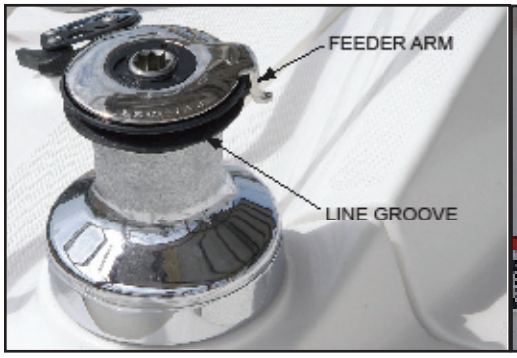


Figure 12.12

Figure 12.13

12.9.4 Blocks, Jammers and Organizers

The rigging is facilitated by a number of blocks (or pulleys) of various designs, line jammers and line organizers. These are all intended to organize the running rigging to allow cockpit control of the sailing experience.

12.9.5 General Hardware Maintenance

Check all fittings regularly to be sure screws are tight. Occasionally lubricate (100% silicone spray) all moving parts on hardware such as blocks, turnbuckles, cam cleats, track slides, etc.

Inspect cleat and fairleads for roughness. Smooth with fine-grained emery paper if necessary. Also, replace any missing or damaged cotter pins in turnbuckles and shackles. Tape them or use protective covers manufactured for that purpose. Grease winches a minimum of once annually.

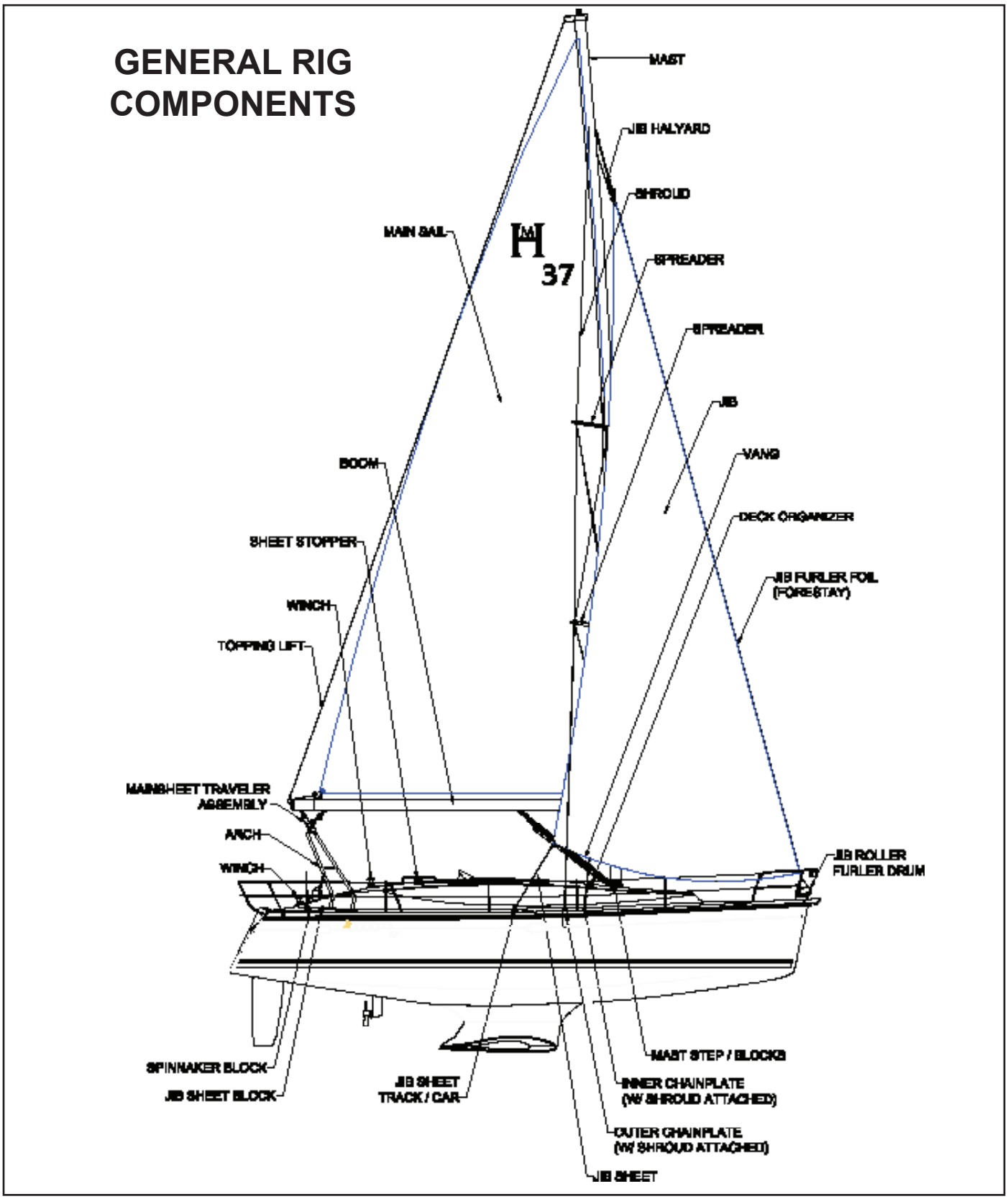


Figure 12.14

MAINSAIL / JIB SPECIFICATIONS

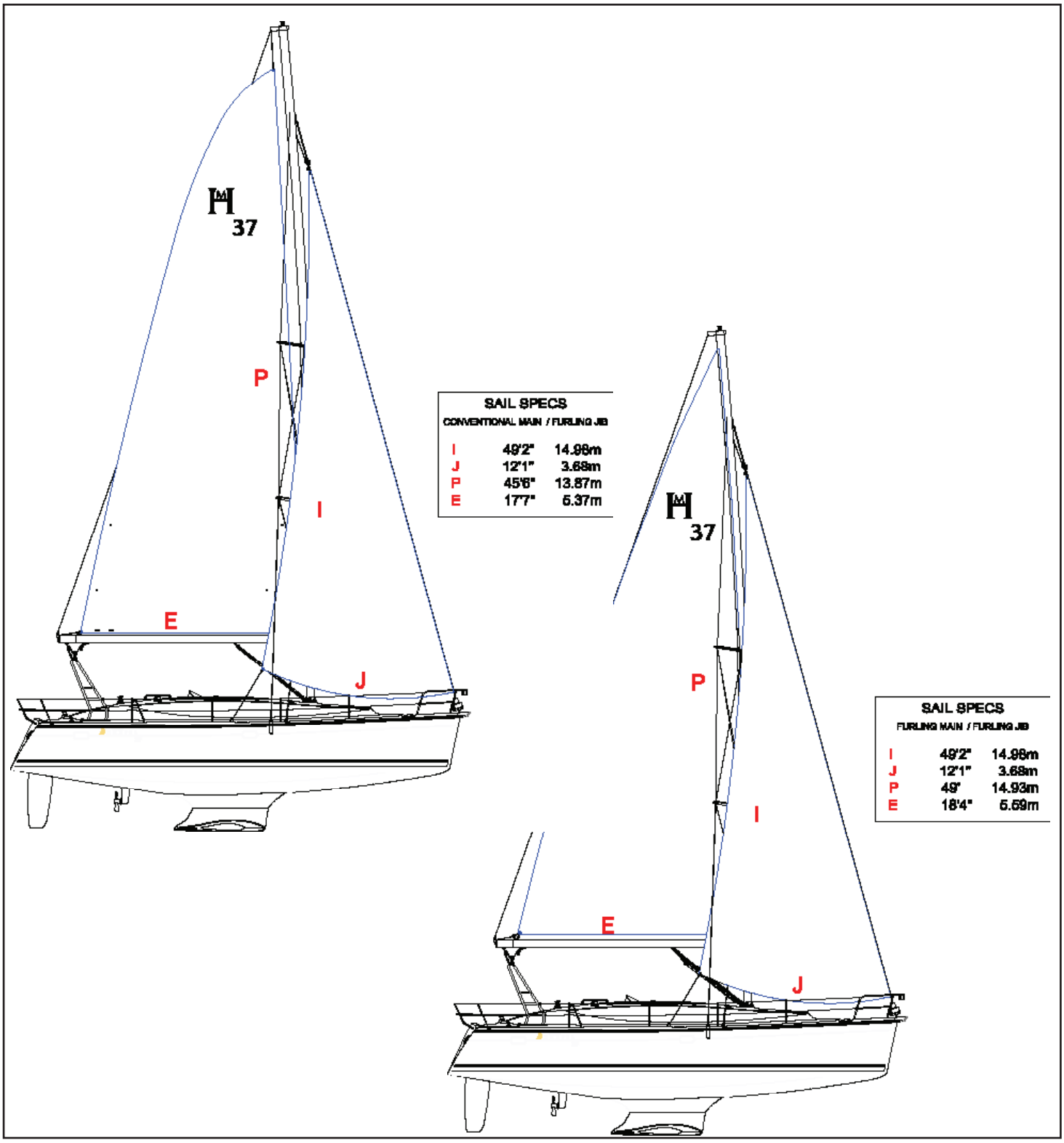
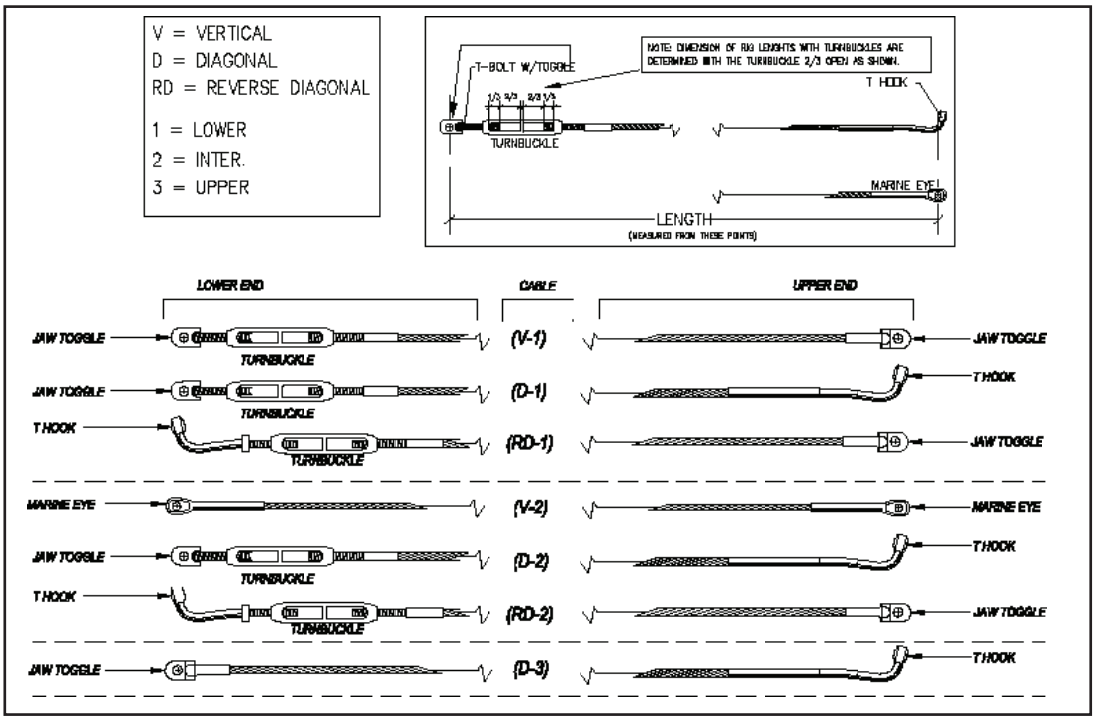


Figure 12.15

STANDING RIGGING SPECIFICATIONS

STANDARD & FURLING RIGS

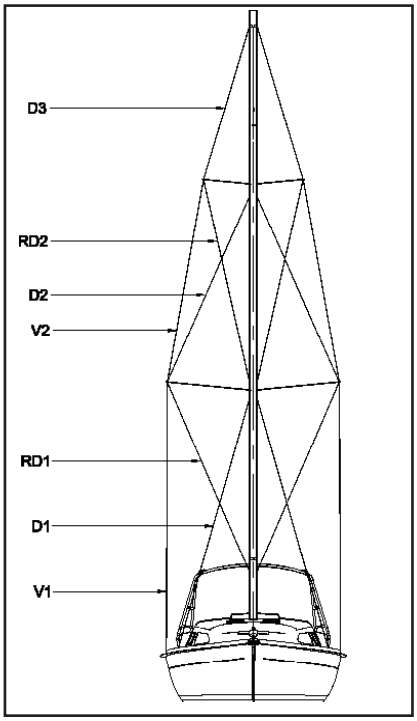


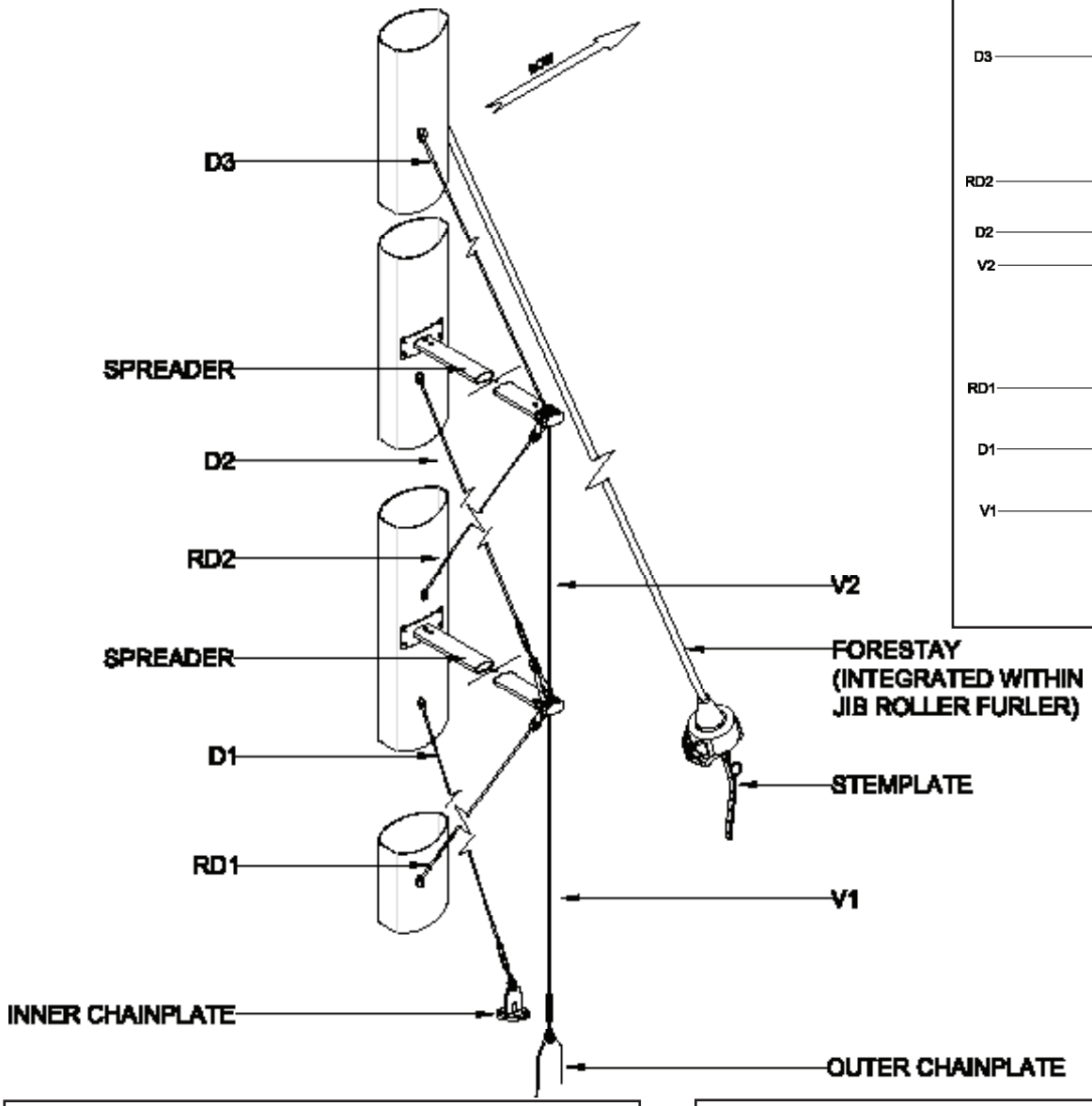
#	ITEM	QTY	WIRE SIZE	FITTINGS	PIN	CP-CP OR CP-EOS
1	FORESTAY	1		PART OF JIB ROLLER FURLER SYSTEM		
2	V1	2	3/8" 10 mm	LOW - STUD/TURNBUCKLE/TOGGLE	5/8"	17' 6" 5335 mm
				HIGH - TOGGLE	5/8"	
3	D1	2	5/16" 8 mm	LOW - STUD/TURNBUCKLE/TOGGLE	5/8"	17' 8" 5390 mm
				HIGH - T-HOOK	-	
4	RD1	2	7/32" 6 mm	LOW - STUD/TURNBUCKLE/T-HOOK	-	14' 6" 4415 mm
				HIGH - TOGGLE	1/2"	
5	V2	2	5/16" 8 mm	LOW - EYE	5/8"	16' 5" 5010 mm
				HIGH - EYE	5/8"	
6	D2	2	9/32" 7 mm	LOW - STUD/TURNBUCKLE/TOGGLE	1/2"	17' 1" 5200 mm
				HIGH - T-HOOK	-	
7	RD2	2	7/32" 6 mm	LOW - STUD/TURNBUCKLE/T-HOOK	-	16' 7" 5055 mm
				HIGH - TOGGLE	1/2"	
8	D3	2	5/16" 8 mm	LOW - TOGGLE	5/8"	16' 5" 5000 mm
				HIGH - T-HOOK	-	
	SELDEN MAST FZ28 / BOOM B171					

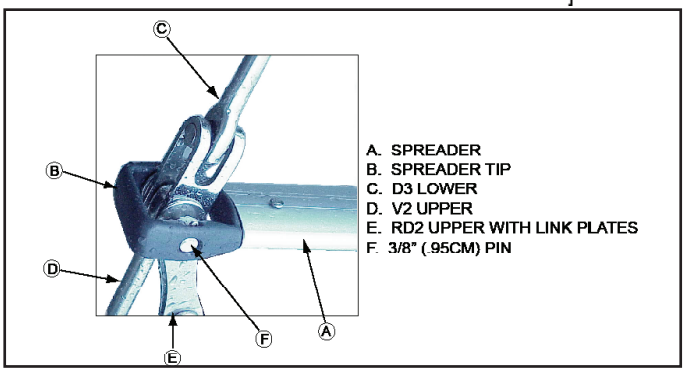
Figure 12.16

STANDING RIGGING LAYOUT

STANDARD & FURLING RIGS







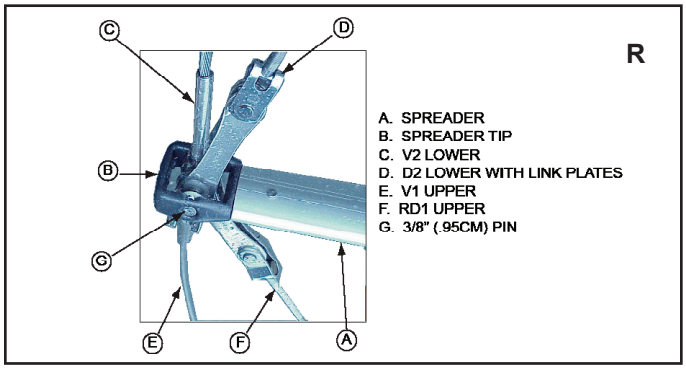


Figure 12.17

RUNNING RIGGING SPECIFICATIONS

#	OPTIONS	ITEM	QTY	SIZE/DIA	SIZE/DIA	COLOR	TOP	BOTT	LENGTH/FT	LENGTH/M	SHIPPED
1	STD	MAIN HALYARD	1	3/8	10	NAVY BLUE	BARE	BARE	131.2	40.0	W/ MAST
2	STD	MAIN SHEET	1	15/32	12	WHITE [redacted]	BARE	BARE	119.0	36.5	W/ BOOM
3	STD	TRAVELER LINES	2	5/16	8	WHITE	EYE	BARE	26.2	8.0	W/ STAND RIG
4	OPT	MAIN FURLING LINE	1	3/8	10	WHITE [redacted]	CONT	CONT	49.2	15.0	W/ MAST
5	STD	TOPPING LIFT	1	5/16	8	WHITE [redacted]	BARE	[redacted] SHACKLE	121.4	37.0	W/ MAST
6	STD	BOOM OUTHAUL	1	3/8	10	WHITE [redacted]	BARE	BARE	75.5	23.0	W/ BOOM
7	STD	VANG TACKLE	1	15/32	12	BLACK	BARE	SMALL EYE	59.0	18.0	W/ VANG
8	OPT	SOLID VANG LINE	1	5/16	8	BLACK	BARE	BARE	59.0	18.0	W/ SOLID VANG
9	STD	REEFING LINE #1	1	3/8	10	WHITE [redacted]	BARE	BARE	59.3	17.6	W/ STAND RIG
10	STD	REEFING LINE #2	1	3/8	10	WHITE [redacted]	BARE	BARE	97.1	29.6	W/ STAND RIG
11	STD	JIB HALYARD	1	3/8	10	RED	BARE	[redacted] SHACKLE	114.8	35.0	W/ MAST
12	STD	JIB SHEET	2	15/32	12	GREEN [redacted]	BARE	BARE	59.0	18.0	W/ STAND RIG
13	STD	JIB FURLING LINE	1	5/16	8	WHITE [redacted]	BARE	BARE	82.0	25.0	W/ FURLEX
14	OPT	SPINNAKER HALYARD	1	15/32	12	BLACK	BARE	SNAP SHACKLE	131.9	40.0	W/ MAST
15	OPT	SPINNAKER TACK LINE	1	7/16	11	WHITE	BARE	2" LOOP	18.0	5.5	W/ SPIN OPT
16	OPT	SPINNAKER SHEET	2	3/8	10	WHITE	BARE	BARE	78.7	24.0	W/ SPIN OPT
17	STD	LAZY JACK LINE WIRE	2	5/32	4	WHITE [redacted]	BARE	SHACKLE	18.0	5.5	W/ STAND RIG
18	STD	LAZY JACK LINE - FIXED	2	3/8	10	WHITE	BARE	BARE	19.7	6.0	W/ STAND RIG
19	STD	LAZY JACK LINE - ADJUSTABLE	2	3/8	10	WHITE	BARE	NYLON TH[redacted]LE EYE	10.2	3.1	W/ STAND RIG

Figure 12.18

RUNNING RIGGING LINES FROM MAST STEP / STANDARD RIG

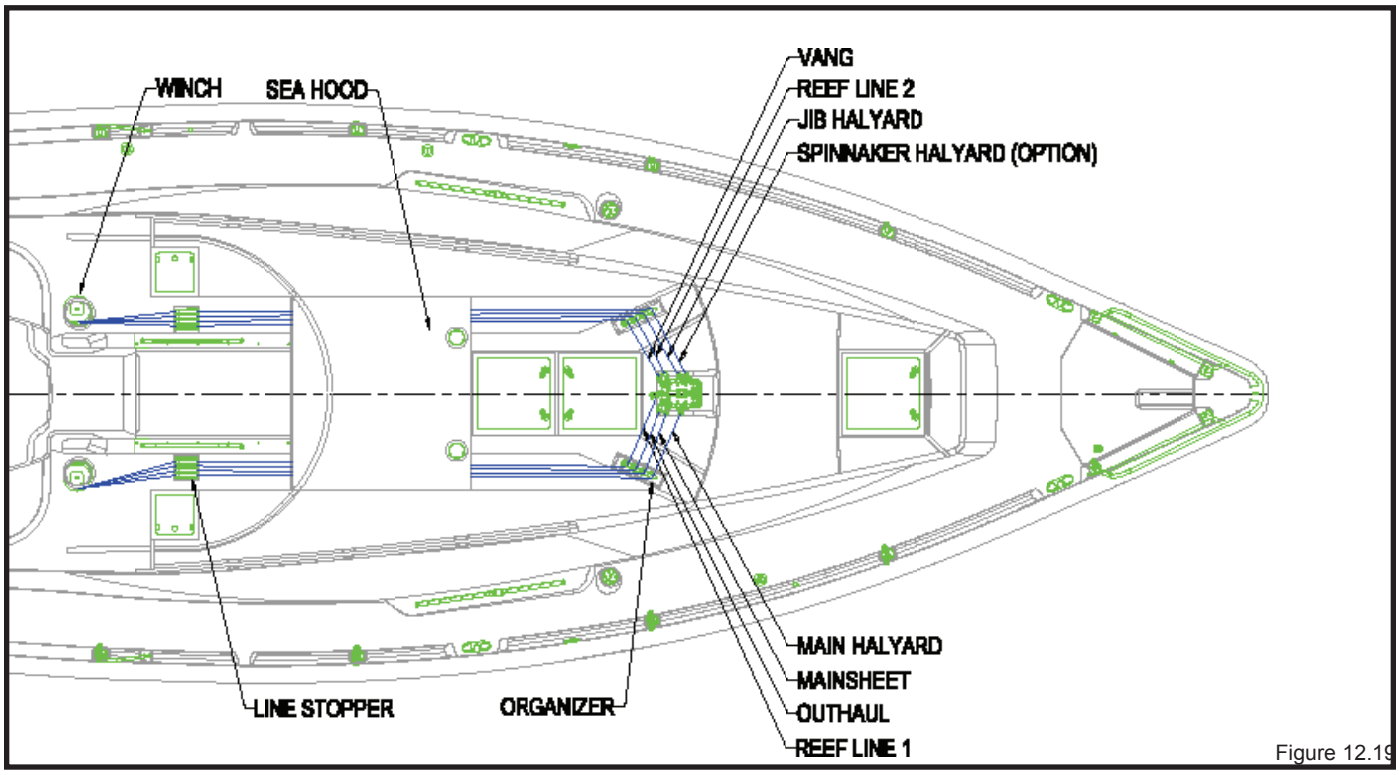


Figure 12.19

RUNNING RIGGING LINES FROM MAST STEP / FURLING RIG

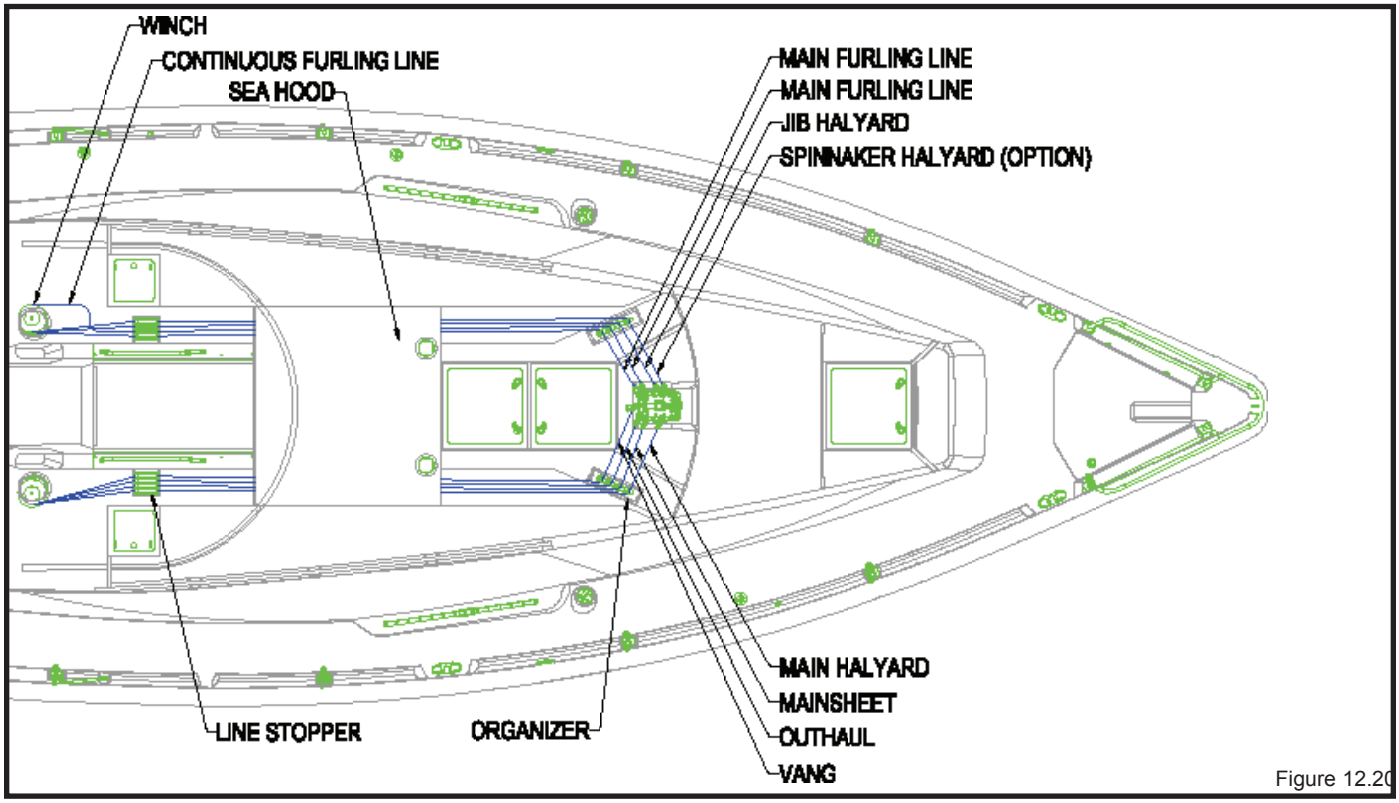


Figure 12.20

MAINSHEET & BOOM OUTHAUL LAYOUT

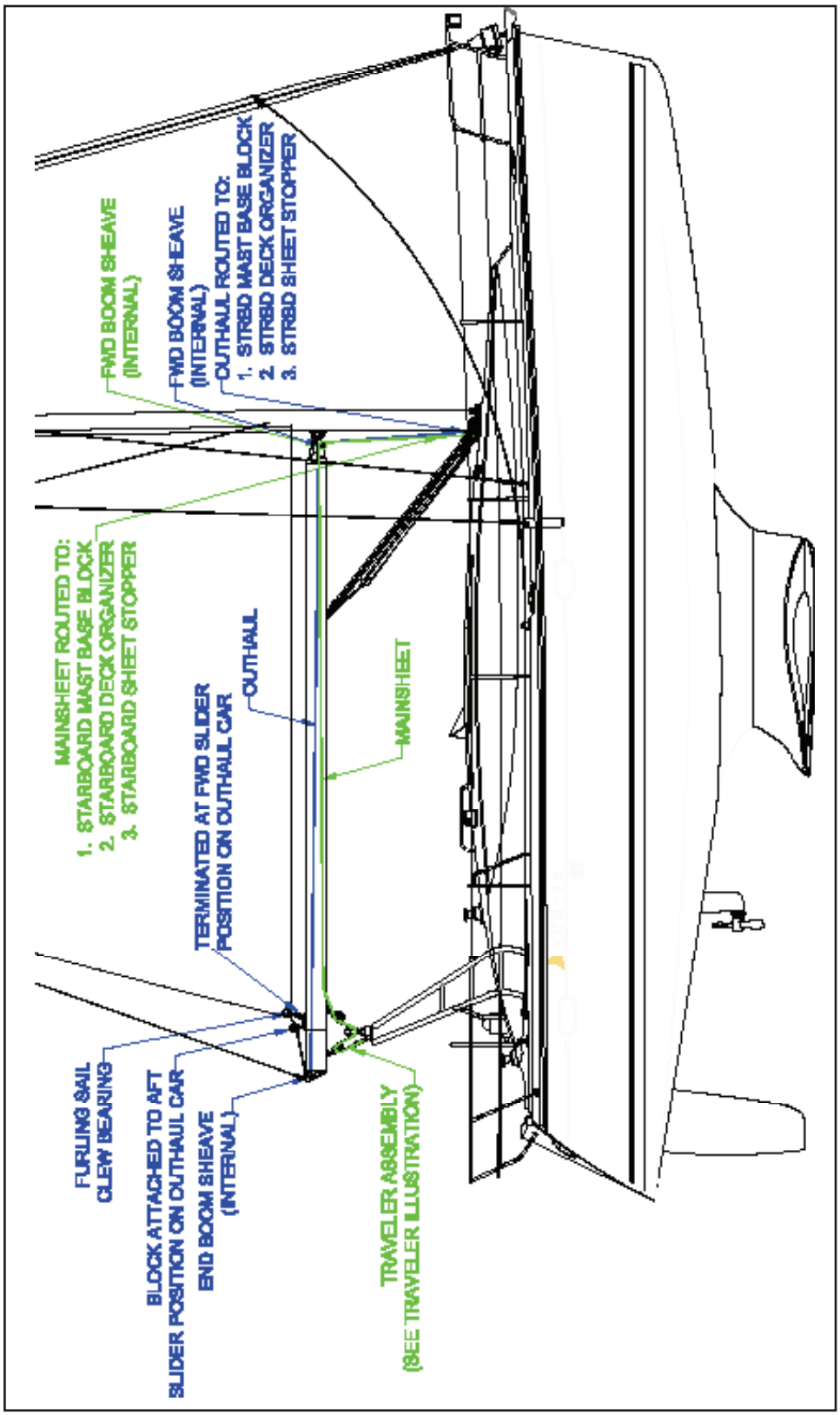


Figure 12.21

TRAVELER LINES LAYOUT (WITH MAINSHEET)

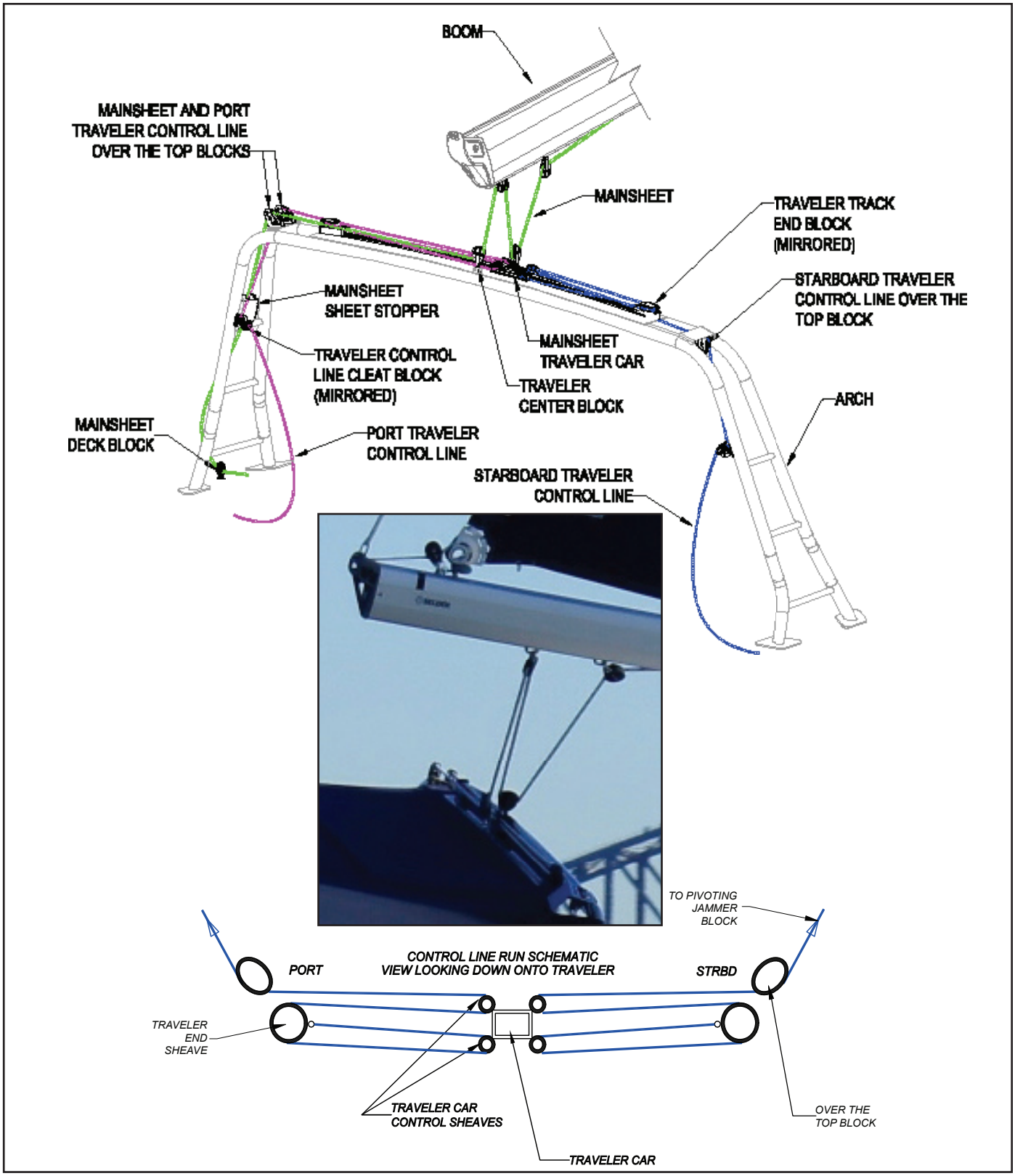
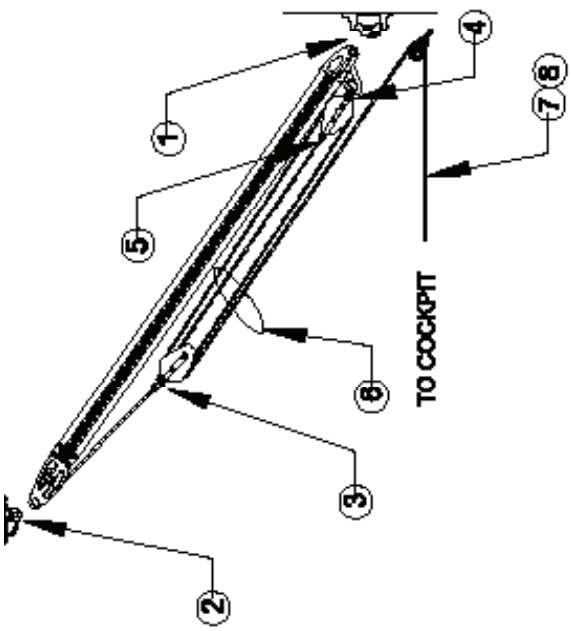


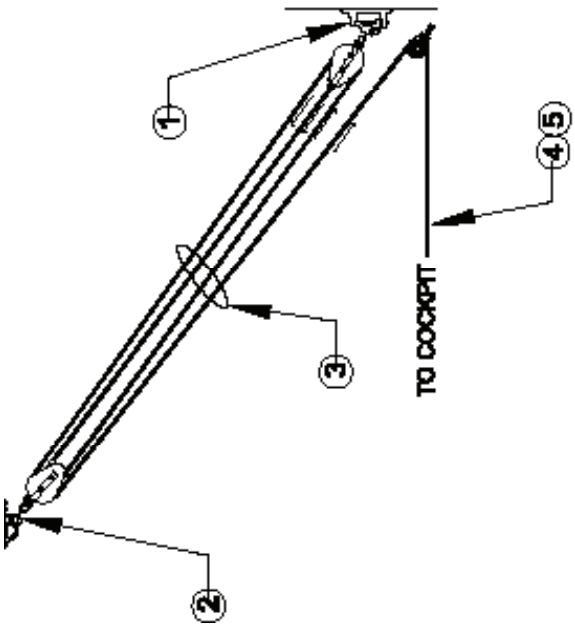
Figure 12.22

VANG LAYOUT (CONVENTIONAL & SOLID)



SOLID VANG (RODKICKER) INSTALLATION:

1. SHACKLE THE VANG END CAP WITH INTEGRATED TACKLE EXTENSION TO TO VANG BRACKET ON THE MAST (TACKLE EXTENSION POINTING TO THE DECK)
2. SHACKLE THE VANG END CAP WITH SHEAVE TO THE BOOM VANG SLIDER
3. SHACKLE UPPER VANG CABLE TO THE HEAD OF THE DOUBLE SHEAVE BLOCK
4. SHACKLE SINGLE SHEAVE BLOCK TO THE TACKLE EXTENSION ON THE LOWER VANG
5. DEAD END THE VANG LINE ONTO THE BECKET OF THE LOWER VANG BLOCK
6. ROUTE THE LINE AS SHOWN
7. CONTINUE VANG LINE FROM MAST BLOCK TO DECK ORGANIZER
8. CONTINUE VANG UNDER SEA HOOD TO SHEET STOPPER



ROPE VANG INSTALLATION:

1. ATTACH VANG LOWER FIDDLE BLOCK TO VANG TOGGLE ON MAST
2. ATTACH VANG UPPER FIDDLE BLOCK TO BALE ON BOOM
3. ROUTE THE VANG LINE AS SHOWN
4. CONTINUE VANG LINE FROM MAST BLOCK TO DECK ORGANIZER
5. CONTINUE VANG UNDER SEA HOOD TO SHEET STOPPER

Figure 12.23

FURLING JIB LAYOUT

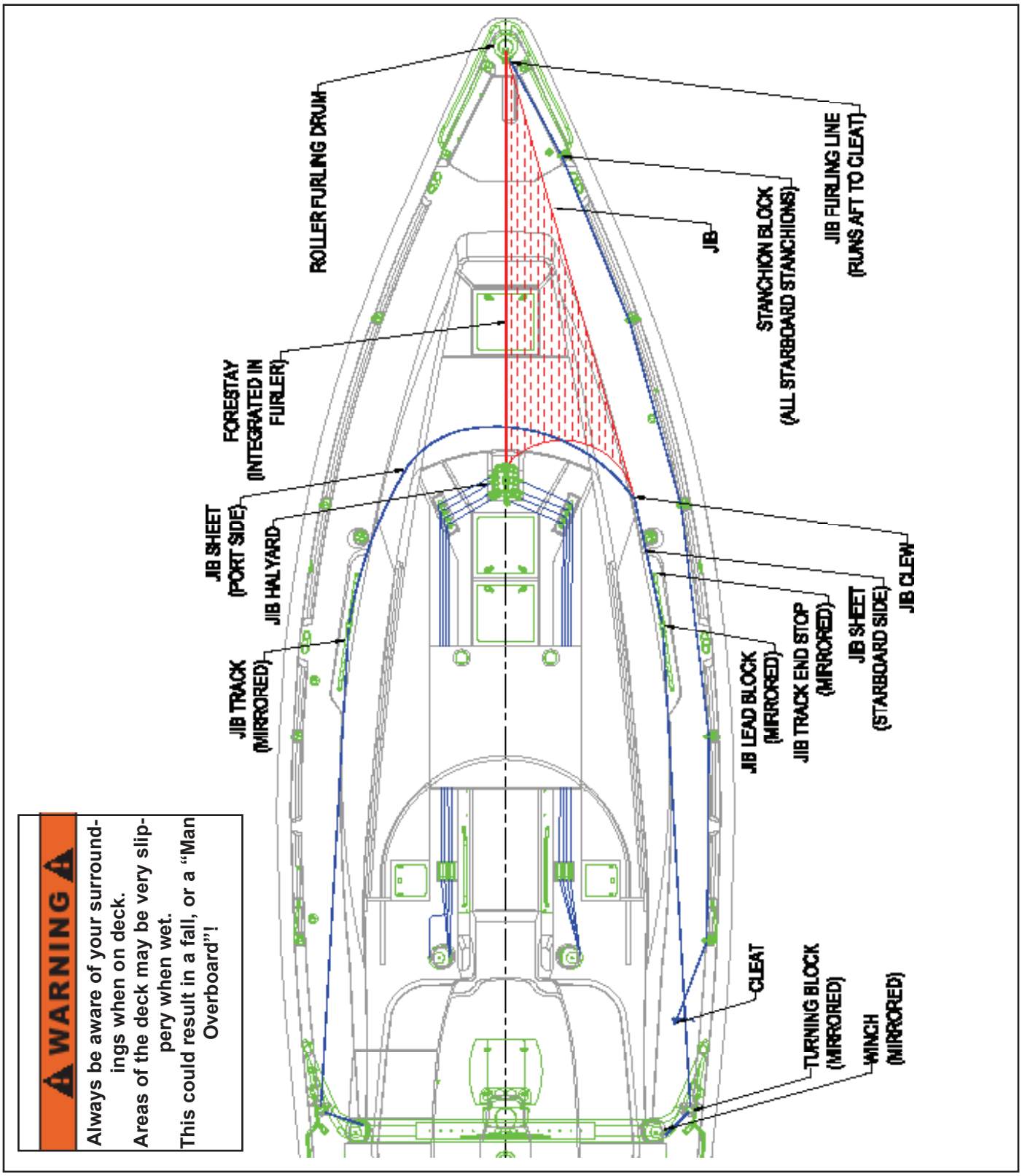


Figure 12.24

SPINNAKER LAYOUT (OPTION)

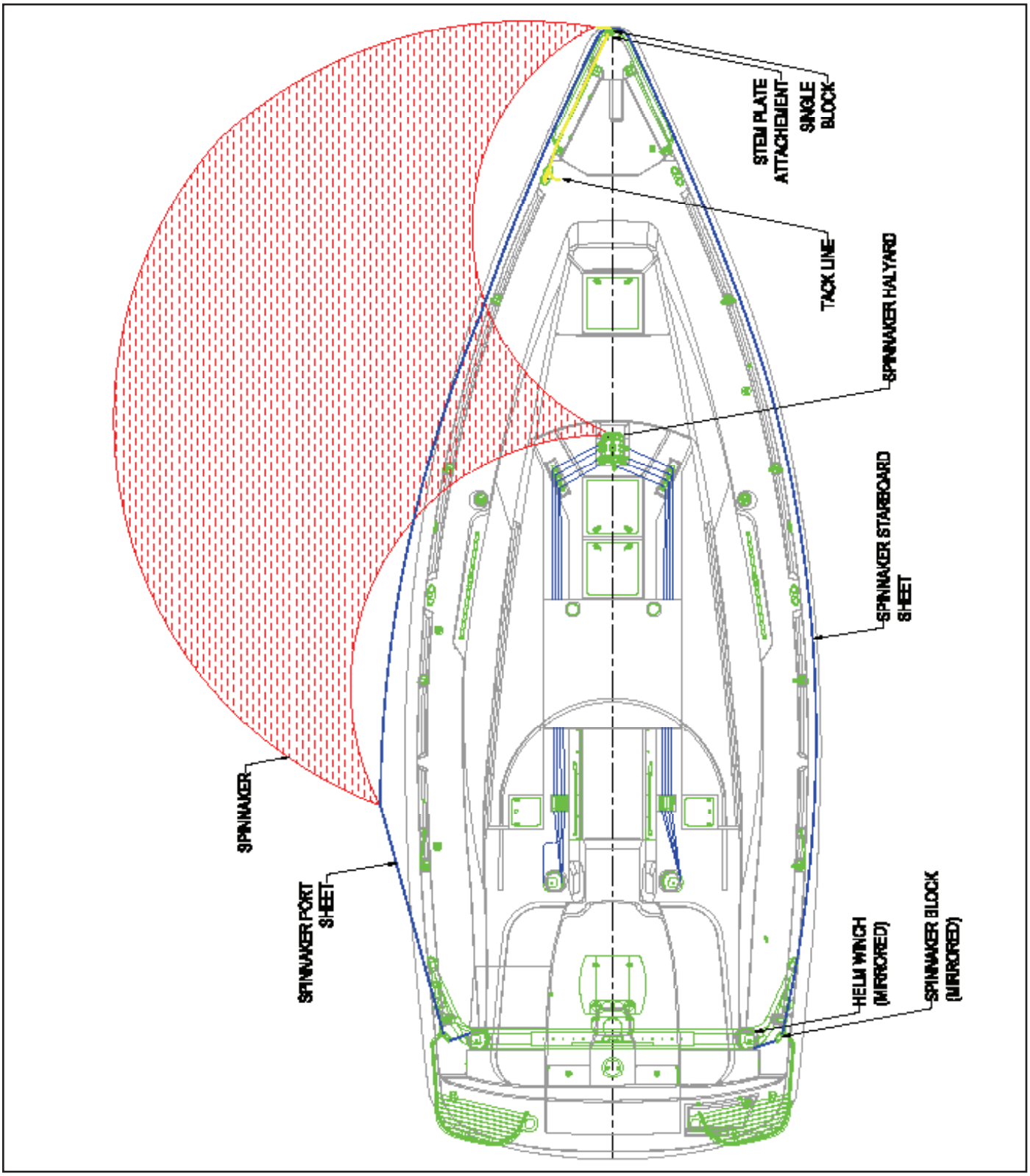


Figure 12.25

GENERALIZED REEFING LAYOUT

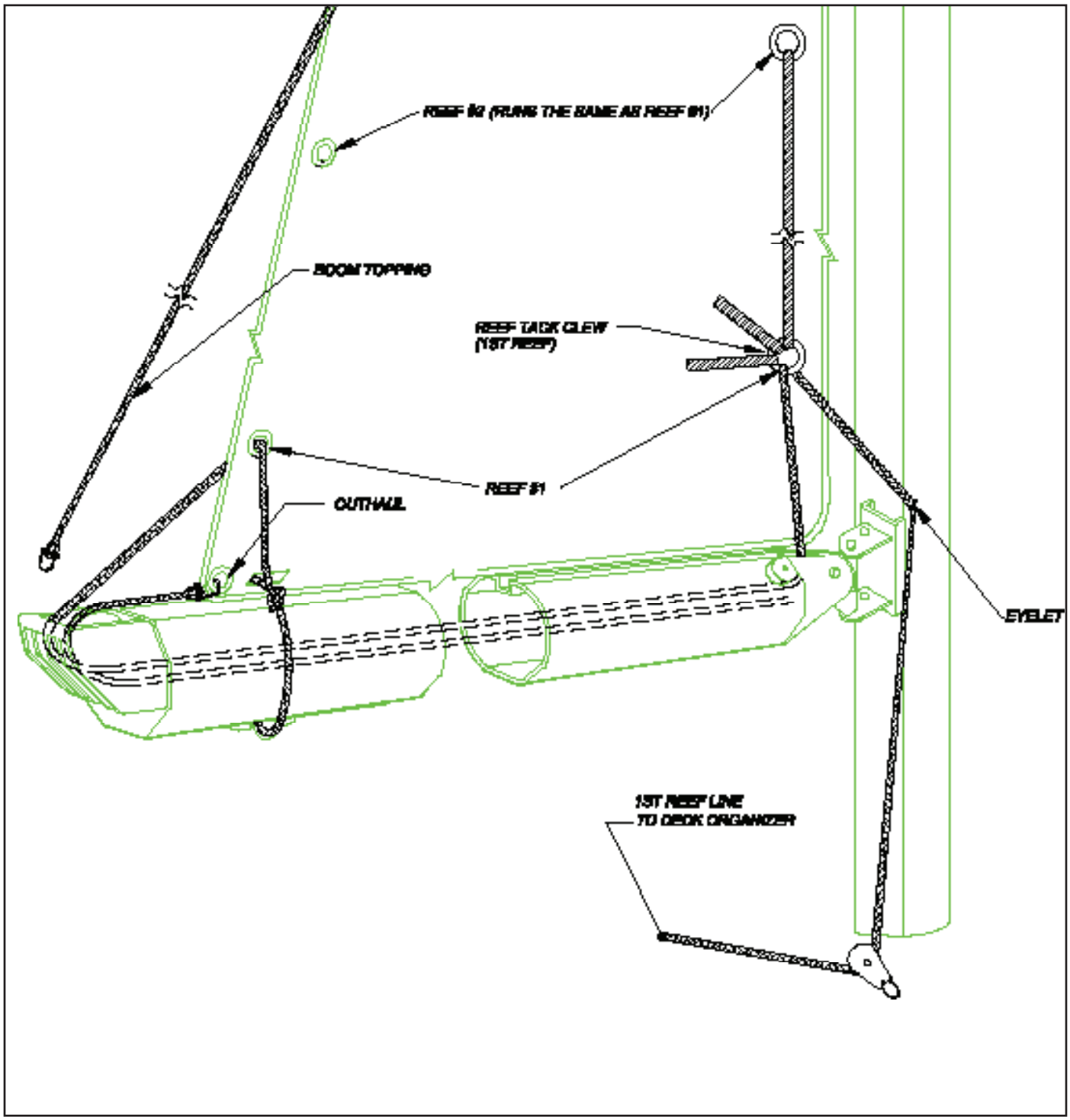
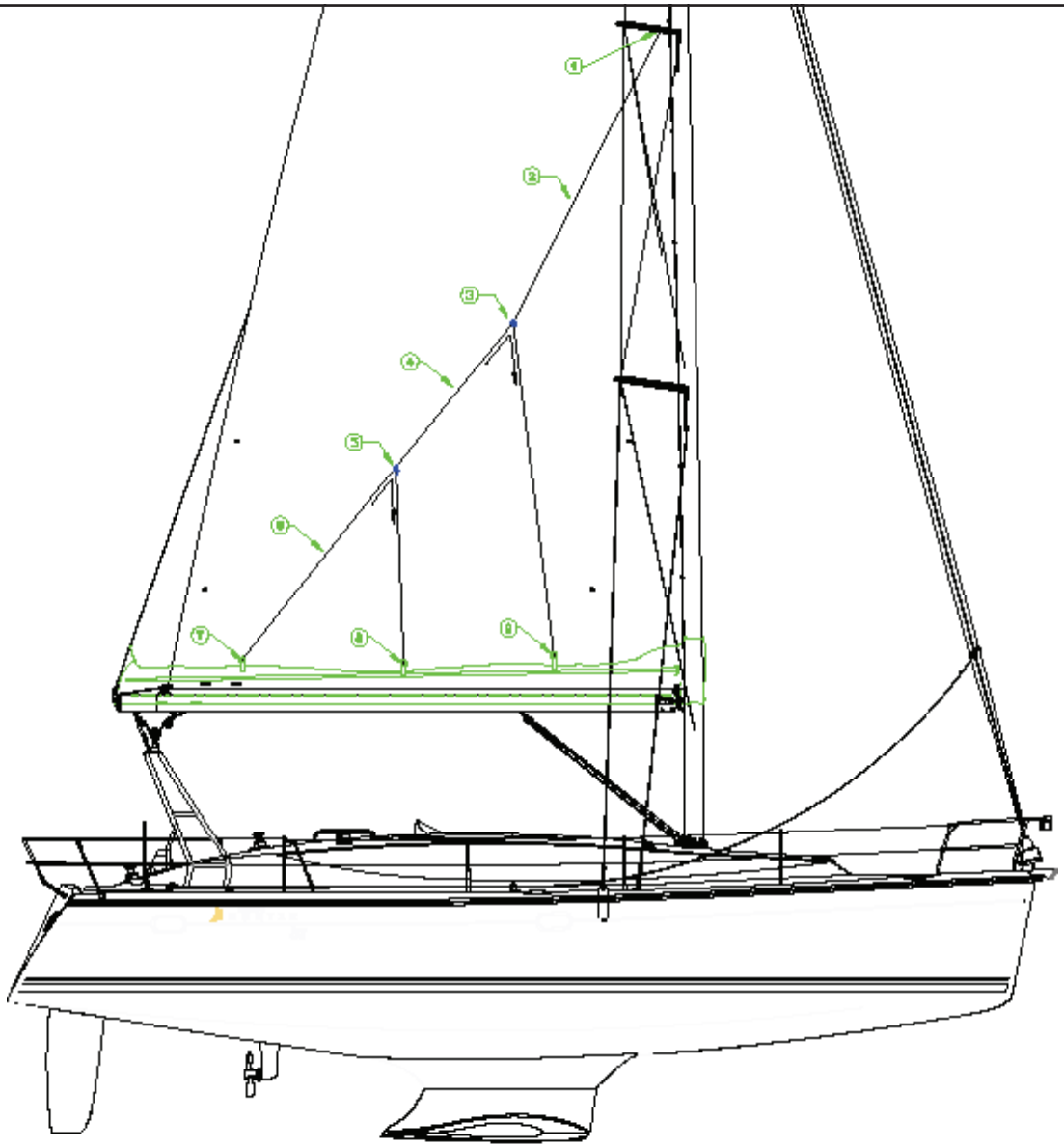


Figure 12.26

LAZY JACK LAYOUT
WITH OPTIONAL STACK-PACK SAIL COVER

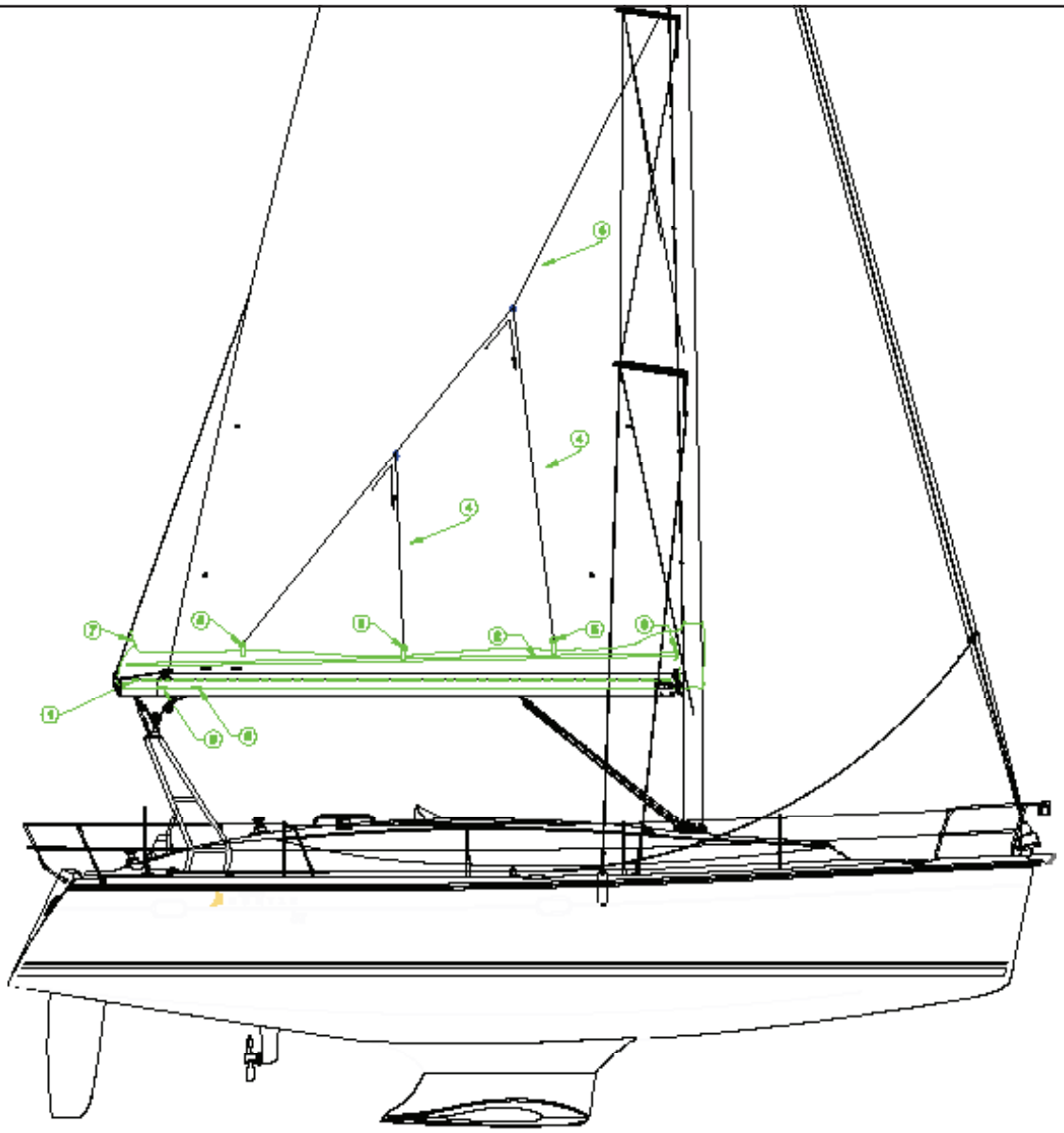


LAZY JACKS LAYOUT:

1. LAZYJACK WIRE ATTACHMENT @ UPPER SPREADER (1)
2. LAZY JACK UPPER FIXED CABLE (2)
3. THIMBLE OR BLOCK ON FIXED CABLE (3)
4. FORWARD LAZY JACK LINE (THRU THIMBLE / BLOCK) (4)
5. LOWER THIMBLE (5)
6. AFT LAZY JACK LINE (THRU LOWER THIMBLE) (6)
7. AFT BALE (SECURE LAZY JACK LINE END) (7)
8. MID BALE (SECURE OTHER END OF AFT LAZY JACK LINE) (8)
9. FWD LAZY JACK LINE DEAD ENDS AT FWD STACK PACK STRAP (9)

Figure 12.27

STACK-PACK SAIL COVER INSTALLATION
WITH LAZY JACKS



INSTALLATION INSTRUCTIONS:

1. SLIDE SAIL COVER BOLTROPE INTO CHANNEL (1) ON TOP OF BOOM - BEGINNING FORWARD AND CONTINUING AFT
2. INSERT PVC BATTENS (2) INTO THE SMALL FORWARD INSIDE POCKETS (3) ON EACH HALF OF THE SAIL COVER AND PUSH AFT UNTIL FULLY INSERTED
3. ROLL OR FOLD EACH SIDE OF THE MOUTH OUTWARD TO RECEIVE THE SAIL
4. TIE THE LAZY JACK LINES (4) TO THE THREE SAIL COVER EYE STRAPS (5)
5. RUN THE REEF LINES THROUGH THE COVER SLOTS (6) AND TIE OFF (BE SURE REEFING LINES ARE INSIDE OF SAIL COVER ZIPPER AT AFT END)
6. TIE LINE FROM AFT END EYELET OF SAIL COVER TO TOPPING LIFT (7)

Figure 12.28

Notes:

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Chapter 13

Getting Underway

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Having been introduced to your boat and its systems, understood all relevant safety procedures and received training in seamanship, you are now ready to set sail. We will break the stages of your outing into the following categories:

1. Before Boarding
2. Boarding Your Boat
3. Starting the Engine
4. Getting Underway
5. Returning to Port
6. Emergency Operations

13.1 Before Boarding

In addition to the above noted preparatory training, you should also be able to answer "yes" to the following questions before you go on that first cruise:

- Has your dealer completed the Pre-Delivery Service Inspection Report?
- Have you and your dealer signed the Pre-Delivery Service Inspection Report?
- Have you completed and emailed or mailed all applicable warranty registrations?
- Have you read and understood this operator's manual and the OEM manuals?
- Has your boat been registered with the proper authorities?
- Does your hull display the proper identification?
- Has your dealer reviewed with you the operation of the boat and its systems?
- Has your dealer answered all your questions?

If you have taken care of these preliminary steps, you are ready to take your first cruise. Before you start, give some thought to the cruise itself. Choose a calm day if possible.

13.2 Boarding your Boat

Make it a routine to visually inspect the exterior of your boat every time you approach to board. Look for signs of damage that could be caused by the dock or other boats.

13.2.1 Alarms

As you board your boat, you should listen for any alarms which could be sounding.

13.2.1.1 High Water Alarm

The high water alarm in the cockpit will warn you of accumulating water in the bilges. Immediately investigate the source of this accumulation and take appropriate action.

13.2.1.2 CO Detector Alarm

The CO detectors could indicate the presence of Carbon Monoxide gas. The dangers of Carbon Monoxide are detailed at length in the Boating Safety chapter of this manual.

Actuation of your CO alarm indicates the presence of carbon monoxide (CO) which will KILL YOU! If the alarm sounds:

1. Press the Reset/Silence button.
2. Call Emergency Services.
3. Immediately move to fresh air, outdoors, or to an open window or door. Do a head count to check that all persons are accounted for. Do not reenter the premises nor move away from an open door or window until the emergency responders have arrived, the premises have been aired out, and your alarm returns to its normal operation.
4. After following steps 1, 2, and 3, if your alarm reactivates in a 24 hour period, repeat steps 1 – 3 and call a qualified appliance technician to investigate for sources of CO from fuel burning equipment and appliances, and inspect for proper operation of this equipment. If problems are identified during this inspection, have the equipment serviced immediately. Note any combustion equipment not checked by the service technician and contact the manufacturer directly for more information about CO safety and this equipment.

⚠ CAUTION ⚠

The CO detectors will only indicate the presence of Carbon Monoxide at the sensor. Carbon Monoxide gas may be present in other areas.

NOTE: There are other issues that could cause these alarms to sound, such as the loss of power in the batteries that feed the CO detectors and other systems. These alarms exist to warn of impending loss of function of these important systems.

13.2.1.3 Engine Alarms

There are also alarms on your engine that could be sounding if the engine is running. Be sure and check your manufacturer's documentation for information concerning these alarms.

13.2.2 Strong Fuel Fumes

⚠ WARNING ⚠

Leaking fuel is a fire and explosion hazard. Personal injury or death could occur.

Fuel fumes are heavier than air and can collect in the bilge area. These fumes are extremely hazardous. Perform a Fuel Safety Checklist For Boarding found in the Fuel System chapter in this manual. If you detect strong fumes, proceed as follows:

1. Evacuate all occupied enclosures immediately.
2. Shut down engine (if already operating).
3. Turn off all electrical circuits.
4. Inform the dock master. Have a qualified technician check the boat immediately to determine the source of the odor.
5. Open the boat for natural ventilation.
6. When you can no longer smell fumes, locate the source. Dispose of fuel in a safe, approved manner.

⚠ DANGER ⚠

Explosive fuel vapors can become trapped in the lower portions of the boat. Close all hatch covers, windows, doors, and compartments while fueling your boat.

13.3 Starting the Engine

For convenience, some information is repeated here from the DC Electric System chapter of this manual (and other sections). However, if you take the opportunity to review that chapter, it will assist your understanding and recollection of the following material.

To begin, first determine the source of your boat's DC power by setting the battery selector switche(s) to the desired settings. The battery switch panel has two selector switches with two settings - the "Off" position (12 o'clock) and the "On" position (3 o'clock). The House Battery selector switch also has a "Combined" position (7:30 o'clock) which allows both batteries to simultaneously source power.

NOTE: As an added precaution against a depleted start battery, your engine can be started from both batteries, or, in other words, from a combined battery bank. This is accomplished by positioning the House switch to "Combined" together with the Start battery switch to "ON" (refer to the DC Electric chapter of this manual). After starting your engines, return the engine battery selector switch to its standard position.

Manually check the bilge pumps are working properly by switching the bilge pump toggle switch (located on the DC panel) to the right. The pump should turn on. The toggle will spring back when released and the pump will turn off again.

Verify the engine compartment blower hose is properly attached (see Waste Systems chapter in this manual).

Deliver power to the DC Panel by switching the DC Main breaker switch on the Battery Selector Switch to the "ON" position. Check other DC powered items, such as the fresh water pump, by switching on their respective switches.

Also, do a physical review and ensure the following:

- Seawater intakes that feed the systems (engine, generator, air conditioner) are open (refer to the Water Systems chapter in this manual for details)
- Throttle and shifter operate smoothly
- Steering system operates smoothly
- Engine oil level is proper (refer to the engine manufacturer's OEM manual for details)
- Gear box oil level is proper (refer to the engine manufacturer's OEM manual for details)
- Engine coolant level is proper (refer to the engine manufacturer's OEM manual for details)

- Engine fuel is at the desired level

NOTE: We recommend executing the Inspection checklists presented in the Forms and Documents chapter in this manual. These are a comprehensive list of items/issues to review. Continuous execution is beneficial to produce good habits for safe boating.

13.3.2 Starting Sequence

NOTE: Excessive cranking could cause seawater to enter the cylinders and damage the engine, also known as hydrolock. If the engine does not start after cranking for 15 seconds, close the sail drive cooling water seacock (refer to the engine manufacturer's OEM manual for location) to avoid filling the muffler with water. Crank for 10 seconds at a time until the engine starts. When the engine does start, stop the engine immediately and turn off the power switch. Be sure to re-open the seacock and restart the engine. Operate the engine normally.

1. Move the throttle/shift levers to the neutral (center) position.
2. Press the "Power Switch" button (Fig. 12.2) to energize the panels. The alarm buzzer will sound. Verify that the instrument panel indicators are powered and working.
3. Verify the engine compartment blower is operating properly (place your hand in front of the blower vent located in the starboard transom garage).
4. Press the "Start Switch" button (Fig. 12.2) until the engine starts. The alarm buzzer and alarm lamps should silence and extinguish. If not, press the "Stop Switch" and investigate the cause of the alarm.
5. Once the engines come up to operating temperature, move the shift lever to Fwd and Reverse positions to make sure the transmissions will engage.
6. Now, shut down the engines and recheck your oil and transmission fluid levels.
7. Repeat steps 1-3 and begin your cruise.

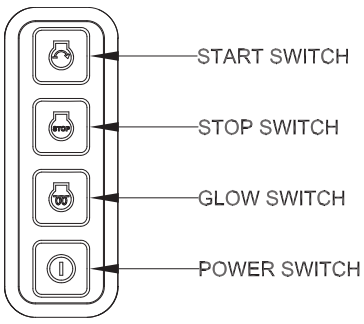

Figure 12.2

⚠ WARNING ⚠

In order to prevent premature starter failure, do not continuously crank engine starters for more than 15 seconds.

⚠ WARNING ⚠

DO NOT remove cooling system filler cap when engine is hot. Allow to cool and then remove pressure cap slowly, allowing pressure to vent. Hot coolant under pressure may discharge violently.

⚠ WARNING ⚠

Exhaust gasses contain Carbon Monoxide. This is a poisonous gas and can cause death. Shut down engines immediately if any exhaust leaks are detected.

IMPORTANT: Always be careful when starting the engine. Use common sense and good judgment. Shut down the engine immediately if you observe any unsafe operating conditions.

IMPORTANT: If engine fails to start within 15 seconds, release switch. Allow starter motor to cool for at least 60 seconds, then try starting the engine again with 10 second attempts.

NOTE: Should there be a problem with the battery voltage level, see the section in this chapter for emergency operation.

13.4 Getting Underway

⚠ WARNING ⚠

Before ever pulling away from the dock, make sure the shore power cord(s) and shore water hose are disconnected.

Execute the following checklist:

- Disconnect shore power.
- Check that the fresh water tanks are full.
- Verify that you have up to date fire extinguishers and flares.

- Make sure you have the required safety equipment for your passengers.
- Ensure your radio is operating properly and understand emergency communication procedures.
- Ensure all rigging and sails are installed and ready for use (refer to the Sails & Rigging section in this manual).
- After the engine reaches operating temperature, accelerate the engine to 2000 RPM's. Check that the voltmeter on the DC Panel reads 13 to 14.5 volts for both batteries.
- Check wind, tide and current to determine the best way to maneuver your boat away from the dock. Cast off mooring lines.
- At low speed, check that gauges, indicators and alarms are normal. Check that sufficient cooling water is being discharged from the exhaust outlets on the transom.
- Shift your boat's engine into forward or reverse, depending on whether you want to move the bow or the stern away from the dock first. Your engines should be running at a slow speed as you move away from the dock.
- Once your boat is in open water, you can safely accelerate to cruising speed. Advance throttle to the setting which provides your desired engine speed (RPM's).

⚠ WARNING ⚠

Using a damaged or improper cord for shore power can cause electrical shock and serious injury. Use a cord specifically designed for shore power connection. Do not use a household extension cord.

⚠ CAUTION ⚠

Water is an excellent conductor of electricity. Keep shore power cord out of water. Do not operate any AC device while you, or the cord, are in the water. To prevent injury or equipment damage, keep all AC electric system components dry.

⚠ WARNING ⚠

DO NOT disconnect the shore power cord to the boat first. You could accidentally drop the cord into the water, which may result in electrical shock and serious personal injury.

13.4.1 Getting Ready to Sail

NOTE: This is not intended to provide a complete guide on sailing. The 'art' of managing a sailboat in all weather, tidal and day/night conditions can not be taught by reading even the best instruction book. If you are not proficient in handling sail boats, please refrain from handling this boat and obtain professional training and certificates, some of which might be required for you to navigate your boat in certain areas or countries.

1. Power into the wind.
2. Raise and/or unfurl sails, beginning with the main and then the jib.
3. Once each halyard, is tensioned by the winch, the halyard can be locked down into its respective sheet stopper and the halyard removed from the winch, freeing the winch for the next halyard or sheet.
4. However, care should be taken not to inadvertently open the rope clutches, since the sails will lower rapidly if this is done.
5. When the sails are raised, the boat can be laid off and the engine turned off.
6. Once the main is sheeted in and you are sailing upwind, confirm the main topping lift position has some slack so the main can be capable of sheeting in hard without the topping lift being tight.
7. Be sure to retighten the topping lift before lowering the main.
8. After a day of sailing, the sails should be lowered or furled in while again powering into the wind, with the jib furled in first and then by lowering or furling the main.
9. Protect your conventional mainsail by covering it with the sailcover, if applicable.

13.3.2 Tuning the Rig

If this is your initial sailing excursion, the mast should be

tuned. (Generally, tuning the mast is performed by an experienced commissioning agent.) Please refer to the Sails and Rigging section in this manual for instructions on tuning the mast.

13.9.4 Spinnaker

To fly the spinnaker, complete the following procedure:

1. Start by heading off to a square run.
2. Leave the mainsail fully out during the hoisting procedure as it will blanket the spinnaker and keep it from filling until you are ready for it to be set.
3. Raise the spinnaker from the starboard side, winching until the halyard is tight.
4. Once it is fully hoisted, slowly head up your desired course and release the furling line from both fiddle block jammers and pull in the sheet until the sail sets.
5. Make sure you have at least two turns of the sheet around the winch.

13.5 Returning to Port

After completing the day's cruise or excursion and mooring your boat, shut down the engine as follows:

1. Reduce engine speed to idle.
2. Move the throttle/shift lever to the neutral (center) position.
3. Accelerate from low speed to high speed and repeat five times. This will help clean out carbon from engine components.
4. Allow engine to run at idle for about five minutes.
5. Press the "Stop Switch" until the engine stops, followed by the "Power Switch".

Before going ashore, check the following items:

- Seawater intakes that feed the various systems (and generator) are closed
- Shore power is connected.
- Battery charger operating.
- Battery switches are positioned to OFF on the Battery Switch Panel.
- No visible leaks at the propeller shaft.

A thorough wash down of your hull, decks, and rigging with soap and fresh water will help keep your boat looking like new for years.

NOTE: See the AC Electric chapter in this manual for information on connecting the shore power, and the Water Systems chapter in this manual for information on connecting the dock side water supply.

13.6 Emergency Operations

You should always understand and be prepared to engage in emergency operations aboard your boat. The sea can be unforgiving, and you can find yourself in very bad trouble in a very short time, even if you are prepared.

Note: Do not rely on this manual to educate you in all the emergency procedures aboard your boat.

Always insure that you, and all aboard, know the outlines for emergency operations and the location of emergency equipment. Emergency drills should be developed and routinely implemented. Potential emergency situations may include flooding, explosions, man overboard accidents and fire. Review the book, Chapman Piloting and Seamanship, for assistance in planning emergency responses and the Boating Safety chapter in this manual for additional information.

Notes:

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Chapter 14

Maintenance

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Proper care and maintenance of your boat will pay dividends over time on your investment. The appearance, life and functionality of individual parts and of the whole will generally correlate to the discipline and management provided in their maintenance.

This chapter seeks to provide guidelines and procedures to properly maintain your boat. We will separate it into the following sections:

1. Tools / Parts / Materials
2. Exterior
3. Interior
4. Mechanical Components
5. Periodic Maintenance
6. Storage & Lifting
7. Fitting out After Storage

At the end of the chapter, we will offer you some maintenance tips and schedules. However, if any OEM components have recommended maintenance schedules that differ from this Operator's Manual, consider those schedules to supersede those offered here.

14.1 Tools / Parts / Materials

The following lists are the minimum items recommended to be stored and available on-board:

14.1.1 Tools

- Flashlight
- Extra batteries for flashlight
- Vise grips (small and medium)
- Needle nose pliers
- Screw and nut driver set with ratchet handle
- Multi-bladed knife
- Set of screwdrivers (phillips and flat blade, including "shorty" in both)
- Offset screwdriver (phillips and flat blade)
- Set of combination wrenches (box at one end, open end at the other)
- Set of tubing wrenches
- Wire crimping and stripping tool
- Hacksaw

14.1.2 Parts

- Engine oil (Refer to engine/generator manual)
- Antifreeze (Refer to engine/generator manual)
- Oil filters (Refer to engine/generator manual)
- Coolant pump impeller and cover plate gaskets (Refer to engine/generator manual) Spare engine hoses and clamps
- Fuel filters (Refer to engine/generator manual)
- Water pipe or hose for freshwater unions
- Pipe or hose unions
- Engine accessory belts
- Propeller and shaft (for extended cruises)

14.1.3 Materials

- Plastic marine tape
- Instant glue
- Silicone rubber
- Electrical tape
- Two-part epoxy adhesive
- Spray lubricant
- Miscellaneous fasteners

14.2 Exterior

To keep the exterior of your boat in good condition, you should follow a periodic preventive maintenance program and practice good storage habits. In this section, we offer important suggestions that will help keep your boat in the best possible condition.

14.2.1 General Care and Maintenance

Wash down. After each use, rinse the entire boat with fresh water. If the boat has been used in brackish or salt water, use a mild soap during the wash down.

Coverings. Covering your boat between uses will protect the finish from direct sunlight. Do not cover it with anything that will not allow moisture to evaporate, for example, sheet plastic.

14.2.2 Gelcoat

14.2.2.1 General Gelcoat Protection

Gear Storage. Before storing your boat, remove loose items such as cushions, towels, and similar items. Water trapped under these items can cause gelcoat discoloration and mildew.

Wax. Waxing two to four times a year is recommended. If you are in a climate where you use your boat year

round, wax your boat every three months. If you have a summer boating season, wax at the beginning of the season and before winter storage.

Waxing helps protect your boat from everyday elements. Use a wax recommended for fiberglass (gelcoat) finishes. Many automatic, over-the-counter waxes can be used. Check the product label for recommended surfaces and applications.

14.2.2.2 Gelcoat Color Fading and Yellowing

Darker colors are more prone to fading because they absorb more of the sun's ultraviolet rays. Whites and off-whites will yellow, usually on the deck radii. If the finish on your boat has started to fade or yellow, and waxing will not restore the finish, compounding with a fine grit compound and a low speed buffer may be necessary. An automotive, fine grit rubbing compound will work well in most cases. When compounding, consider the following guidelines:

- Follow the manufacturer's application instructions.
- Do not apply compound or wax in direct sunlight.
- Never place the buffer in such a manner that the pad touches the ground. The pad will pick up dirt which will cause deep scratches in the finish.
- After compounding, clean the surface with soap and water.
- Apply a good coat of wax.

14.2.2.3 Gelcoat Minor Scratches

If you have light surface scratches and rubbing compound does not remove them, wet etching may be necessary. When wet etching, consider the following guidelines:

- Clean the area with soap and water.
- During etching, try to keep the area free of dust and dirt.
- Use a 500 or 600 grit wet and dry sandpaper. Use a sanding block. Sandpaper and sanding blocks can be purchased from automotive supply stores.
- When etching, keep the surface wet. On dry surfaces, press a wet sponge above the etching area. Always keep the sanding block flat on the surface. Never use the edge or corner. Doing so will make scratches that rubbing compound will not remove.
- After completing wet etching, compound the etched area with a fine grit rubbing compound. Use a low speed (1200 – 2800 rpm) buffer. Several applications of rubbing compound will have to be applied before all the scratches are removed.
- Apply a good coat of wax.

NOTE: Sanding the gelcoat of the hull, as opposed to etching the gelcoat, will void Marlow-Hunter's bottom blister limited warranty. Contact Marlow-Hunter's Customer Service if you have questions regarding gelcoat sanding.

14.2.2.4 Gelcoat Stains

You can remove stains using a cleaner specifically made for gelcoat surfaces. Any cleaner recommended for cultured marble or fiberglass tubs and sinks will work. Most of these cleaners can be purchased at a grocery store.

If a cleaner does not remove the stain, use a fine grit rubbing compound. When compounding, consider the following guidelines:

- Apply by hand a small amount of the compound to the stain area.
- Using a cotton cloth with medium pressure, rub the compound into the stained area.
- After the stain is removed, wash the area with soap and water.
- Apply a good coat of wax.

14.2.3 Stainless Steel

Your boat hardware is made from top quality stainless steel. The mirror finish on most of your stainless hardware is produced by a series of progressive machine and hand polishing operations. It is this careful polishing that makes the stainless finish so beautiful and easy to clean and maintain.

14.2.3.1 Cleansers

We have reviewed several general stainless cleansers/polishers to determine their effectiveness in cleaning and protecting your stainless steel. Many performed acceptably when used properly, however, we recommend Collinite© # 850 Metal Wax as one of the most effective

cleaning and polishing products.

14.2.3.2 Recommended Procedures

- DO…Apply an even layer of the polishing compound onto a clean soft rag and distribute over a manageable area of the stainless surface with a soft rotational motion.
- DO…Repeat the application if some surface stains remain until all the finish is back to the original clean shiny finish.
- DO…Remove any excess polishing compound and polish out the stainless finish for a mirror shine.
- DO...Rinse thoroughly with fresh water after each cruise. Thorough rinsing can prevent a lot of the surface staining that stainless steel experiences when left in contact with salt water residue.
- DO...Dry after each use to prevent mineral deposits from building up on the surface of the finish.
- DO NOT...Scour the stainless. Scouring can damage the original finish.
- DO...Be careful using most brands of cleansers. Often they contain chemical additives which will affect the original high polish finish if left on the stainless.
- DO NOT...Use a steel wool pad to clean your stainless. If a more abrasive product is needed, use a stainless polishing paste being sure to rub in the paste with a clean rag. Steel wool pads have a tendency to break apart and small particles of steel can become embedded in the surface and will rust and will give the appearance that the stainless itself is rusting.

14.2.3.3 Chlorides

Today, chlorides are found in almost all soaps, detergents, bleaches and cleansers; chlorides can be aggressive to stainless steel. However, chlorides are very water soluble. Therefore, THOROUGH RINSING of your bright work after each use will help to keep your stainless looking bright and shiny.

14.2.2.4 Scratches

Like many metallic surfaces, your stainless steel will scratch. These are merely usage scratches and over time will blend into the overall finish. Surface scratches can be polished out with a polishing paste but this can be a lengthy and work intensive process.

14.2.4 Deck Hatches

14.2.4.1 Gaskets

Wax the rubber gaskets on all deck hatches with a carnauba wax to ensure gasket material does not stick to Plexiglass.

14.2.4.2 Acrylic and Plexiglass

DO NOT use glass cleaning sprays, scouring compounds, or solvents (such as acetone, gasoline, or thinners) to clean acrylic or Plexiglass.

Following are guidelines for cleaning acrylic and Plexiglass parts:

- Wash acrylic hatches, windows, and any other acrylic compounds with mild soap and plenty of lukewarm water.
- Use a clean, soft cloth.
- Apply only a light pressure when cleaning.
- Rinse with clear water, and blot dry with a damp cloth or chamois.

14.2.5 Windows

14.2.5.1 Port Lights

See the Acrylics and Plexiglass section above.

14.2.5.1.1 Frames

The port light window frames on your boat are made of high quality aluminum with an enamel paint or anodized surface. The frames need no maintenance other than cleaning with soap and water. Do not use abrasive or strong chemicals. These may damage the finish and allow corrosion to start. Frames should be protected with marine wax.

14.2.6 Caulking

All deck fitting, bow rails, hatches, etc, have been caulked with the highest quality material to ensure a waterproof joint with the boat. However, normal use will flex the joint and eventually break down the seal.

We recommend that all deck fittings, hatches, windows, rail, etc. be caulked periodically to prevent damaging leaks from developing.

14.2.6 Bottom Paint

We recommend an annual cleaning, stripping, and application of anti-fouling paint. Some owners may have problems with paint failure because of unusually deep penetration of the parting compound used in molding the hull. This condition is unpredictable and is not covered by warranty. Usually cleaning and paint peeling or stripping is all that is needed before recoating with a quality anti-fouling paint. Check with your dealer for recommendations about the specific paint to be used in your area.

NOTE: Sanding the gelcoat of the hull will void Marlow-Hunter's bottom blister limited warranty. Contact Marlow-Hunter's Customer Service if you have questions regarding gelcoat sanding. Non-sanding paint strippers should be used on hull paint.

14.2.7 Cockpit Teak Decking

Do not use caustic or acidic cleaners on you teak decking. This will not only degrade the decking but will void the OEM warranty. Beyond a daily wash down with plain water, it is recommended to clean weekly with a solution of water and a mild household cleaner or a sudsy ammonia. More specifically, the manufacturer has developed 2 products to safely clean and maintain your teak decking for weekly and monthly application. Check their website or the OEM manual included with your Operator's Manual.

It is not recommended to use oils on the teak decking. Teak already contains natural oils and some petroleum based oils can degrade the caulking. Additionally, oils often act as a carrier for dirt or soot to get into the pores of the wood and darken its color.

14.2.8 Sails & Rigging

14.2.8.1 Sails

UV rays are a chief cause of sail degradation. Sail covers are strongly recommended for conventional mainsails (as they are not protected as the in-mast furled mainsail). Ensure the roller furling jib is furled properly and only the protected portions of the sail are exposed to UV rays.

In addition, ensure your sails are properly set and trimmed. Properly tensioned lines will positively affect the life of your sails.

Depending on your type of sailing and frequency, an annual inspection and servicing are recommended to prolong the life of your sails. Sails should be inspected and serviced for chafe damage, rust, mildew or other impurity accumulation, stitch, fabric and hardware integrity or other possible problems, Sail lofts or other professionals are available to perform inspections and service.

If you chose to service your own sails, ensure you read, understand and follow the instructions of any cleaning product used when washing your sails. Different stains and build-ups will require different cleaning agents. Care must be taken when choosing cleaning agents to ensure they do not negatively affect your sail fabric, stitching or hardware.

NOTE: Please refer to the sail manufacturer's OEM manual for specific details and maintenance specifications.

14.2.8.2 Rigging

Without careful inspection and proper maintenance, the rigging is subject to fatigue, wear, discoloration, and therefore, product failure. Remember, regular inspection and cleaning will increase the life of your investment and secure your rigging.

14.2.8.2.1 Standing Rigging

- Always rinse your rigging with fresh water after sailing, especially salt-water sailing. Salt can create corrosion pits, causing cracks and deterioration.
- Clean with a water-soluble chlorine-free detergent. Nonabrasive cleansers are best for hard white vinyl coated cables.
- Inspect rigging for stains. Rust stains may indicate stress cracks or corrosion. Remove stains with synthetic or brass pads. Never use steel wool pads.
- Look for broken wires- a sign of fatigue in rigging. Replace standing rigging if wires are broken.
- Never mix stainless steel and galvanized metals on cable, fittings, pins, cotter keys, etc. If mixing dissimilar metals, electric currents may conduct between metal causing rapid deterioration

Remember that rigging, like everything else, can age. As

it gets older, it may need to be replaced. The frequency for which this becomes necessary depends on your maintenance and the climate and conditions in which the boat is sailed. For example: If you sail in the Caribbean, it should be replaced every 3-4 years compared to every 10 years for the Great Lakes. You should consult a professional rigger for advice.

14.2.8.2.2 Running Rigging

Running rigging should be periodically inspected for line degradation and replaced as needed.

14.2.8.2.3 Mast and Boom

With regard to the mast and boom, a few maintenance procedures should be implemented. The boom traveler car should be regularly rinsed with mild detergent and fresh water. The top and bottom of the roller furler mechanism in the furling mast should be regularly washed, rinsed and lubricated. Additionally the roller furling line should be annually inspected and replaced as needed.

NOTE: Please refer to the rig manufacturer's OEM manual for specific details and maintenance specifications.

14.2.8.2.4 Roller Furling Jib

The roller furling jib assembly should also be annually inspected. The lower bearing and halyard swivel should be annually lubricated in specific locations as outlined in the manufacturer's OEM manual. The entire assembly can be washed with a mild detergent and rinsed with fresh water.

NOTE: Please refer to the rig manufacturer's OEM manual for specific details and maintenance specifications.

14.2.9 Keel

The keel bolt nuts (Fig. 14.2) should be checked periodically to re-adjust for any thread slippage. At a minimum, the nuts should be checked before the initial launch of each new sailing season. Access to the keel nuts is through the main bilge floor panel in the main salon. Adjustments musts be made with deep sockets, sizeable torque wrench and long extension bar. Please refer to Figure 14.1 keel nut torque specs.

Bolt Size (In.)	Nut Torque (Ft/Lbs.)
3/8	21
1/2	45
5/8	97
3/4	132
1	325
1 1/4	546

Figure 14.1

Figure 14.2

Removal, installation and nut adjustments of the keel should be performed by trained and competent professionals.

14.2.10 Repairs

In the event materials or specialized tools are required to repair your boat, contact your dealer or Marlow-Hunter for input or assistance in securing those items.

14.3 Interior

You can generally clean the surfaces of interior components with a mild cleaner such as Fantastic. Avoid using harsh or abrasive cleaners. Use approved marine sanitary treatment chemicals to control the odor in the toilet and holding tank.

14.3.1 Walls

14.3.1.1 Wood

The wood used in your boat is treated at the factory with a multi-coat finish process. To maintain the finish, use a high grade of furniture polish.

14.3.1.2 Fabric

Some walls on your boat have been crafted with a non-backed fabric material producing a gentler more pleasing appearance. Cleaning this material simply includes using a mild soapy water or 50/50 solution of water and white vinegar to clean water-soluble stains on these surfaces. Water soluble stains can include drinks such as soft drinks, coffee, etc. Clean by blotting rather than rubbing.

Use a citrus based cleaner to remove non water-soluble stains such as grease or oil. Again, clean by blotting from the outside toward the center.

14.3.1.3 **Hull**-liner

See the Fabric section above.

14.3.2 Ceilings

Your ceilings will be either a fiberglass headliner or a pocketed network of a soft fabric material similar but distinct from the hull-liner, referred to as Whisper.

14.3.2.1 Fiberglass Headliner

Use a mild soapy water or 50/50 solution of water and white vinegar to clean water-soluble stains on these surfaces. Water soluble stains can include drinks such as soft drinks, coffee, etc. Clean by blotting rather than rubbing.

Use a citrus based cleaner, acetone or other similar solvent to remove non water-soluble stains such as grease or oil. Again, clean by blotting from the outside toward the center.

14.3.2.2 Whisper

See the Fabric section above.

14.3.3 Floors

Maintain your hard wood floors using a soft dust attracting and trapping fabric such as a Swifter. Use furniture polish to clean water and non-water-soluble stains.

14.3.4 Dinette Table

Clean your dinette table with a mild soap and water solution or general purpose cleaner.

14.3.5 Cushions / Covers

14.3.5.1 Mattress Cover

Periodically dry clean the mattress cover as appropriate.

14.3.5.2 Leather Cushions

See the Fabric section above.

14.3.5.2 Fabric Cushions

See the Fabric section above. These cushions have a zippered back to allow the foam to be removed. These covers can be machine washed from time to time using a gentle cold-water cycle with mild detergent. Hang dry; do not machine dry.

14.3.6 Shades

See the Fabric section above.

14.3.7 Shower Grate

See the Cockpit Teak Decking section above.

14.3.9 Bilges

The bilges are finished with a high quality gelcoat which is easy to keep clean. Several brands of bilge cleaners will dissolve dirt and grime, but will not harm the environment when pumped overboard. If you keep the bilge clean, it is much easier to identify leaks or other problems if they should develop.

IMPORTANT: The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into or upon navigable waters in the United States. Violators are subject to a penalty.

14.3.10 Light Bulbs

14.3.11 Repairs

In the event materials or specialized tools are required to repair your boat, contact your dealer or Marlow-Hunter for input or assistance in securing those items.

14.4 Mechanical Systems and Components

Refer to the OEM manuals supplied by the boat component manufacturers for their recommended periodic maintenance. These manuals may indicate maintenance requirements beyond the minimum maintenance tasks listed in the maintenance charts located in the back of this chapter.

NOTE: In case of conflicts between the maintenance information in this manual and the manuals supplied by the equipment manufacturer, the equipment OEM manuals take precedence.

14.4.1 Engine Oil

See the engine/generator's manufacturer's manual for recommended oils and correct procedures for checking and replenishing oil.

14.4.2 Engine Coolant

See the engine/generator manufacturer's manual for recommended coolants and correct procedures for checking and adding coolant.

⚠ WARNING ⚠

Hot coolant under pressure may boil over and cause burns or other serious injury when cap is removed. Allow engine to cool. Open pressure cap slowly to allow pressure to vent before removing cap.

14.4.3 Engine Exhaust

Visually inspect the engine and generator exhaust systems (hoses, joints, manifolds, etc.) for leaks. Make sure all clamps are tight. Check hoses and exhaust boxes for damage. Replace any damaged exhaust system component.

NOTE: Any discoloration around a joint or gasket usually indicates a leak.

14.4.4 Fuel Filter

Check all fuel filters daily to remove all sediment and water from the filter. Inspect the canister for possible corrosion or deterioration. Replace canister if you observe any corrosion or other deterioration.

Replace the filter element at least once each season, more often if there is contamination of the fuel system. Always replace the bowl gasket each time the filter is reassembled. Check carefully for any signs of leakage.

14.4.5 Fuel Line Connections

Check all fuel line connections for leaks at least once a year. Tighten as necessary.

IMPORTANT: Be careful when tightening fittings. Over-tightening can crack the flair fittings and flair nuts. Use only tube wrenches when tightening connections.

14.4.6 Batteries

⚠ WARNING ⚠

If using lead-acid batteries, avoid spilling battery electrolyte into the engine compartment or bilge. Also, avoid getting saltwater on or in the battery. Either condition can create a gas that is explosive and poisonous if inhaled. If you spill electrolyte, ventilate the area. Neutralize the acid in the electrolyte with baking soda. Clean up neutralized electrolyte with a disposable rag or paper towel.
We recommend you use Gel type batteries.

Although the batteries are relatively maintenance free, some simple routine maintenance can increase the effectiveness and life.

- Keep the batteries fully charged. Batteries kept fully charged last longer than batteries kept at a partial charge.
- If using lead-acid batteries, check the level of the electrolyte regularly. Correct level is just above the plates. Add distilled water only if necessary. Over-filling can cause poor performance and early failure.
- Check the battery every 30 days. Keep the top of the battery clean. When necessary, clean the top of the battery with a baking soda solution and rinse with fresh water.

IMPORTANT: To prevent battery failure, do not allow the soda solution to enter the battery cells.

- Inspect the cables and clamps regularly.
- Remove the battery cables and clean the battery terminals and posts regularly. Use a wire brush or bronze wool.

- After re-connecting the terminals, apply a coating of grease or petroleum jelly (Vaseline) to protect them against corrosion.

IMPORTANT: Before cleaning the batteries, disconnect and remove them from the boat.

- Replace corroded or damaged parts immediately.
- Remove the batteries from the boat during periods of extended storage. Store the batteries in a cool (above freezing), dry area.

All batteries lose some charge during storage, but the loss of charge is proportional to the temperature. The lower the temperature, the less charge is lost. Avoid storing the batteries in a humid area. Humidity will lead to corrosion of the terminals.

14.4.7 Shore Power Cable Care

⚠ WARNING ⚠

Electrical shock can cause injury or death. Before working on electrical system, disconnect all power sources. Inform others to prevent accidental re-connection of electrical service. All voltages above 12 volts are dangerous. Performing maintenance while connected to shore power can cause electrical shock. Disconnect cord before performing maintenance.

Clean the cable with a grease cutting household detergent. Apply a vinyl protector periodically.

The metallic parts of the cable are corrosion resistant. You can, however, increase the life of the cable in a salt water environment by wiping the exposed parts with fresh water. Then, dry them and spray them with a moisture repellent.

If the cable is dropped into salt water, rinse the plug and connector end thoroughly in fresh water. Then shake or blow off excess water and allow cable to dry. Spray plug and connector with a moisture repellent before you use the cable again.

14.4.8 Windlass Maintenance

Periodically check the motor and control box electrical connections. Remove any residue and cover connections with a small coating of grease.

It is recommended that you annually disassemble the windlass and remove any residue buildup. To perform this maintenance follow all safety procedures and complete the instructions listed in the windlass OEM manual.

1. Using the emergency handle, unscrew and remove the clutch nut and gypsy cone.
2. Unscrew and remove the stripper arm. Pull control are back to clear gypsy and remove gypsy assembly from the drive shaft.
3. Wash down with water to remove any residue.
4. Coat surfaces with a light film of lubricant.
5. Reassemble the unit and tighten the clutch by turning the handle clockwise.

NOTE: Consult the windlass manufacturer's OEM manual for further details regarding operation, care and maintenance.

⚠ DANGER ⚠

Ensure power is off before performing work or maintenance on the windlass.

14.4.9 Electrical System Connections

At least once each year, disconnect electrical connectors in the bilge, engine, and upper control panels. Check the terminals for corrosive buildup. Have your dealer repair connectors and terminals if they are corroded.

14.5 Periodic Maintenance

Proper and timely maintenance is the best insurance for trouble free and enjoyable boating. Please refer to the maintenance charts located in the back of this chapter to help identify maintenance tasks and their frequency. Use the charts as a checklist.

Remember to check your OEM manuals to understand the recommended periodic maintenance and procedures for their products. OEM period maintenance guidelines will take precedence over the minimum guidelines suggested in this manual.

14.5.1 20 Hours of Operation

Following the first 20 hours of operation, complete the maintenance items listed below:

- Check rudder lip seal for leaks (no leaks at all).
- Check all through hull fittings for leaks.
- Check all doors and cabinets for proper fit and operation.
- Tighten all engine mounts.
- Complete engine/generator maintenance as recommended by engine/generator manufacturer.
- Tighten all hose clamps and lubricate them.
- Check and tighten all pressurized water system fittings.
- Check and service batteries, tighten battery connections, and lubricate as needed.

14.5.2 Zinc Maintenance

Generally, sacrificial anode maintenance consists of a minimum annual replacement of the zincs. This should be completed during the spring launch procedure for example. The anodes may require more frequent replacement, depending on your docking location and the length of your boating season. If possible, check the anodes for excessive corrosion midway through your boating season. If excessive corrosion is noted, have your dealer or a competent technician replace the sacrificial zinc anode.

14.5.2.1 Sail Drive Leg

The sacrificial anode should be replaced:

1. every 100 hours of use
2. every 6 months
3. if the anode had degraded to half its original size

Inspection and replacement requires the boat to be out of the water.

14.6 Storage and Lifting

In most cases, the reason for storage is winter lay up. A competent boat yard should prepare your boat for winter storage. If you are removing your boat from the water for another reason, use the information in this section as a basic guideline. Following the procedures in this section will help to extend the life of your boat and its equipment and simplifies re-commencing in the spring.

Indoor storage is beneficial if you are storing your boat in a climate that produces ice and snow. However, the storage building should be adequately ventilated, not tightly closed. Ventilation, both around and throughout the boat, is very important.

If you use outdoor storage facilities, cover your boat with a canvas cover with provisions for ventilation to keep the boat from “sweating.” Building a frame over the boat to support the canvas will allow the passage of air around the boat. The frame should be a few inches wider than the boat so the canvas will clear the rails.

Before preparing your boat for winter storage, check the condition of the boat and its systems and equipment. Note any repairs needed. The need for other repairs may become apparent during winterization. Make arrangements to have the repairs completed.

14.6.1 Disassemble the Rigging

The rigging should be disassembled as per the manufacturer’s instructions noted in the OEM manual (reverse the assembly instructions). Once disassembled, the sails should be stored dry and free of salt, folded but without wrinkles. The mast and boom should be stored dry or covered with sufficient supports to minimize any deflection. The jib furler assembly should be stored near the other rigging with the center supported to protect the luff extrusion (long center rod).

14.6.2 Lifting Your Boat

Following are guidelines which will help prevent damage to your boat as it is being lifted.

- Never hoist the boat with a greater than normal accumulation of water in the bilge. Fuel and water tanks should be empty.
- Place slings where indicated by the Sling stickers on the gunwale (Fig. 14.3). Proper location of the slings is critical. Lifting at locations other than designated by the Sling stickers may cause damage to the boat. The labeled locations are optimal for balanced lift with the structural integrity for the full distributed weight. Damage caused by improperly placed straps is not

covered by the limited warranty.

- Use flat, wide slings made of belting and spreader bars long enough to keep pressure off the gunwale. Do not use cable slings. Pressure by the slings on the gunwale can cause severe gelcoat crazing or more serious hull damage.
- The spreader bar at each sling should be as long as the distance across the widest point the sling surrounds.
- Weight should be primarily distributed along the keel. If a marine railway or platform is used, locate and adjust the blocking to distribute the weight over several areas at the intersection of stringers and bulkheads. The bunks and/or blocks should match deadrise angle and provide adequate support and stability.
- When lifting the boat, keep the bow higher than the stern so the exhaust lines can drain. This will keep water from running forward through the manifold and into the engine itself where the water can become trapped.

NOTE: Keep the bow higher than the stern every time the boat is lifted. Do not lift the stern to change a propeller. Doing so can cause water to enter the engine. Engine failure is possible if water enters the engine cylinders. This water can cause hydrolock and bend the piston rods. Even a small amount of water can cause rust or other damage.

14.6.3 Preparing for Storage

- Clean, scrub, and sponge the hull and deck as soon as the boat is pulled from the water and is still in the sling. Cleaning marine growth from the hull is easier when it is still wet.
- Clean the inside of all hull openings, thru hull fittings, and screens. Inspect the hull and underwater gear for signs of wear, deterioration, or damage. Note any damage to the propulsion equipment, helm area, cabin, etc. Make repairs, if at all possible, before covering your boat.
- Fill the fuel tanks with treated fuel to prevent condensation. If you use a stabilizer or conditioner, be sure to follow the instructions on the container.

IMPORTANT: Do not overfill fuel tanks so fuel flows from the vent. Allow room in the tanks for fuel to expand.

Prepare the Engines for Storage:

- In areas where temperatures fall below freezing, the bilge area under the engines must be pumped out and sponged completely dry. Check for areas that did not drain to the pumps. Drain mufflers.

NOTE: Refer to the engine owner's manual for winterization and storage procedures (i.e. water drainage from the engine block, etc.).

Prepare the Batteries for Storage:

- Be sure main battery switch breakers are off.
- Remove batteries from boat and store in area where temperatures remain above freezing.
- Place batteries on a wooden pallet or bench.
- Keep batteries charged. Check electrolyte levels regularly. Add electrolyte if needed.

Prepare Holding Tank for Storage:

- Empty and rinse holding tank until tank is clean.
- Close head intake valve and remove hose.
- Pour the nontoxic antifreeze into the head and keep flushing the head until the antifreeze reaches the holding tank.

Prepare the Fresh Water System for Storage:

- Remove the fresh water supply by opening the hot and cold faucets in the galley for 10 minute intervals. Repeat until the fresh water tank is empty.
- Open all faucets in the galley, shower, cockpit shower, etc.
- Drain the water heater. Disconnect lines from the engine heat exchanger. Drain exchanger and lines.
- Remove hot and cold water lines and hook them together.
- Remove inlet hose from tank and insert it into a container of nontoxic antifreeze. Turn pump on. Starting at faucet furthest from pump, open all faucets until antifreeze flows out.
- Turn off pump and reconnect hose to water heater and pump.

Prepare Interior of Boat for Storage:

- To keep mildew from forming, remove all items that will hold moisture (PFD's, towels, blankets, clothing, canvas, etc.).
- Make sure all garbage is removed.
- Clean the inside of the boat. Clean cabinets, drawers, cupboards, storage areas and all surfaces. Allow cabin area to dry and air for at least one day if possible.
- Stand or prop up mattresses and cushions remaining on board to allow good air circulation around them. Hang life preserver and other equipment to prevent mildew.
- Remove any detachable and valuable equipment and electronics.

Prepare Exterior of Boat for Storage:

- Apply at least one coat of anti-fouling paint. Surface preparation will depend on the status of your bottom paint. Follow the paint manufacturer's recommended procedures for preparation and application.

NOTE: This coat of paint must be applied during winterization or before the beginning of a new boating season. Check with your dealer for information about the paint you should use.

- Apply a coat of wax to the entire boat. Put rust inhibitor on all metal parts.
- Cover the boat with a tarpaulin or mooring cover. If the boat is stored outside, you may need to place supports under the cover to shore up pockets where rain or snow can collect.

14.6.4 Draining Your Boat

Your boat has bilge pumps for draining water from the bilges. Some compartments in the bilge may not drain completely because of the position of the boat. Pump these compartments out then use a sponge to remove all remaining water.

Refer to the previous section "Prepare the Fresh Water System for Storage" for draining and winterizing the fresh water system.

14.6.5 Supporting Your Boat During Storage

A cradle is the ideal support for your boat whenever it is not in the water. Properly designed and located, the cradle will support the boat under the main frames preventing damage to the hull.

If a cradle is not available, the boat may be supported on two or three timbers across a boat well or on another firm footing substantial enough to keep the boat level. The timbers and the foundation must be substantial enough to prevent any change in shape while supporting the boat during storage. The weight carried by the supports should be evenly divided, the keel should carry a share of it.

Store the boat with the bow up so any accumulation of moisture will run off.

14.7 Fitting out after Storage

Refer to the Documents and Forms chapter of this manual for more complete item checklists for the various stages of boat preparation and usage. The following subset lists are an extrapolation of some of those items.

If the hull was not painted during winterizing, prep and paint the hull bottom before removing the boat from its cradle. Follow the paint manufacturer's recommended procedures for preparation and application.

Before launching your boat, do not load unneeded equipment, furniture, and personal items until the launch and final checkout are complete.

14.7.1 Pre-Launch Checkout

Before placing your boat in the water, check and perform the following:

- Check all anchor lines and gear and replace, if necessary.
- Check all thru hull fittings to make sure they are clean. Check all thru-hull hardware for damage and tightness. Repair or adjust as needed.
- Check propeller and the drive leg for proper installation and tightness. Clean propeller. Check the sacrificial anodes on the drive leg.
- Check keel bolt nuts for specified tightness
- Clean battery terminal posts and cable terminals with a wire brush or bronze wool. Install batteries and

attach cables. After cable posts are tightened down, coat posts with oil or Vaseline to keep out air and acid. Check all wiring connections and contacts for corrosion and tightness.

- Check all intake valves for easy operation. Check the condition of all hoses.
- Check operation of bilge pumps in manual and automatic modes. Check operation of shower sump pump.
- Check engine compartment blower for proper operation.
- Check operation of all DC circuits.
- Launch your boat.
- Flush entire freshwater system thoroughly.

14.7.2 Post Launch Checkout

After launching your boat, check the following:

- Check all sources of possible leaks from bow to stern. Make this check with boat fully in the water, but still in the slings!
- Check the engine following the procedures described in the engine manufacturer's OEM manuals.
- Completely check the entire exhaust system for the engine. Make sure all exhaust systems are gas tight. If exhaust openings were plugged or covered during storage, remove blockage.

Routine Maintenance					
Item	**Daily**	**75hr**	**250hr**	**Yearly**	
Diesel Engine					
Check Exhaust system for leaks	X	X	X	X	
Check for loose or damaged parts	X	X	X	X	
Check fuel system line for leaks	X	X	X	X	
Drain water and sediment from primary fuel filter	X	X	X	X	
Drain water from fuel separator				X	
Clean or replace air cleaner elements			X		
Check oil level	X	X	X	X	
Check oil and filters			X		
Check cooling system for leaks	X	X	X	X	
Check zinc anodes					4 times/year
Tighten engine mounts				X	
Lubricate shifter cables				X	
Transmissions					
Check transmission fluid level	X	X	X	X	
Underwater Gear					
Check rudder and shaft				X	
Check propeller for dents or gouges				X	
Miscellaneous					
Check automatic pumps for operation	X	X	X	X	
Check caulking on deck hardware				X	
Check electrical connections for corrosion				X	
Check bottom paint				X	
Wax deck to maintain sheen				X	
Item	**Daily**	**75hr**	**250hr**	**Yearly**	

Check and service batteries				X	
Lubricate terminals				X	
Routine Maintenance					
Item	**Daily**	**75hr**	**250hr**	**Yearly**	
Tighten all pressurized water system fittings				X	
Item	**Daily**	**25hr**	**75hr**	**250hr**	**Yearly**
Miscellaneous					
Halon Fire Extinguishers	X	X	X	X	X
Check battery electrolyte level	X	X	X	X	X
Check raw water strainers (generator, AC unit)	X	X	X	X	X

SLING LOCATIONS

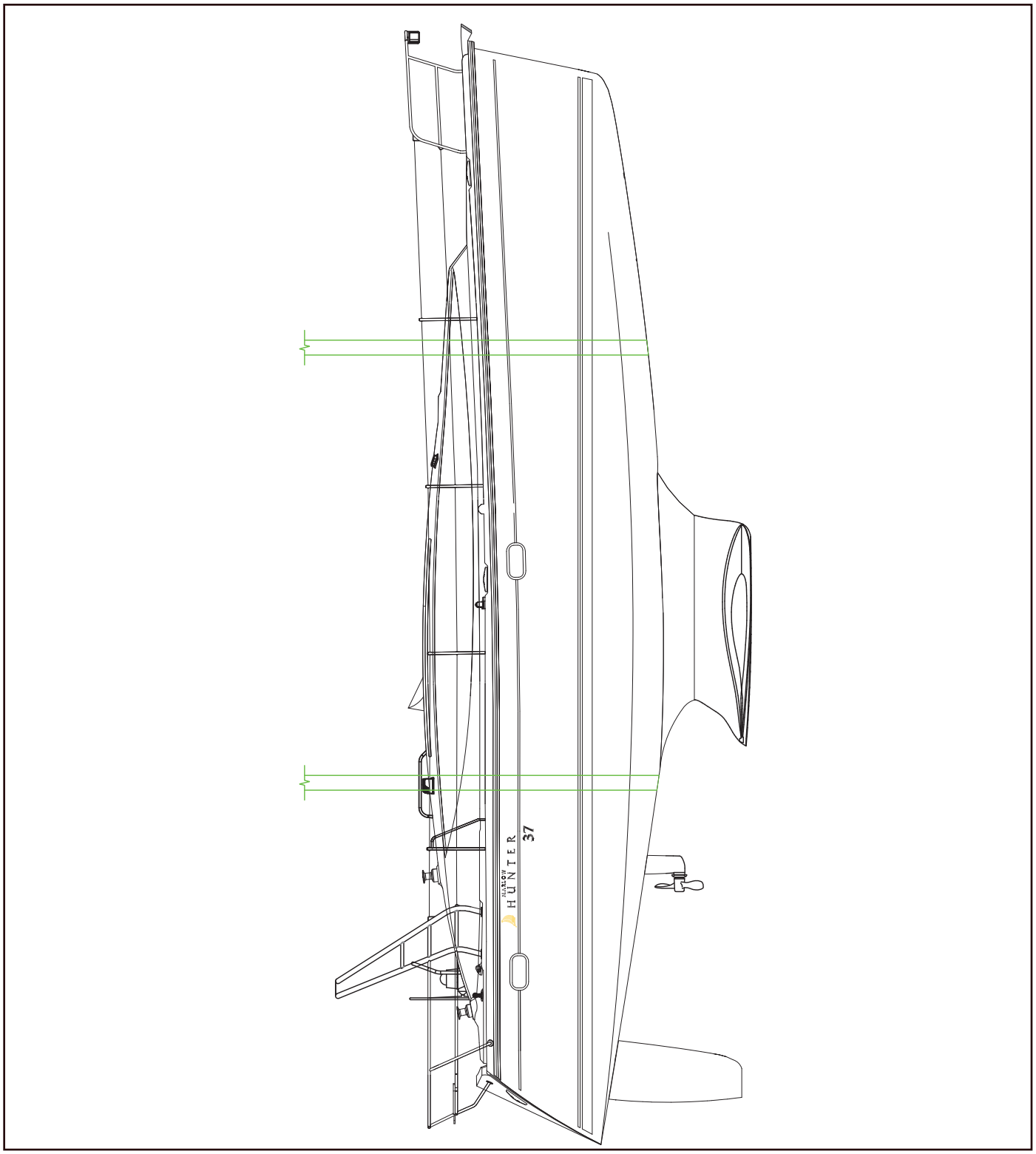

Figure 14.3

Notes:

MARLOW-HUNTER, LLC

Chapter 15

Glossary

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NMMA CERTIFIED Using ABYC Standards

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Aback: Describes a sail when the wind strikes it on the lee side.

Abaft: Toward the rear of the boat, behind the boat.

Abeam: At a right angle to the length of the boat.

Abreast: Off the side, even with the boat.

Admiralty law: The “law of the sea”.

Adrift: Floating free with the currents and tide, not under control.

Aft, After: Toward the stern (rear) of the boat.

Aground: When a boat is in water too shallow for it to float in, i.e: the boat’s bottom is resting on the ground.

Aid to navigation: Any fixed object that a navigator may use to find his position, such as permanent land or sea markers, buoys, radio beacons, and lighthouses.

Amidships: The center of the boat, athwartships and fore and aft.

Anchor: (1) a heavy metal object designed such that its weight and shape will help to hold a boat in its position when lowered to the sea bottom on a rode or chain. (2) The act of using an anchor.

Anchor locker: A locker used to store the anchor rode and anchor.

Anchor windlass: A windlass used to assist when raising the anchor.

Anchorage: A place where a boat anchors, usually an established and marked area.

Anemometer: A device that measures wind velocity.

Anti-fouling: A poisonous paint compound used to protect the underwater part of a hull from marine growths.

Apparent wind: The direction and speed of the wind felt by the crew. It is a combination of true wind and that created by the movement of the boat.

Astern: Toward the stern of a vessel, or behind the boat; to go astern is to drive the boat in reverse.

Athwart, Athwartships: Lying along the ship’s width, at right angles to the vessel’s centerline.

Auxiliary: A second method of propelling a vessel. On a sailboat this could be an engine.

Aweigh: To raise an anchor off the bottom.

Back a sail: To sheet it to windward so that the wind fills on the side that is normally to leeward.

Backing (wind): The changing of the wind direction, opposite of veering. Clockwise in the southern hemisphere, counter-clockwise in the northern hemisphere.

Back-splice: A method of weaving the end of a rope to keep it from unraveling.

Backstay: A stay that supports the mast from aft and prevents its forward movement.

Bail: To remove water from a boat, as with a bucket or a pump.

Ballast: Weight at the bottom of the boat to help keep it stable. Ballast can be placed inside the hull of the boat or externally in a keel.

Ballast keel: A mass of ballast bolted to the keel to increase stability and prevent a keel boat from capsizing.

Bar: A region of shallow water usually made of sand or mud.

Batten: A light, flexible strip fed into a batten pocket at the leech of the sail to support the roach.

Beam: 1, the maximum breadth of a boat; 2, a transverse member that supports the deck; 3, on the beam means that an object is at right angles to the centerline.

Bear away, bear off: To fall off. A boat falls off the wind when it points its bow further from the eye of the wind. The opposite of heading up.

Beat: To sail a zigzag course towards the wind, close-hauled on alternate tacks.

Beaufort wind scale: Used to gauge wind speed using observations of the winds effects on trees and other objects.

Belay: To make fast a rope around a cleat, usually with a figure-of-eight knot.

Bend: 1, to secure a sail to a spar before hoisting; 2, to moor a boat; 3, a sleeping place on board.

Berth: (1) a place for a person to sleep. (2) a place where the ship can be secured. (3) a safe and cautious distance, such as "We gave the shark a wide berth."

Bight: A bend or loop in a rope.

Bilge: The lower, round part inside the hull where the water collects.

Binnacle: The mount for the compass, usually located on the wheel's pedestal.

Bitt: A sturdy post mounted on the bow or stern to which anchor or mooring lines may be attached.

Bitter end: The end of a line. Also the end of the anchor rode attached to the boat.

Block: One or more wheels with grooves in them (pulleys) designed to carry a line and change the direction of its travel. A housing around the wheel allows the block to be connected to a spar, or another line. Lines used with a block are known as tackle.

Block and tackle: A combination of one or more blocks and the associated tackle necessary to give a mechanical advantage. Useful for lifting heavy loads.

Boatswain: Also bosun, bos'n, bo's'n, and bo'sun, all of which are pronounced bosun. A crew member responsible for keeping the hull, rigging and sails in repair.

Boot-topping: A narrow colored stripe painted between the bottom paint and the topside enamel.

Bottlescrew: See Rigging screw.

Bow: The front of the boat.

Bowline: A knot used to make a loop in a line. Easily untied, it is simple and strong. The bowline is used to tie sheets to sails.

Breakers: A wave that approaches shallow water, causing the wave height to exceed the depth of the water it is in, in effect tripping it. The wave changes from a smooth surge in the water to a cresting wave with water tumbling down the front of it.

Bridge: The room from which a ship is controlled. On a smaller boat this is usually not a room, is outside, and is known as a cockpit.

Broach: When a boat running downwind slews broadside to the wind and heels dangerously. It is caused by heavy following seas or helmsman's error.

Broaching: The unplanned turning of a vessel to expose its side to the oncoming waves. In heavy seas this could cause the boat to be knocked down.

Broad reach: The point of sailing between a beam reach and a run, when the wind blows over a quarter.

Bulkhead: An interior wall in a vessel. Sometimes bulkheads are also watertight, adding to the vessel's safety.

Cabin: A room inside a boat.

Camber: The curvature of an object such as a sail, keel or deck. Usually used when referring to an objects aerodynamic or hydrodynamic properties.

Can buoy: A cylindrical buoy painted green and having an odd number used in the United States as a navigational aid. At night they may have a green light. Green buoys should be kept on the left side when returning from a larger body of water to a smaller one.

Captain: The person who is in charge of a vessel and legally responsible for it and its occupants.

Cardinal points: The points of North, South, East and West as marked on a compass rose.

Caulk: To make the seams between wooden planks watertight by filling with cotton, oakum or a compound.

Cavitation: The formation of a vacuum around a propeller, causing a loss in efficiency.

Celestial navigation: A method of using the stars, sun and moon to determine one's position. Position is determined by measuring the apparent altitude of one of these objects above the horizon using a sextant and recording the times of these sightings with an accurate clock. That information is then used with tables in the Nautical Almanac to determine one's position.

Center line: The imaginary line running from bow to stern along the middle of the boat.

Center of effort (COE): The point at which all the forces acting on the sails are concentrated.

Center of lateral resistance (CLR): The underwater center of pressure about which a boat pivots when changing course.

Centerboard: A board lowered through a slot in the keel to reduce leeway.

Chain pawl: A short lug which drops into a toothed rack to prevent the anchor chain running back.

Chain plate: A metal plate bolted to the boat to which the shrouds or backstays are attached.

Channel: A navigable route on a waterway, usually marked by buoys. Channels are similar to roads where the water is known to be deep enough for ships or boats to sail without running aground.

Chart datum: Reference level on a chart below which the tide is unlikely to fall. Soundings are given below chart datum. The datum level varies according to country and area.

Chart table: A table designated as the area in the boat where the navigator will study charts and plot courses.

Chine: The location where the deck joins the hull of the boat.

Chop: Small, steep disorderly waves.

Cleat: A wooden, metal or plastic fitting around which rope is secured.

Clevis pin: A locking pin through which a split ring is passed to prevent accidental withdraw.

Clew: The after, lower center of a sail where the foot and leech meet.

Close reach: The point of sailing between close-hauled and a beam reach, when the wind blows forward of the beam.

Close-hauled: The point of sailing closest to the wind; see also beat.

Close-winded: Describes a boat able to sail very close to the wind.

Coaming: The raised structure surrounding a hatch, cockpit, etc., which prevents water entering.

Compass course: The course as read on a compass. The compass course has added the magnetic deviation and the magnetic variation to the true course.

Compass rose: A circle on a chart indicating the direction of geographic north and sometimes also magnetic north. Charts usually have more that one compass rose. In that case the compass rose nearest to the object being plotted should be used as the geographic directions and magnetic variations may change slightly in different places on the chart.

Coordinated Universal Time (UTC): The international time standard. It is the current term for what was commonly referred to as Greenwich Meridian Time (GMT). Zero (0) hours UTC is midnight in Greenwich England, which lies on the zero longitudinal meridian. Universal time is based on a 24 hour clock, therefore, afternoon hours such as 4 p.m. UTC are expressed as 16:00 UTC (sixteen hours, zero minutes). Since a day is 24 hours long, the world may be split into 15 degree wide longitudinal bands (360 degrees/24 hours). Each band represents one hour. As an example, Huntsville Alabama is located at approximately 90 degrees west longitude, hence, local time lags UTC time by 6 hours (90/15, assuming Central Standard Time, 5 hours in Central Daylight Time). So, if the universal time is 14:30 UTC, United States Central Standard Time would be 8:30 am CST. <http://www.ghcc.msfc.nasa.gov/utc.html>

Cotter pin: Soft, metal pin folded back on itself to form an eye.

Course: The direction in which a vessel is steered, usually given in degrees; true, magnetic or compass.

Cringle: 1, a rope loop, found at either end of a line of reef points; 2, an eye in a sail.

Current: The movement of water, due to tides, river movement and circular currents caused by the motion of the earth.

Davit: A device that projects beyond the side of the boat to raise objects from the water. Typically a single davit is used on the bow of a vessel to raise an anchor, and a pair are used on the side or stern of the vessel to raise a dinghy.

Dead ahead: A position directly in front of the vessel.

Dead reckoning: A method of determining position by making an educated guess based on last known position, speed and currents.

Dead run: Running with the wind blowing exactly aft, in line with the center-line.

Deckhead: The underside of the deck, viewed from below (the ceiling).

Depth sounder: An instrument that uses sound waves to measure the distance to the seafloor.

Deviation: The difference between the direction indicated by the compass needle and the magnetic meridian; caused by object aboard.

Displacement: The weight of a boat measured as a the weight of the amount of water it displaces. A boat displaces an amount of water equal to the weight of the boat, so the boat's displacement and weight are identical.

Displacement speed: Also hull speed. The theoretical speed that a boat can travel without planing, based on the shape of its hull. This speed is 1.34 times the length of a boat at its waterline. Since most monohull sailboats cannot exceed their hull speed, longer boats are faster.

Distance made good: The distance traveled after correction for current, leeway and other errors that may not have been included in the original distance measurement.

Downhaul: A rope fitted to pull down a sail or spar.

Downwind: In the direction the wind is blowing.

Draft: The vertical distance from the waterline to the lowest point of the keel.

Drag: 1, an anchor drags when it fails to hole; 2, the force of wind on the sails, or water on the hull, which impedes the boat's progress.

Drift: 1, to float with the current or wind; 2, US the speed of a current (rate UK); 3, UK: the distance a boat is carried by a current in a given time.

Drogue: A sea anchor put over the stern of a boat or life raft to retard drift.

Drop keel: A retractable keel which can be drawn into the hull, when entering shallow waters and recovering on to a trailer.

Echo-sounder: An electrical depth sounder that uses sound echoes to determine water depth. It does so by timing how long it takes a sound pulse to leave the instrument travel to the seafloor and return to the receiver on the ship.

Eye of the wind: Direction from which the true wind blows.

Fair: Well-faired line or surface is smoother with no bumps, hollows or abrupt changes in directions.

Fairlead: A fitting through which a line is run to alter the lead of the line.

Fall off: Also bear away or bear off. A boat falls off the wind when it points its bow farther from the eye of the wind. The opposite of heading up.

Fathom: The measurement used for depths of water and lengths or rope. 1 fathom = 6 ft. or 1.83m.

Fetch: The distance that wind and seas (waves) can travel toward land without being blocked. In areas without obstructions the wind and seas can build to great strength, but in areas such as sheltered coves and harbors the wind and seas can be quite calm.

Fid: A tapered tool used for splicing heavy rope and for sail-making, often hollow.

Fiddle: A raised border for a cabin table, chart table etc., to prevent objects falling off when the boat heels.

Fix: The position of the vessel as plotted from two or more position lines.

Flotsam: Debris floating on the water surface.

Following sea: Sea with waves approaching from the stern of the boat.

Fore: Toward the bow (front) of the vessel.

Forecastle: Also fo'c'sle or fo'csle. Pronounced fo'csle. The most forward below decks area of a vessel.

Forestay: The foremost stay, running from the masthead to the stemhead, to which the headsail is hanked.

Freeboard: Vertical distance between the waterline and the top of the deck.

Gale: A storm with a wind speed between 34 to 40 knots.

Galley: The kitchen area on a boat.

Genoa: A large headsail, in various sizes, which overlaps the mainsail and is hoisted in light to fresh winds on all points of sailing.

Gimbals: Two concentric rings, pivoted at right angles, which keeps objects horizontal despite the boat's motion, e. g. compass and cooker.

Global Positioning System: GPS for short. A system of satellites that allows one's position to be calculated with great accuracy by the use of an electronic receiver.

Go about: To turn the boat through the eye of the wind to change tack.

Gooseneck: The fitting attaching the boom to the mast, allowing it to move in all directions.

Goosewing: To boom-out the headsail to windward on a run by using a whisker pole to hold the sail on the opposite side to the mainsail.

Great circle route: A course that is the shortest distance between two points; the center of a great circle is the center of the earth.

Greenwich Meridian Time (GMT): A time standard that is not affected by time zones or seasons. Now called Coordinated Universal Time (UTC).

Ground swells: Swells that become shorter and steeper as they approach the shore due to shallow water.

Ground tackle: General term used for anchoring gear.

Guard rail: A metal rail fitted around the boat to prevent the crew falling overboard.

Gudgeon: A rudder fitting. It is the eye into which the pintle fits.

Guy: A steadying rope for a spar; a spinnaker guy controls the fore and aft position of the spinnaker pole; the foreguy holds the spinnaker pole forward and down.

Gybe: To change from one tack to another by turning the stern through the wind.

Hail: To attempt to contact another boat or shore, either by voice or radio.

Halyard: Rope used to hoist and lower sails.

Hand rail: Hand hold. Usually along the cabin top or ladder.

Hank: Fitting used to attach the luff of a sail to a stay.

Harbormaster: The individual who is in charge of a harbor.

Hatch: A sliding or hinged opening in the deck, providing people with access to the cabin or space below.

Haul out: Remove a boat from the water.

Hawes pipe: see Navel pipe.

Hawse hole: A hole in the hull for mooring lines to run through.

Hawser: A rope that is very large in diameter, usually used when docking large vessels.

Hazard: An object that might not allow safe operation. A group of rocks just under the water or a submerged wreck could be a navigational hazard.

Head: The toilet and toilet room in a vessel.

Head seas: Waves coming from the front of the vessel.

Head up: To turn the bow more directly into the eye of the wind. The opposite of falling off.

Headfoil: A streamlined surround to a forestay, with a groove into which a headsail luff slides.

Head-topwind: When the bows are pointing right into the wind.

Headway: The forward motion of a vessel through the water.

Heave-to: To back the jib and lash the tiller to leeward; used in heavy weather to encourage the boat to lie quietly and to reduce headway.

Heaving line: A light line suitable for throwing ashore.

Heaving to: To slow or stop the forward motion of the boat, such as when in heavy seas.

Heavy seas: When the water has large or breaking waves in stormy conditions.

Heavy weather: Stormy conditions, including rough, high seas and strong winds.

Heel: To lean over to one side.

High tide: The point of a tide when the water is the highest. The opposite of low tide.

Hitch: A knot used to attach a line to a cleat or other object.

Horizon: Where the water and sky or ground and sky appear to intersect.

Hull: The main structural body of the boat, not including the deck, keel, mast, or cabin. The part that keeps the water out of the boat.

Hurricane: A strong tropical revolving storm of force 12 or higher. In the northern hemisphere; hurricanes revolve in a clockwise direction. In the southern hemisphere they revolve counterclockwise and are known as typhoons.

Inboard: (1) toward the center of the boat. (2) an engine that is mounted inside the boat.

Inflatable: A dinghy or raft that can be inflated for use or deflated for easy stowage.

Isobars: Lines on a weather map joining places of equal atmospheric pressure.

Jackstay: A line running fore and aft, on both sides of the boat, to which safety harnesses are clipped.

Jury: A temporary device to replace lost or damaged gear.

Keel: A flat surface built into the bottom of the boat to reduce the leeway caused by the wind pushing against the side of the boat. A keel also usually has some ballast to help keep the boat upright and prevent it from heeling too much.

Kicking strap: A line used to pull the boom down, to keep it horizontal, particularly on a reach or run.

Knot: (1) a speed of one nautical mile per hour. (2) a method of attaching a rope or line to itself, another line or a fitting.

Land breeze: A wind moving from the land to the water due to temperature changes in the evening.

Lanyard: A short line attached to one object, such as a knife, with which it is secured to another.

Lash: To tie something with a line.

Launch: (1) to put a boat in the water. (2) a small boat used to ferry people to and from a larger vessel.

Lead line: A line with a weight on the end used to measure depth. The lead is dropped into the water and marks on the line are read to determine the current water depth. The lead usually has a cavity to return a sample of the bottom type (mud, sand, etc.).

League: Three nautical miles.

Lee shore: A shore on to which the wind blows.

Leech: 1, the after edge of a triangle sail; 2, both side edges of a square sail.

Leehelm: The tendency of a boat to bear away from the wind.

Leeward: The direction away from the wind. Opposite of windward.

Leeway: The sideways movement of a boat away from the wind, usually unwanted. Keels and other devices help prevent a boat from having excessive leeway.

Life jacket: A device used to keep a person afloat. Also called a life preserver, life vest, PFD or personal flotation device.

Life raft: An emergency raft used in case of serious problems to the parent vessel, such as sinking.

Lifeline: A wire or rope rigged around the deck to prevent the crew falling overboard.

Limber holes: Gaps left at the lower end of frames above the keel to allow water to drain to the lowest point of the bilges.

List: A boat's more or less permanent lean to one side, owing to the improper distribution of weight, e.g., ballast or water.

Log: (1) a device used to measure the distance traveled through the water. The distance read from a log can be affected by currents, leeway and other factors, so those distances are sometimes corrected to a distance made good.

Longitude: Imaginary lines drawn through the north and south poles on the globe used to measure distance east and west. Greenwich England is designated as 0° with other distances being measured in degrees east and west of Greenwich.

Luff: The forward edge of a sail. To luff up is to turn a boat's head right into the wind.

Luff groove: A groove in a wooden or metal spar into which the luff of a headsail is fed.

Lurch: The sudden roll of a boat.

Magnetic north: The direction to which a compass points. Magnetic north differs from true north because the magnetic fields of the planet are not exactly in line with the north and south poles. Observed differences between magnetic and true north is known as magnetic variation.

Make fast: To attach a line to something so that it will not move.

Make way: Moving through the water.

Marlin spike: A pointed steel or wooden spike used to open up the strands of rope or wire then splicing.

Mast Step: The socket in which the base of the mast is located.

Measured mile: A distance of one nautical mile measured between buoys or transits/ranges ashore, and marked on the chart.

Member: A part of the skeleton of the hull, such as a stringer laminated into fiberglass hull to strengthen it.

Meridian: An imaginary line encircling the Earth that passes through the poles and cuts at right angles through the Equator. All lines of longitude are meridians.

Messenger: A small line used to pull a heavier line or cable. The messenger line is usually easier to throw, lead through holes or otherwise manipulate than the line that it will be used to pull.

Midships: A place on a boat where its beam is the widest.

Mizzen: 1, the shorter, after-mast on a ketch or yawl; 2, the fore and aft sail set on this mast.

Moor: To attach a boat to a mooring, dock, post, anchor, etc.

Mooring: A place where a boat can be moored. Usually a buoy marks the location of a firmly set anchor.

Mooring line: A line used to secure a boat to an anchor, dock, or mooring.

Nautical mile: Distance at sea is measured in nautical miles, which are about 6067.12 feet, 1.15 statute miles or exactly 1852 meters. Nautical miles have the unique property that a minute of latitude is equal to one nautical mile (there is a slight error because the earth is not perfectly round.) Measurement of speed is done in knots where one knot equals one nautical mile per hour. A statute mile is used to measure distances on land in the United states and is 5280 feet.

Navel pipe: A metal pipe in the foredeck through which the anchor chain passes to the locker below.

Navigation lights: Lights on a boat help others determine its course, position and what it is doing. Boats underway should have a red light visible from its port bow, a green light on the starboard bow and a white light at its stern. Other lights are required for vessels under power, fishing, towing, etc.

Noon Sight: A vessel's latitude can be found, using a sextant, when a heavenly body on the observer's meridian is at its greatest altitude. The sight of the sun at noon is the one most frequently taken.

Off the wind: With the sheets slacked off, not close-hauled.

On the wind: Close-hauled.

Out haul: A rope used to pull out the foot of a sail.

Outboard: On the side of the hull that the water is on. Outboard engines are sometimes just called outboards.

Overall length (OAL): The boat's extreme length, measured from the foremost past of the bow to the aftermost part of the stern, excluding bowspirt, self-steering gear etc.

Pad eye: A small fitting with a hole used to guide a line.

Painter: A line attached to the bow of a dinghy and used to tie it up or tow it.

Parallels: Lines of latitude

Pay out: To let out a line.

PFD: Personal Flotation Device, a device used to keep a person afloat. Also called a life jacket, life preserver or life vest.

Pile, piling: A pole embedded in the sea bottom and used to support docks, piers and other structures.

Pintle: A rudder fitting with a long pin that fits into the gudgeon to form a hinged pivot for the rudder.

Pitch: 1, the up and down motion of the bows of a boat plunging over the waves; 2, the angle of the propeller blades.

Point of sailing: The different angles from which a boat may sail; the boat's course relative to the direction of the wind.

Poop deck: A boat's aft deck.

Port: (1) the left side of the boat from the perspective of a person at the stern of the boat and looking toward the bow. The opposite of starboard. (2) A porthole. A window in the side of a boat, usually round or with rounded corners. Sometimes portholes can be opened, sometimes they are fixed shut. Also see hatches.

Port tack: A boat is on a port tack when the wind strikes the port side first and the mainsail is out to starboard. A boat on the port tack gives way to a boat on a starboard tack.

Porthole: A port, a window in the side of a boat, usually round or with rounded corners. Sometimes portholes can be opened, sometimes they are fixed shut.

Position line/ Line of position: A line drawn on a chart, as a result of taking a bearing, along which the boat's position must be, i.e. two position lines give a fix.

Pram: A type of dinghy with a flat bow.

Propeller: An object with two or more twisted blades that is designed to propel a vessel through the water when spun rapidly by the boat's engine.

Prow: The part of the bow forward of where it leaves the waterline.

Pulpit: A sturdy railing around the deck on the bow.

Pushpit: Metal guard rail fitted at the stern.

Quarter: The side of a boat aft of the beam. There are both a port quarter and a starboard quarter.

Quarter: The portion of the boat midway between the stern and the beam; on the quarter means about 45 degrees abaft the beam.

Quartering sea: A sea which comes over the quarter of the boat.

Quarters: Sleeping areas on the boat.

Radar: Radio detection and ranging. An electronic instrument that uses radio waves to find the distance and location of other objects. Used to avoid collisions, particularly in times of poor visibility.

Radio beacon: A navigational aid that emits radio waves for navigational purposes. The radio beacon's position is known and the direction of the radio beacon can be determined by using a radio direction finder.

Rake: The fore and aft deviation from the perpendicular of a mast or other feature of a boat.

Range: 1, see transit; 2, of tides, the difference between the high and low water levels of a tide; 3, the distance at which a light can be seen.

Rating: A method of measuring certain dimensions of a yacht to enable it to take part in handicap races.

Reach: To sail with the wind approximately on the beam; all sailing points between running and close-hauled.

Reef: To reduce the sail area by folding or rolling surplus material on the boom or forestay.

Reefing pennant: Strong line with which the luff or leech cringle is pulled down to the boom when reefing.

Reeve: Leading a line through a block or other object.

Rhumb line: A line cutting all meridians at the same angle; the course followed by a boat sailing in a fixed direction.

Riding light to anchor light: An all-around white light, usually hoisted on the forestay, to show that a boat under 50 ft. (15m.) is at anchor. It must be visible for 2 mls. (3 km.).

Rigging screw: A deck fitting with which the tensions of standing rigging, e.g. stays, shrouds, etc. are adjusted.

Roach: The curved part of the leech of a sail that extends beyond the direct line from head to clew.

Rope: Traditionally a line must be over 1 inch in size to be called a rope.

Rudder post: The post that the rudder is attached to. The wheel or tiller is connected to the rudder post.

Run: To run with the wind aft and with the sheets eased well out.

Running rigging: All the moving lines, such as sheets and halyards, used in the setting and trimming of sails.

Safety harness: A device worn around a person's body that can be attached to the ship to prevent the person from being separated from the ship.

Sampson post: A strong post used for to attach lines for towing or mooring.

Scope: The length of rope or cable paid out when moor anchoring.

Screw: A propeller.

Scuppers: 1, holes in the toe rail that allow water to drain off the deck; 2, drain cockpit through hull.

Seacock: A valve that shuts off an underwater inlet or outlet passing through the hull.

Secure: To make fast. To stow an object or tie it in place.

Seize: To bind two ropes together, or a rope to a spar, with a light line.

Serve: To cover and protect a splice or part of a rope with twine bound tightly against the lay.

Serving mallet: Tool with a grooved head, used when serving a rope to keep the twine at a constant and high tension.

Set: 1, to hoist a sail; 2, the way in which the sails fit; 3, the direction of tidal current or steam.

Shackle: A metal link with a removable bolt across the end; of various shapes: D, U.

Sheathing: A covering to protect the bottom of a boat.

Sheave: A grooved wheel in a block or spar for a rope to run on.

Sheepshank: A knot used to temporarily shorten a line.

Sheet: The rope attached to the clew of a sail or to the boom, enabling it to be controlled or trimmed.

Shrouds: Ropes or wires, usually in pairs, led from the mast to the chain plates at deck level to prevent the mast falling sideways; part of the standing rigging.

Sloop: A single-masted sailing boat with a mainsail and one head sail.

Snatch block: A block that can be opened on one side, allowing it to be place on a line that is already in use.

Spar: A general term for any wooden or metal pole, e.g., mast or boom, used to carry or give shape to sails.

Spindrift: Spray blown along the surface of the sea.

Spinnaker: A large, light, balloon shaped sail set when reaching or running.

Splice: To join ropes or wire by unlaying the strands and interweaving them.

Split pin: See cotter pin.

Spreaders: Horizontal struts attached to the mast, which extends to the shrouds and help to support the mast.

Stall: A sail stalls when the airflow over it breaks up, causing the boat to lose way.

Stanchion: Upright metal post bolted to the deck to support guardrails or lifelines.

Standing part: The part of a line not used when making a knot; the part of a rope that is made fast, or around which the knot is tied.

Standing rigging: The shrouds and stays that are permanently set up and support the mast.

Starboard: The right side of the boat from the perspective of a person at the stern of the boat and looking toward the bow.

Starboard tack: A boat is the starboard tack when the wind strikes the starboard side first and the boom is out to the port.

Stay: Wire or rope which supports the mast in a fore and aft direction; part of the standing rigging.

Steerage way: A boat has steerage way when it has sufficient speed to allow it to be steered, or to answer the helm.

Stem: The forward edge of the bow. On a wooden boat the stem is a single timber.

Stern: The aft part of a boat. The back of the boat.

Stern line: Line running from the stern of the boat to a dock when moored.

Sternway: The backward, stern-first movement of a boat.

Stow: To put something away.

Stringer: A fore and aft member, fitted to strengthen the frames.

Stuffing box: A fitting around the propeller shaft to keep the bearing lubricated and to keep water out of the boat.

Swivel: A rotating fitting used to keep a line from tangling.

Tabernacle: A hinged support for the bottom of a mast so that the mast can be lowered easily when passing under bridges.

Tack: 1, the lower forward corner of a sail; 2, to turn the boat through the wind so that it blows on the opposite sides of the sails.

Tack pennant: A length of wire with an eye in each end, used to raise the tack of a headsail some distance off the deck.

Tacking: Working to windward by sailing close-hauled on alternate courses so that the wind is first on one side of the boat, then on the other.

Tackle: A purchase system comprising of rope and blocks that is used to gain mechanical advantage.

Tang: A strong metal fitting by which standing rigging is attached to the mast or other spar.

Telltale: A small line free to flow in the direction of the breeze. It is attached to sails, stays in the slot, and in other areas, enabling the helmsman and crew to see how the wind is flowing.

Tender of dinghy: A small boat used to ferry stores and people to a yacht.

Terminal fitting: Fitting at the end of a wire rope by which a shroud or stay can be attached to the mast, a tang or a rigging screw/ turnbuckle.

Thwartships: Also athwartships. Across the width of a boat.

Tide: The vertical rise and fall of the oceans caused by the gravitational attraction of the moon.

Toe rail: Small rail around the deck of a boat. The toe rail may have holes in it to attach lines or blocks. A larger wall is known as a gunwale.

Topping lift: A line from the masthead to a spar, normally the boom, which is used to raise it.

Topsides: The sides of the hull above the waterline and below the deck.

Track: 1, the course a boat has made good; 2, a fitting on the mast or boom into which the slides on a sail fit; 3, a fitting along which a traveller runs, used to alter the angle of the sheets.

Transit: The time steaming from port to the study site and vice versa.

Traveller: 1, a ring or hoop that can be hauled along a spar; 2, a fitting that slides in a track and is used to alter the angle of the sheets.

Trim: 1, to adjust the angle of the sails, by means of sheets, so that they work most efficiently; 2, to adjust the boat's load, and thus the fore and aft angle at which it floats.

True wind: The direction and speed of the wind felt when stationary, at anchor or on land.

Turnbuckle: See Rigging screw.

Under way: A boat is under way when it is not made fast to shore, at anchor or aground.

Uphaul: A line used to raise something vertically, e.g., the spinnaker pole.

Upwind: To windward, in the direction of the eye of the wind.

Veer: 1, the wind veers when it shifts in clockwise direction; 2, to pay out anchor cable or rope in a gradual, controlled way.

Wake: Waves generated in the water by a moving vessel.

Watch: (1) a division of crew into shifts. (2) The time each watch has duty.

Waterline: The line where the water comes to on the hull of a boat. Design waterline is where the waterline was designed to be, load waterline is the waterline when the boat is loaded.

Waterline length (WL): The length of a boat from stem to stern at the waterline. It governs the maximum speed of displacement hull and effects a boats rating.

Weather helm: (Opp. of lee helm).

Weather side: The side of a boat on which the wind is blowing.

Wetted surface: The area of the hull under water.

Whip: To bind the strands of a line with a small cord.

Whisker pole: A light pole used to hold out the clew of a headsail when running.

Winch: A mechanical device, consisting usually of a metal drum turned by a handle, around which a line is wound to give the crew more purchasing power when hauling taut a line, e.g. a jib sheet.

Wind scoop: Funnel used to force wind in a hatch and ventilate the below decks area.

Windage: Those parts of a boat that increase drag, e.g., rigging, spars, crew, etc.

Windlass: A mechanical device used to pull in cable or chain, such as an anchor rode.

Windward: The direction from which the wind blows; towards the wind (opp. of leeward).

Yaw: Swinging off course, usually in heavy seas. The bow moves toward one side of the intended course.

Yawl: A two masted boat with a mizzen stepped aft of the rudder stock/ post.

Zulu: Used to indicated times measured in Coordinated Universal Time, a successor to Greenwich Mean Time. A time standard that is not affected by time zones or seasons.