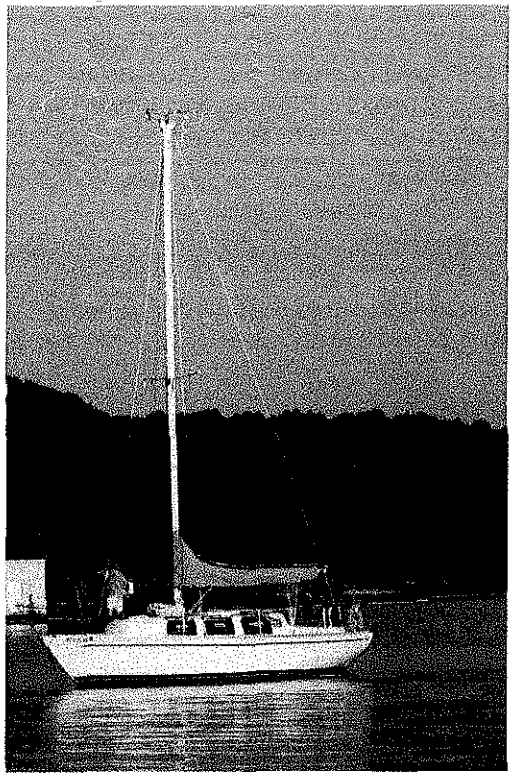
OWNER'S MANUAL

FULL SAIL

1977 COLUMBIA 8.7



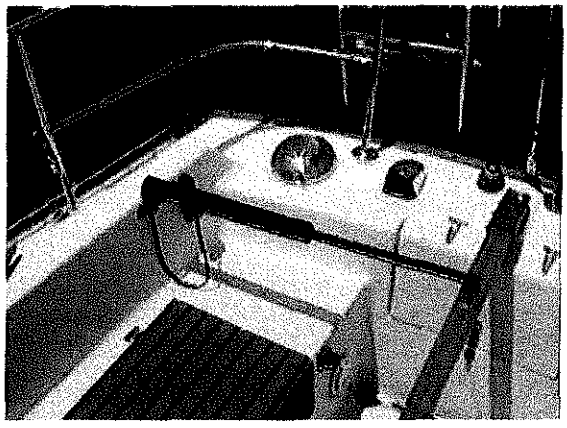
Owner's Manual

The vessel Overview

The vessel is a Columbia 8.7 sloop built in August 1976. The purpose of this document is to update and replace the original owner's manual that came with this boat. Over the years there have been a number of changes made to the vessel. Most of these changes are considered to be improvements, but regardless they have rendered the original manual incomplete and inaccurate. The result is this document which attempts to cover all of the major systems of the vessel.

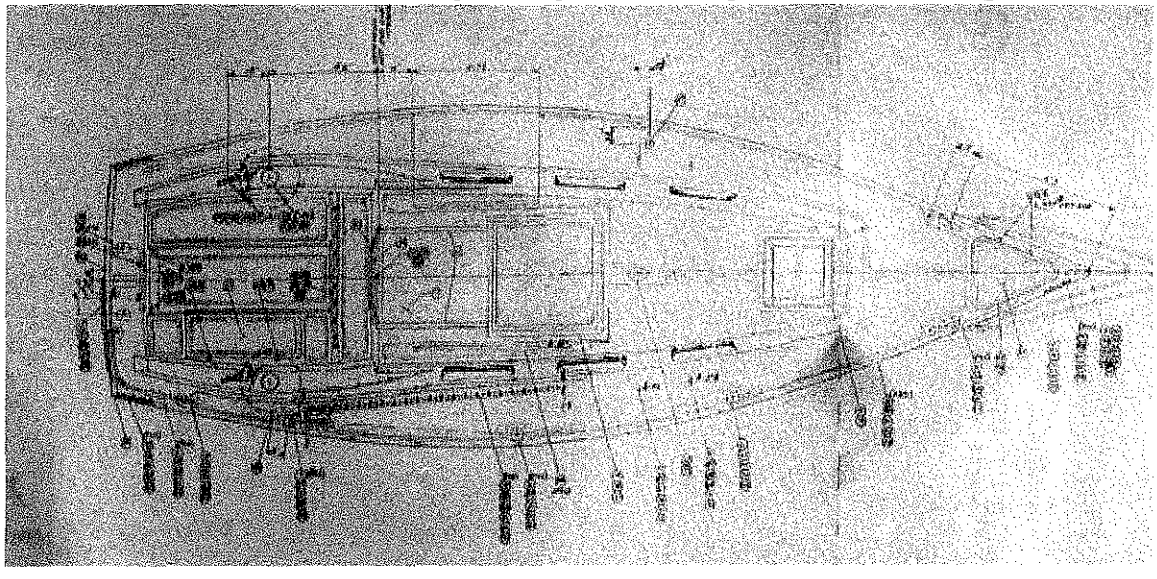
- Deck Systems
- Diesel Engine
- Electrical Systems
- Below the Waterline
- Cabin Systems

I. Deck Systems Overview



The deck is the working platform for this sailboat. Since the vessel has been single-handed most of the time, the deck systems are relatively simple and straightforward. Steering is by tiller. This is much simpler and more reliable than a wheel steering. The tiller also raises up out of the way when at anchor or dockside, allowing full use of the cockpit. An Autohelm ST4000/T autopilot was added for use with the tiller. The relatively inexpensive and simple ST4000/T can steer the vessel in almost any condition and point of sail.

The original deck systems delivered with the vessel have been changed very little over the years. A halyard winch for the mainsail (the Jib halyard winch was standard) and slab reefing for two reef points, but no major upgrades have been made on deck. The basic deck plan is depicted in the diagram below from the original owner's manual.



A. Standing Rigging

The standing rigging includes the mast, boom and wire rope stays and shrouds that support the mast. The mast is a single aluminum extrusion. The masthead contains four sheaves for the two halyards (main and jib) and a platform for the Windex, masthead tricolor/anchor light and the Autohelm wind instrument sending unit. The mast has a single full length extruded sail track, single spreaders and is stepped on the deck in an aluminum shoe. All mast wiring exits the mast on the port side and terminates in Aqua Signal through deck connectors.
The vessel has single fore and backstays, single upper shrouds, and single lower middle and single forward shrouds. The stays and shrouds are 7/32" 7x7 stainless wire rope. Navtec turnbuckles on the backstay and each of the six shrouds are used to tune the rigging. A Merrimam turnbuckle was added to the forestay. The original rigging did not have a turnbuckle in the bow which made tuning the rigging more difficult, so this turnbuckle was added some time ago. The wire rope is the original standing rigging on the vessel. The boom attaches to the mast via a gooseneck, which is secured within the sail track on the mast.

Tuning the Rig

The rig should be re-tuned every spring, any time the mast is re-stepped or after a prolonged sail in apparent winds greater than 20 knots. Tuning can be performed in four steps.

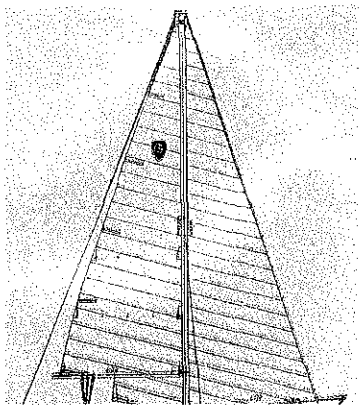
- Set up the mast in column. Secure all shrouds and stays with minimal tension. Adjust to insure the mast has no visible bend to either side.
- Center the masthead over the deck. Using the jib and main halyard adjust the shroud tension to insure that the halyard distance to points opposite each other on the toe rail are the same. At this point you are ready for a trial sail.
- Adjust the shroud tension under sail to keep the mast in column. On a day of moderate sailing (true wind twelve to fifteen knots) start sailing on a close reach. Sighting up the mast to determine if there is any fall-off of the masthead from the straight column. If so adjust the upper and middle lower shrouds to bring the mast back into column. Bring the boat onto the opposite tack, and adjust for any out of column condition. Tack back once more and verify that the mast is still in column. Secure the upper and middle lower shroud turnbuckles with cotter pins.
- Adjust fore and back stay tension to achieve slight mast bend. On the same sail check for mast bend. The mast should have a slight, smooth aft bend. Adjust the fore and backstays and the lower forward shroud to provide the bend with no bow (forward bend) in the mast. You want just enough bend to allow you to flatten the mainsail by fully tensioning the mainsheet and boom vang. If you adjust the lower forward shrouds, be sure you make equal adjustments on both shrouds to keep the mast in column. Check when you have achieved proper mast bend and secure all turnbuckles with cotter pins.

B. Running Rigging

The running rigging consists of halyards, sheets, tackle and winches necessary to trim and control the mainsail and jibs.

1. Halyards

The vessel has two external halyards, one for the mainsail and one for the jibs. The main halyard runs through the starboard masthead sheaves and is tensioned with the halyard winch on the starboard side of the mast. The jib halyard runs through the port masthead sheaves and is tensioned by the halyard winch on the port side of the mast. The main halyard is attached to the mainsail with a headboard shackle. The jib halyard is attached to the headsails with a snap shackle. Both halyards are ½" Sta-Set-X cordage.



2. Sheets

The mainsail sheet is 7/8" double braid line that runs from the becket on the double fiddle block on the traveler through each of the three blocks on the boom the cam cleat on the traveler. The mainsheet provides a 6:1 purchase.

The boom vang attaches to the bail at the base of the mast and the tang welded to the underside of the boom. The vang has a 4:1 purchase.
Each foresail has its own set of sheets, which are stored in their individual sail bags. On the wind the sheets can be lead through the fairlead blocks on the Genoa track on deck to the sheet winches on the cockpit coaming. Off the wind the sheets can lead through snatch blocks attached to the toe-rail. All headsails (Genoa, Lapper, Spinnaker, and Storm Jib) use the same halyard, sheet leads and winches.

C. Sails

The vessel has five bags of sails. All fore sails are hank-on sails.

1. Mainsail

The mainsail is full-battened with two reef points. The full roach of the sail extends slightly aft of the backstay. This is the primary sail on The vessel and she will sail reasonably well, if not optimally fast, on all points of sail with only the main set.

2. Genoa and Lapper

The vessel has two working jibs. The Genoa is very full and provides excellent drive in light airs (less than 18 knots apparent). Once the apparent wind approaches twenty knots it is best to change to the Lapper. This sail is very flat with only a slight overlap of the mast, and can handle apparent winds up to thirty knots.
Both the Genoa and the Lapper are housed in their own deck bags, which have been called Turffels (a combination of a turtle and a duffel bag). These sails can be launched from and retrieved to their Turffels and then stored below in the same bag. Each Turffel is closed in front and on top via heavy-duty zippers. Both also have an internal wire rope to which the sail hanks are attached when the sail is stored.
When the sail is brought on deck, unzip the front and attach the four snap hooks to the forestay. Next transfer the sail hanks from the Turffel internal wire to the forestay, above the lower snap hooks. Next partially unzip the top of the Turffel, remove the sheets, and run them through the fairleads back to the cockpit. If the sail is not going to set immediately, close the zippers and swing the Turffel around the forestay and let it rest on the bow pulpit.
When you are ready to raise the sail, unzip the top and the front and secure the tack to the horn on the stem. Release the upper snap hooks and attach them to the toe rail. Now the Turffel is secured to the deck and the forestay so it won't go anywhere when you raise the sail. Next attach the jib halyard to the head of the sail and raise it with the halyard.
When you are ready to drop the sail, release the halyard and drop the sail on deck as normal. Next release the snap hooks from the toe rail and secure them to the forestay above the sail hanks. Now the sail is secured on deck, it cannot fill and rise up the forestay. Grab the clew of the sail and pull it full aft on deck. Flake the sail on deck and then start to roll the sail up from the clew to the tack. This should roll the sail up over the Turffel. Push the sail down into the Turffel and close the top and front zippers.
The lapper tack has a wire pendant, which allows it to be set above the Genoa Turffel on deck. Therefore the first sail I always bring on deck is the Genoa. If the wind gets to high for this sail I drop it and put it back into the Turffel, still hanked onto the forestay. Then I can secure the Lapper Turffel above the Genoa, hank it on, secure the Lapper tack to the sail horn with the pendant and then raise that sail. This way the Genoa is still on deck ready to be raised should the wind diminish.
I have found the Turffels partially compensate for the convenience of roller furling, while allowing me to set a sail that was designed for the wind conditions.

3. Cruising Spinnaker

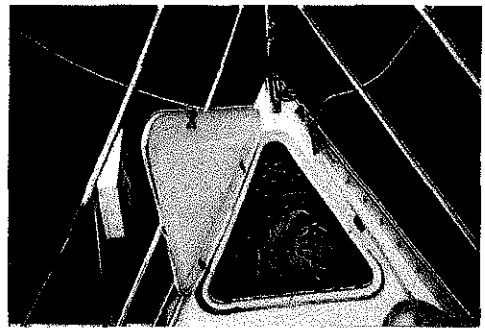
The cruising spinnaker on the vessel is Thrasher from Thurston Sails. The spinnaker is set and doused using a Chutescoop sock. To set the spinnaker, first secure the sail bag to the toe rail or a lifeline stanchion. The piston hank is used to clip the tack of the sail to the fore stay. The tack has a downhaul that is run through the block on the stem to a cam cleat secured to the toe rail with a snap shackle. Run the sheets through snatch blocks on the toe rail to the cockpit. The snatch blocks are normally set up aft of the sheet winches. Now attach the jib halyard to the shackle on the head of the Chutescoop. Raise the Chutescoop the masthead. Be sure to remove any twists in the Chutescoop before you raise the sock. With the leeward sheet secured, pull down on the Chutescoop halyard to raise the sock and let the sail fill with wind. If there is a fresh wind (greater than 12 knots apparent), it is best to turn the

boat nearly dead down wind and raise the spinnaker in the lee of the mainsail. Secure the Chutescoop halyard to the mast, trim the spinnaker and then adjust the trim as you bring the boat onto your intended course.
To douse the spinnaker, reverse the process. If in a fresh breeze turn the boat down wind and blanket the spinnaker behind the main sail. Pull the sock down over the sail to douse it, and then drop the halyard to bring the sail on deck. Finally stuff the sock and sail back in the sail bag and secure the halyard.

4. Storm Jib

The least used sail on The vessel is the storm jib. I have had few opportunities to sail The vessel in over thirty knots of apparent wind. This sail can also be set on the back stay when at anchor and sheeted to the toe rail as a riding sail at anchor. The vessel has a lot free board and a cut away fore foot, which means she tends to sail at anchor in a fresh breeze. Setting the storm jib on the backstay will tend to hold her on one tack or the other.

D. Anchoring

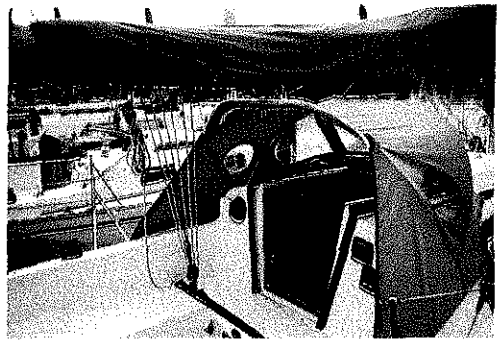


Vela has two anchors, a 25-lb CQR on 300' of rode and 12 LB Danforth on 150' of rode. Both anchors and their rodes are stored in the anchor well on the foredeck. I normally flake both rodes into figure eight's and then secure them with small stuff. This allows the anchor rodes to run easily from deck when the anchor is dropped. The 300' rode for the CQR is split into two sections of approximately 150' each. Normally the second 150' is not use except in very deep water (> 20').

E. Canvas

The vessel has a full set of deck canvas to protect the cockpit and the sails.

1. Dodger

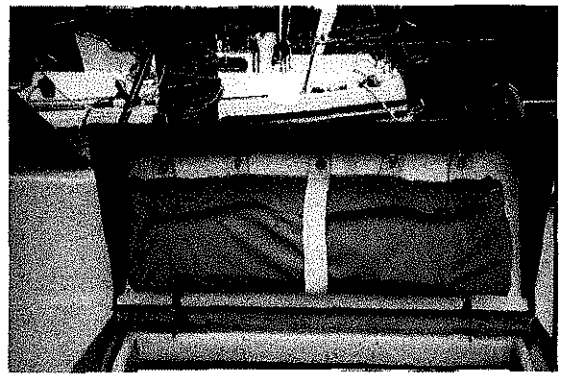


The dodger provides wind and spray protection for the crew in the cockpit. It also provides a handhold when standing in the cockpit. The center clear vinyl window can be unzipped and rolled up to allow a breeze in the cockpit when motoring. In a hot anchorage with little wind I normally drop the dodger to allow for maximum air movement through the cockpit. When motoring in hot sun I normally set the cockpit awning off the dodger. This awning normally can't be set under sail because the mainsheet must run through the opening in the awning.

2. Mainsail Cover

The mainsail cover is secured around the mast with a heavy-duty zipper and shock cord. It is secured around the sail and boom with Dacron sail ties.

3. Hatch Board Bag



The hatch drop boards can be stored in the bag, which hangs on the underside of the cockpit locker.

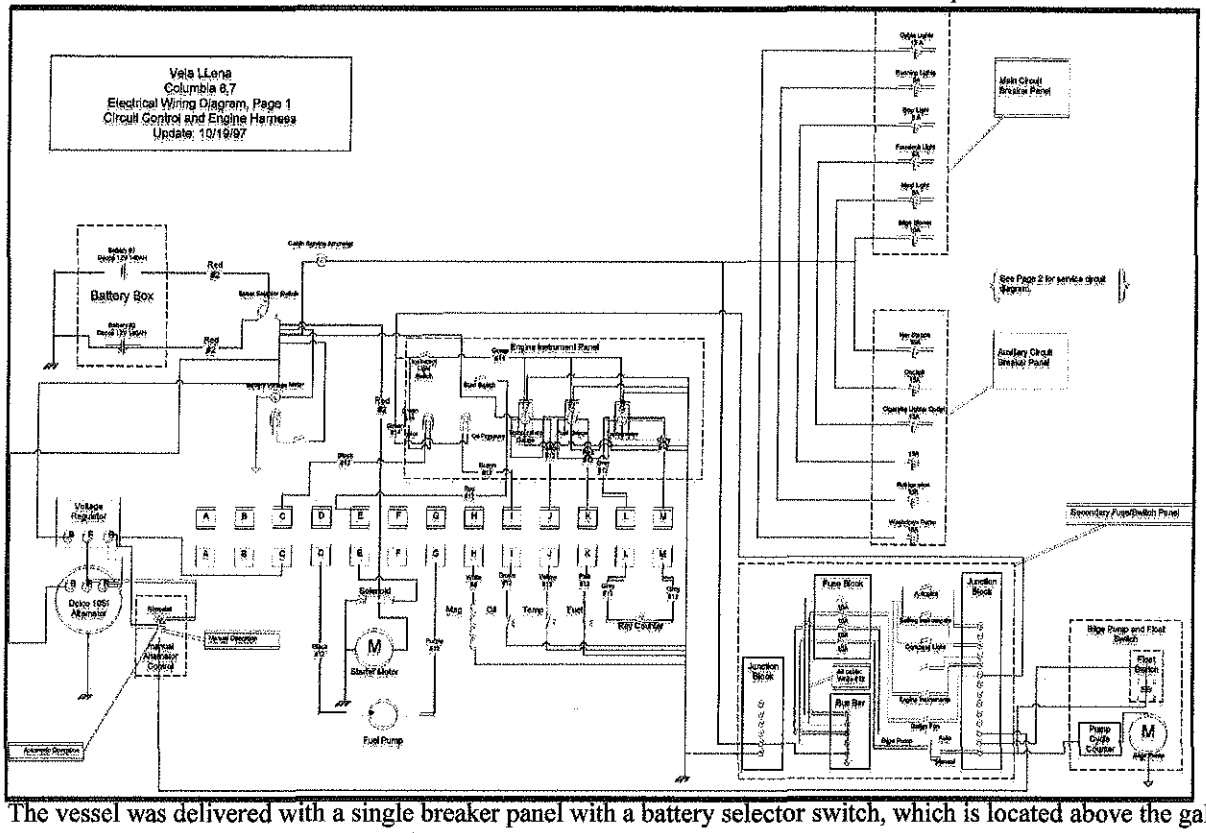
III. Electrical

The electrical system is a combination of the original wiring and several additions over the life of the vessel. The additions are documented in the large format diagrams included with this document and reproduced in this section. I have organized the wiring documentation into four diagrams.

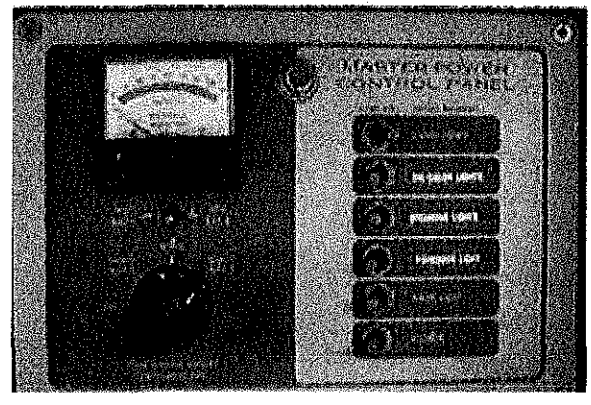
- Circuit Control and Engine Harness
- Cabin Service Circuits
- Mast and Deck Circuits

A. Circuit Control and Engine Harness

All of the circuits are controlled and distributed from one of three circuit breaker/switch panels.



The vessel was delivered with a single breaker panel with a battery selector switch, which is located above the galley sink, and depicted at right. On the right side of the panel is the battery selector switch and the battery voltmeter. This switch controls only the output of the batteries, not the charging circuits. The Newmar battery charger is wired directly to the batteries, and the alternator is wired to battery isolator and then directly to the batters. Therefore you don't need to be concerned about someone accidentally switching the batteries off-line when the engine is running and destroying the diodes in the alternator.



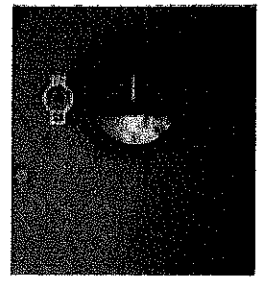
The circuit control and engine harness wiring diagram is reproduced above. The full size diagram is included as an annex to this document.

The main electrical panel switches are depicted in the upper right of the diagram. There are a total of six circuit breakers on this panel, which control the following circuits.

- Cabin Lights: This 15-amp breaker activates the circuits to most of the cabin lights. Switches built into the individual fixtures control each of the lights.
- Running Lights: This 5-amp break turns on the masthead tricolor light. This light is shown when under sail after dark.
- Steaming Lights: This 5-amp breaker turns on the port and starboard running lights in the bow pulpit, the bow light on the mast and the stern light on the transom. These lights are shown when running under engine power after dark.
- Foredeck Light: This 5-amp breaker turns on the floodlight on the mast (in the same fixture as the bow light) that illuminates the foredeck.
- Mast Light: This 5-amp breaker turns on the anchor light built into the masthead tricolor fixture. When operated by this switch the light is dimmed to reduce current load. The momentary button switch on the starboard companionway grab rail above the galley sink can override the dimmer. Pressing this switch with or without the mast light breaker in the on position will turn on the mast light at its maximum brightness. This switch can be used to turn the mast light into as signal light.
- Bilge Blower: This 10-amp breaker activates the circuit for the bilge blower to evacuate any explosive fumes that may worked their way into the bilge. The blower is turned on and off by a pull switch on the engine instrument panel at the base of the bridge deck in the cockpit
- To the left of the main electrical panel is the auxiliary circuit breaker panel. This panel controls some of the additional circuits that I have added over the years and contains six circuit breakers. These breakers control the following circuits.

- Navigation Station: This 15-amp breaker controls the circuit for the navigation station at the head of the quarter berth on the port side of the cabin. This circuit feeds a bus bar on the aft side of the aft bulkhead in the navigation station. The VHF radio, the stereo system (including the power amplifier and CD changer) and the lights over the navigation table all receive power from this bus bar.
- Cockpit: This 15-amp breaker activates the dry-plug receptacles in the cockpit and at the base of the mast on top of the cabin trunk. These receptacles are used primarily for the spotlight when entering an anchorage at night, but they could be used to provide 12volt power to any portable device.
- Cigarette Lighter Outlet: This 15-amp breaker activates the cigarette lighter receptacle on the forward side of the bulkhead after of the galley stove. This receptacle is used primarily as an outlet for portable devices that can be plugged into an automotive cigarette lighter (e.g., a cell phone charger).
- Miscellaneous: Empty.
- Refrigeration: This 15-amp breaker activates the circuit for the Adler-Barbour refrigeration. The refrigerator is turned on and off by the thermostat switch located inside the icebox.
- Washdown Pump: This 15-amp breaker controls the circuit for both the deck washdown pump and the holding tank macerator pump, which are located under the port v-berth. The washdown pump is turned off and on by the pull switch located under the v-berth insert in the forward cabin. The macerator pump is turned on the by the pull switch located under the sink in the head. Never turn on the macerator pump when the output seacock is close.

Just outboard of the auxiliary panel is an ammeter, which measures the current delivered by the batteries to the active circuits on the boat. I use this ammeter to monitor the current usage while at anchor or under sail. It is also a useful tool in diagnosing refrigeration problems.



The third electrical panel is the secondary fuse/switch panel on the bulkhead behind the companionway steps. This panel controls the last set of circuits added to the vessel. Unlike the other two panels, fuses rather than breakers protect the circuits on this panel. The switches are just that, not breakers. The fuses are located on the backside of the plywood panel and are accessed by removing the four wood screws that hold it in place. Since there has never been any problem with the fuses blowing, there has been no imperative to change it.
The switches and fuses control the following circuits.

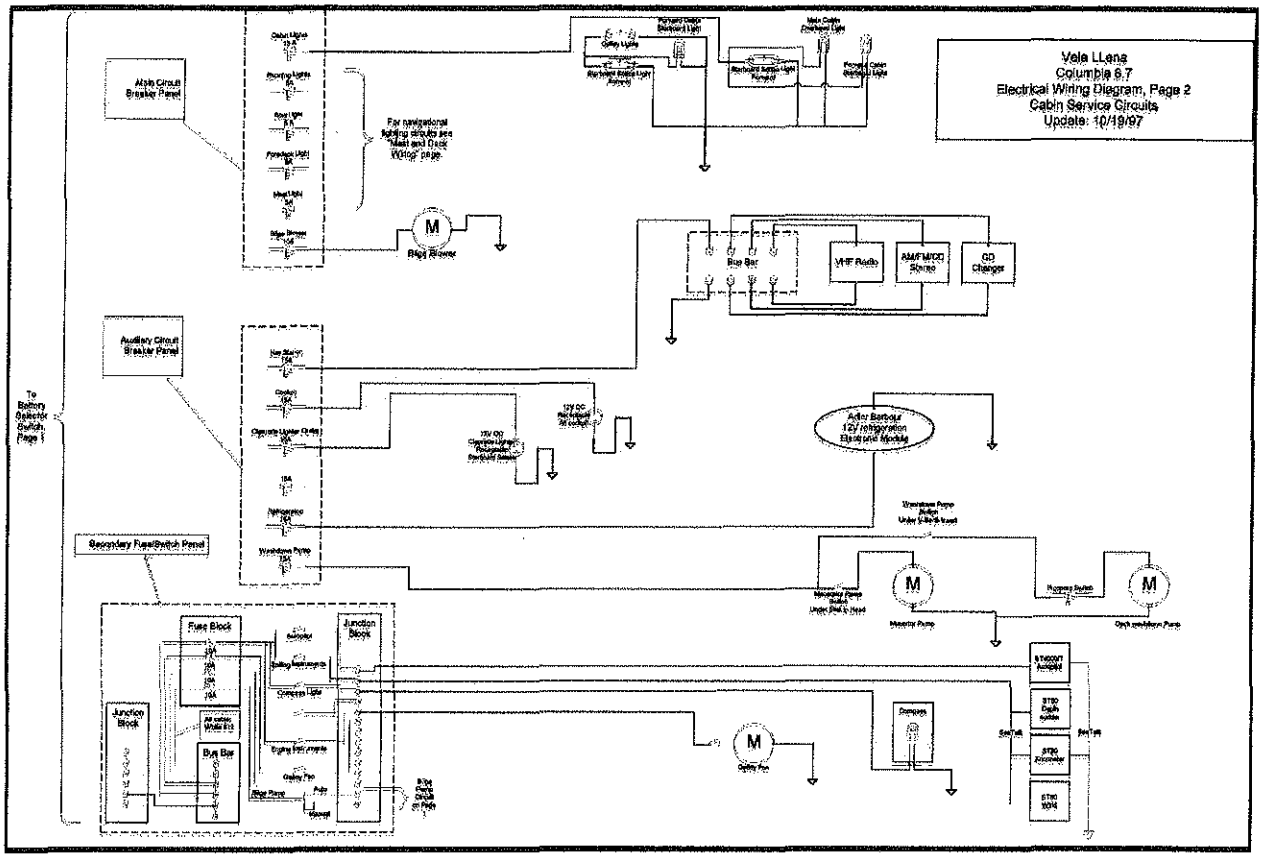
- Autopilot: This switch activates the autopilot control head in the cockpit. This also activates the flux gate compass, which located under the forward end of the port settee berth in the main cabin.
- Sailing Instruments: This switch activates the Autohelm wind, depth and speed instruments in the cockpit. It also activates the Autohelm multi display above the navigation station.
- Compass Light: This switch turns on the light in the Ritchie compass in the cockpit.
- Engine Instruments: This switch activates the engine instrument panel at the base of the bridge deck in the cockpit.
- Galley Fan: This switch turns on the oscillating fan over the stove in the galley. There is also a switch on the fan.

In addition to these circuits, the panel contains the switch and cycle counter for the electric bilge pump. The pump is located under the furthest aft of the lift up hatches in the cabin sole. The pump can be operated manually by the panel switch or automatically by the float switch, which is located under the center hatch in the cabin sole. Above the bilge pump switch is an ammeter that measures the charging current produced by the alternator when the engine is running.

On the starboard side of the same panel is the alternator control, which consists of three-way switch and a rheostat. This control is used to manually regulate the field current delivered to the alternator which in turn controls the output current and voltage of the regulator. The standard alternator in use on the vessel has an internal regulator and is not controlled by this panel.

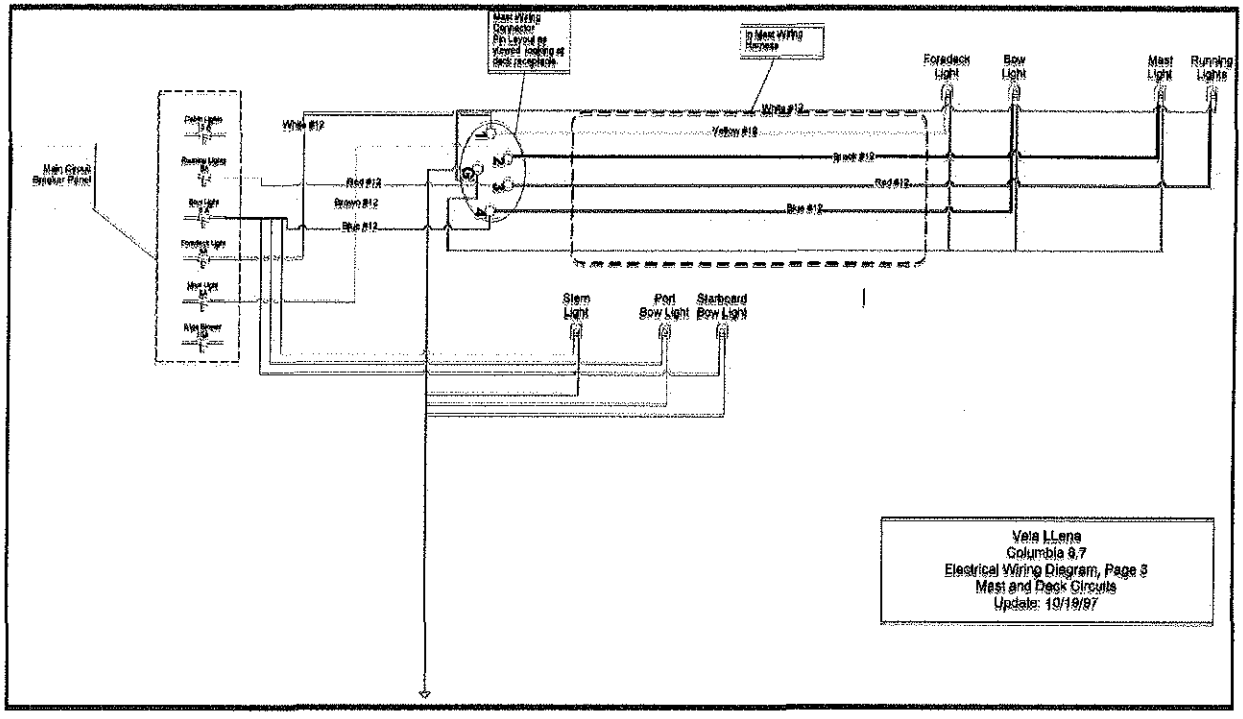
B. Cabin Service Circuits

The second diagram depicts the cabin circuits that are controller by all three panels.



C. Mast and Deck Circuits

The third diagram depicts the circuits in the mast and on deck. In particular it documents the wiring in the deck plug that connects the circuits in the mast to the deck.



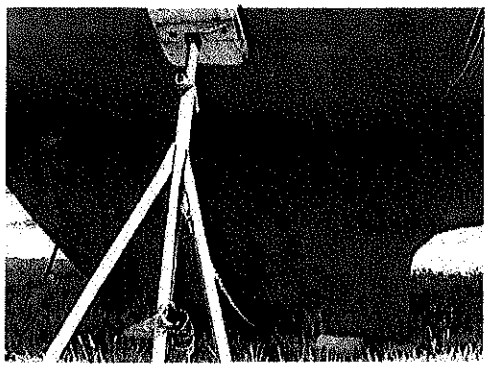
IV. Below the Waterline

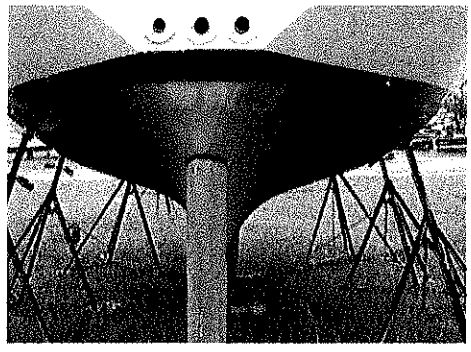
Below the waterline the vessel does not resemble many of its contemporary designs. The keel is shallow and low aspect with a long skeg that runs aft to provide protection for the propeller. Above this skeg is another short skeg to which the rudder is attached. Alan Payne, the designer, call this configuration a "skeg-on-a-skeg". The forward sections are U-shaped to minimize pounding. The aft sections are flat to minimize wetted surface and to provide additional resistance to healing.

It is best to have the boat hauled annually to re-apply bottom paint and to visually inspect all of the underwater fittings. This is also an opportunity to breakdown and lubricate all of the seacocks in the cabin.
To apply a fresh coat of bottom paint you must first prep the surface. The boat yard should have power-washed the bottom and scrapped any barnacles or other growths from the hull. Using a disk sander (preferably a random-orbital one) smooth all painted surfaces below the water line. Before starting to apply paint use masking tape to cover the waterline. One gallon of paint thinned about 10-15% is adequate to provide one coat of paint to the hull and rudder.

The propeller and propeller shaft should also be cleaned and painted. A wire wheel or brush in a power drill makes fairly quick work of this task. If you are going to paint the prop, make sure you clean it extremely well. The bronze metal should be free of any contaminant and be brushed to a golden yellow. I have used Tri-Lux-II successfully for an entire season. I prep the surface with the Tri-Lux wash, then apply 2-3 coats of primer and then 4-6 coats of the paint. Be sure to replace the prop shaft zinc before launching.

Below, on the left is a picture of the keel profile, which shows it's low aspect nature and shallow draft. The picture on the right shows the full bilges and flat underbody of the center sections of the hull. This keel and hull configuration allows The vessel to cruise in shallow water while still providing a stiff hull that can stand up to a relatively large sail plan.





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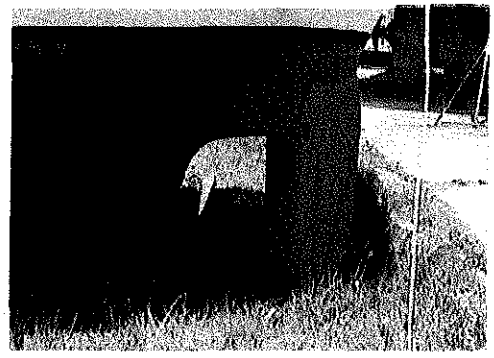
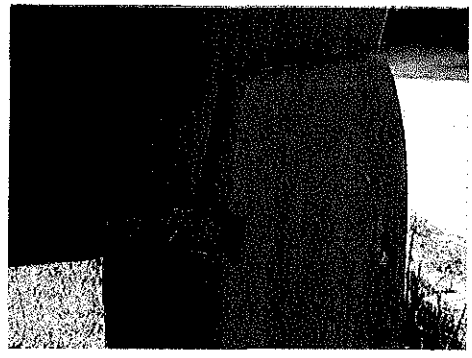
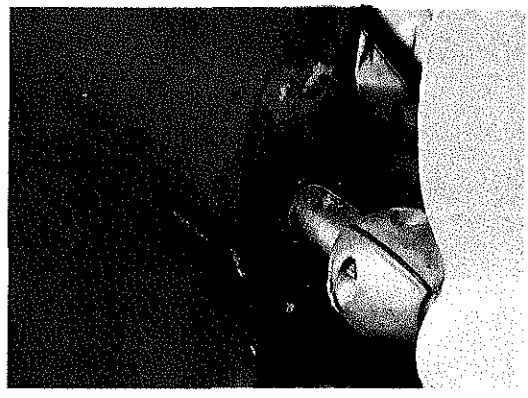
The pictures below show the skeg and rudder configuration as well as a close up of the gudgeon that holds the rudder to the skeg. This configuration provides a partially balance helm and relatively effortless steering, eliminating any need for wheel steering on. The gudgeon is made up of two bronze pieces that wrap around the rudder shaft where it is exposed in the notch in the rudder. The gudgeon is through-bolted to the rudder skeg. As delivered from Columbia this skeg was hollow and the through-bolts where the source of slow, but persistent leak on The vessel. Eventually I filled this skeg with epoxy and the leaks have ceased.





The picture on left is a close up of the propeller, shaft and the skeg. There is a cutlass bearing within the skeg, which provides a low friction surface within which the shaft can rotate. The cutlass bearing and the shaft were replaced in 1996. The propeller is one of two propellers included in The vessel 's inventory. This is the original 15x9 prop. For the first two seasons I owned The vessel I got poor performance under engine power. On the advice of the boatyard I went a smaller 13x10 prop, and got adequate performance. Seven or eight years later the 13x10 prop needed to be re-conditioned and I replaced it with the 15x9 prop temporarily – I thought. Much to my surprise the performance of The vessel under power improved again. I can't explain why this prop now provides excellent performance when it was a poor performer twenty years ago, except to note that propeller sizing is a black art. The 13x10 prop has been reconditioned and is included in the spare parts inventory.



V. Cabin Systems Overview

This section describes the operation and maintenance of the various cabin systems installed on the vessel. These systems include the following.

1) Ventilation

The hatches, portlights and vents that allow air to flow through the cabin.

2) Plumbing:

The tanks, hoses and pumps that move fluids into, out of, and within the cabin.

3) Galley:

The stove, refrigerator, and sink used for meal preparation

4) Head:

The toilet and other sanitation devices.

5) Navigation Station

The chart table and navigation instruments.

A. Ventilation System

The ventilation system consists of the hatches, ports and vents that allow air to flow through the interior of the cabin. This airflow is necessary not just for human comfort but also to preserve the woodwork, electrical wiring, and other systems within the cabin that are attacked by mold and corrosion.

a) Companionway Hatch

The companionway hatch consists of a sliding hatch cover and removable drop slides. This hatch provides the main access to the cabin from the cockpit. The hatch is protected by the canvas dodger and thus can be left open most of the time while underway, at anchor, or tied to the dock. This is the largest opening into the cabin and provides the primary ventilation.

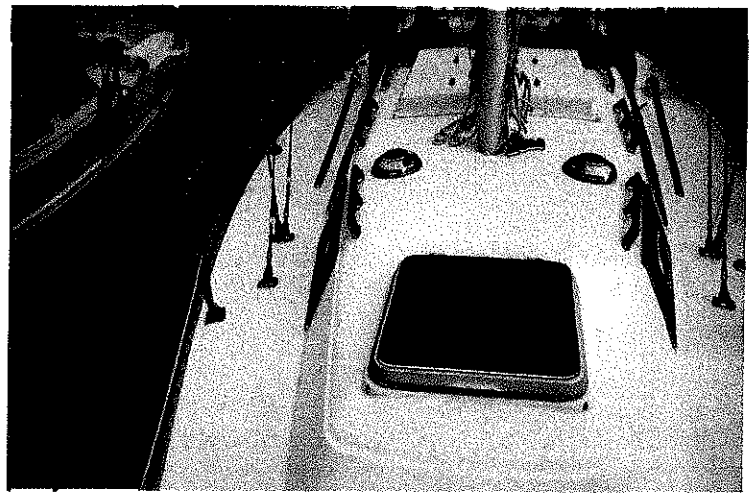
When it is raining and the boat is underway, tied to a dock or swinging at anchor such that the wind is abeam or abaft it may be necessary to insert all but the top drop slide in place to prevent rain from entering the cabin. Except when the wind is blowing directly from astern, the top slide and the overhead hatch can be left open and no significant amount rain will enter the cabin.

The drop slides were built in 1988. The original plywood drop slides were retained for use during winter storage. The drop slides are stored in a canvas pouch that is secured to the underside of the cockpit locker.

Maintenance: Beyond keeping the hatch clean the only maintenance required is to regularly apply Semco, or similar products, to the teak on the sliding hatch and to varnish the drop slides annually.

b) Forward Hatch

The forward hatch is a 22-1/2" Lewmar Roll Stop Hatch installed in 1990. The two handles on the forward edge of the hatch cover secure the Lewmar hatch. The handles can be operated both from within the cabin and from on deck. To open the hatch, rotate the handles outward until they are parallel to side edges of the hatch. This releases the cams that secure the hatch cover. Pushing or pulling the cover upward to one of the roll-stop positions opens the hatch.



The Hatch may be secured in two positions: fully sealed and ventilation. To fully seal the cover pull or push it fully down so that the gasket in the cover is pressed against the frame then turn the handles inward until they are parallel to the forward edge of the hatch. The cams should slide under the frame and seal the gasket against the frame. In this position the hatch provides a complete watertight seal.

To secure the hatch in the ventilation position pull or push the hatch down until the cams on the handles line up with the slot in the frame. Turn the handles inward so that the cams slide into the slot until the handles are parallel to the forward edge of the hatch. In this position the cover is secure, but will allow air to flow under the forward edge of the cover. The lip on the cover provides a spray shield in this position, but water can enter and drip onto the forward berth in a driving rain or when beating into a chop. The hatch can be locked in either secured position by pushing the levers inside the handles toward the end of the handle. The lock is released by pushing the levers in the opposite direction. The hatch can be locked only from inside the cabin. When locked, if someone should attempt to force the hatch open from outside by turning the outside handles these handles will shear off.

Maintenance: Beyond keeping the hatch clean the only maintenance required is to regularly apply Armor-All, or similar products, to the gasket on the cover.

c) Portlights

There are five Lewmar opening portlights in the main cabin plus one more in the head compartment for a total of six ports, three on each side of the trunk cabin. The aft portlights on each side are 4"x14" and the remaining four portlights are 4"x10". Two cam dogs on the lower edge of the lexan window secure each portlights. When the handles on the dogs are turned inward so that the cams slide into the slots on the portlight frame the window is pushed against the gasket on the frame providing a watertight seal. Releasing the dogs and rotating the window inward on its hinges opens the portlights. The click-stop hinges will hold the window in one of the pre-set open positions.

Maintenance: Beyond keeping the portlights clean the only maintenance required is to regularly apply Armor-All, or similar products, to the gasket on the frame.

d) Vents

There are three all-weather vents on the vessel. On is located on the top of the transom and the other two are located in the top of the trunk cabin just forward of the mast.
The transom vent provides ventilation to the refrigeration unit located under the cockpit sole. The combination of the engine exhaust line that is looped under the port quarter and the refrigerator can cause a significant buildup of heat under the cockpit. The vent will remove a great deal of this heat.
The trunk cabin vents are Nicro Marine Solar Vents. One of the vents is located in the head compartment and is normally set up in exhaust mode. The other is just outside of the head compartment and is normally set up to pull air into the cabin. Both vents have built-in solar panels that provide the power necessary for the fans. These units also allow the use of a nicad battery to provide power when sunlight is not available. Normally the fans are not required when the sun is not shining.
Replacing the fan blade can change the airflow direction of each of the vents. To remove the fan blade, grab it securely and carefully but forcefully pull it down until it releases. Insert the replacement blade by pushing it up onto the motor spindle. Check the blade rotation to insure it does not strike or brush against the side of the vent housing. The blades are coded by the colored dot on the blade cylinder. Exhaust blades have a red dot and the intake blade has a blue dot.

Both trunk cabin solar vents are of the push-in, pullout type. The entire vent can be removed by grabbing the outer edge of the top of the vent pulling it out of through-deck frame. A plastic cover can then seal the frame. This should be done when sailing in rough conditions primarily to preclude catching a sheet under one of the vents and ripping it apart. The vents would also allow a considerable amount of water below should the boat take a knock down. Under normal conditions (rain showers, deck spray, etc.) no water will enter the cabin from these vents.
Maintenance: The only maintenance required is too keep the solar panels and the internal fans clean.

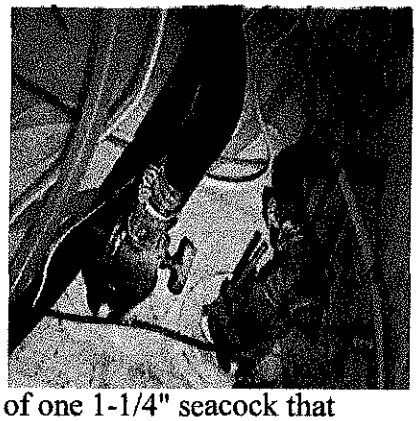
A. Plumbing

The vessel is equipped with a relatively simple plumbing system that consists of four (4) through hull fittings, and a non-pressurized fresh water system.

a) Through Hull Fittings

Two of the four fittings are located under the galley sink and the other two are located under the sink in the head compartment. All are fitted with Groco Seacocks.

The through hulls under the galley sink (right) are both fitted with 3/4" seacocks. The outboard seacock provides the drain for the galley sink. The inboard seacock provides seawater coolant for the engine and seawater to the salt-water pump on the galley sink. Removing the garbage pail from under the sink provides access to these seacocks.



The through hulls in the head compartment (above, left) consist of one 1-1/4" seacock that provides the overboard discharge for the holding tank and a 3/4" seacock that provides the drain for the sink and seawater input for the toilet and the deck wash-down pump.
All seacocks consist of a caste bronze housing and a drum, with a tube through the middle, which is rotated by the handle. When the handle is vertical the seacock is open and when it is horizontal the seacock is closed. Unless sealed by the butterfly screw on the right side of the housing, the seacock will leak. To seal the seacock the butterfly screw must be turned clockwise until finger tight. To loosen the seal and move the handle, turn the screw counterclockwise. Whether open or closed, the seacock should always be sealed to prevent a serious leak. When sealed the drum handle cannot be turned and the seacock cannot be opened or closed. Therefore to open or close the seacock, the butterfly screw must first be loosened and then the handle operated. Once the seacock is opened or closed the butterfly screw must be re-tightened to seal the seacock.

Whenever the boat is to be left unattended for an extended period of time, all seacocks should be closed and sealed.

Maintenance: The seacocks require only annual maintenance, although they should be checked for a tight seal and good hose connections on a regular basis. Annual maintenance is best performed when the boat has been hauled. At this time the seacock can be removed by disconnecting the hose and unscrewing the seacock from the through hull fitting. Once removed the seacock can be disassembled, cleaned, greased, and reassembled.

b) Fresh Water System

The fresh water system consists of a single 30-gallon aluminum tank located under the port settee, a foot pump and faucet at the galley sink, and a hand pump at the sink in the head compartment. All hoses are 1/2" I.D. clear vinyl.
The galley pump is located below the sink beneath the built-in garbage pail. The foot lever protrudes through the bottom of paneling under the sink. The pump is double action, delivering water on both the up and down stroke.
The head sink pump is located on inboard edge of the sink and is operated my moving the pump handle forward and backward. This pump is single action and delivers water only on the forward movement of the handle.
The freshwater tank is filled from the deck pipe on the port side directly opposite the head portlight. When filling the tank you should monitor the galley faucet. Once the tank is full water

will flow freely from this faucet. The overflow vent for the tank is located in the head closet behind the toilet and will be spilling water into the bilge at this time.

Maintenance: The pumps require little or no maintenance. Annual disassembly and cleaning would be nice, but in my opinion, unnecessary. The tank should be cleaned at least annually. At a minimum this should involve the pouring of one cup of liquid bleach down the fill pipe and filling the tank with fresh water. Each pump should then be operated to allow the bleach solution to move into the hoses and the pump housings. Then the tank should be allowed to sit overnight, drained, then refilled and drained repeatedly until the taste and odor of the bleach is gone. This procedure should prevent the build up of algae and mold in the tank and the hoses.
Eventually the tank will require a thorough cleaning. There are two ports in the top of the tank for this purpose. These ports allow the tank to be cleaned with a mild soap solution by hand. This is most easily accomplished by removing the tank from the boat. To do this remove the wood screws that hold the bunk board in place and remove the bunk board. Disconnect the three hoses (deck fill, galley service and head service) from the tank and then pick up the tank. Be sure the tank is empty when you attempt this.

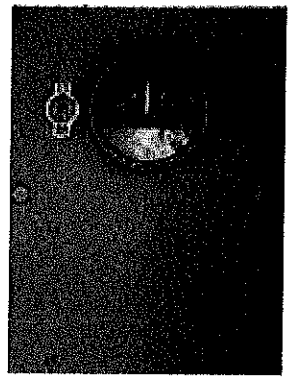
B. Galley

The galley is located in the aft, starboard quarter of the main cabin and consists of the range/oven, refrigerator and sink. Shelves are provided outboard of the stove and above the refrigerator for the storage of cooking utensils and condiments.

a) CNG Stove

The Force 10 stove has two burners, an oven and a broiler. Currently the stove is set up for CNG fuel. It can be converted to propane by replacing the burner orifices with the propane orifices included in the spare parts inventory. I went with CNG to avoid having to build a sealed and vented enclosure for the tank. The CNG tank is stored under the forward end of the starboard berth/settee. This is not strictly according to code, because the code requires a sealed enclosure for CNG as well as propane. However, CNG is lighter than air and it will self vent as long as the cabin is ventilated. I believe the solar vents installed in the cabin overhead as well as the opening ports provide more than adequate ventilation. CNG is a more expensive fuel than propane and less convenient in that you must exchange the tank at an authorized dealer in order to get a re-fill. However, it is more than satisfactory for coastal cruising, as almost any harbor will have a dealer. Refer to the Force 10 manual for details on operating this stove.

Maintenance: The stove requires little maintenance beyond keeping it clean and respecting the fuel.



b) Refrigeration

An Adler-Barbour 12-volt unit provides refrigeration. The compressor and condenser are located under the cockpit, just aft of the diesel fuel tank. The thermostat control knob is located inside the icebox on the inboard side. The refrigerator has a dedicated circuit breaker on the secondary electrical control panel behind the galley sink.

To turn on the refrigerator first turn the circuit breaker (second from bottom) on then turn the thermostat control knob clockwise to the "3" position. The compressor should now be running. This can be checked at the system ammeter behind the sink, which should show well above 5 amps of current (the compressor draws 6 amps). It can also be checked at the compressor by listening for the hum or observing the condenser fan in operation. Compressor operation can be checked at the evaporator in the icebox. You should head a tingling sound like a small waterfall at the evaporator. If the compressor does not come on, move to the trouble-shooting section below.
Once the compressor is in operation it will take from one to three hours, depending on the starting temperature of the box, for the icebox to get cold enough for fresh food. Leave the thermostat set between the "3" and the "4" positions. This is the normal operating temperature setting for the icebox. If it is set above "5" most of the contents of the box will eventually freeze and the batteries will be seriously depleted if the boat is disconnected from shore power. Settings below 2 will not keep food fresh during a hot summer day.

Continuous Operation: As long as the boat is connected to a reliable shore power source and the battery charger is active, I recommend leaving the refrigeration on continuously, even when the boat is not in use. Bringing a warm icebox down to the proper temperature level requires a lot of time and energy. It takes up to twenty-four (24) hours for the icebox to get cold enough to minimize the compressor operation. This means that if you leave the dock within twelve hours of turning on the refrigeration you will experience a great deal more battery drain while under sail than if the refrigerator had been operated continuously. The only danger from continuous operation is that the shore power will fail during the week when the boat is unattended and the battery will be fully discharged. *Don't leave anything that will spoil in the icebox when the boat is unattended.*

Freezer: The evaporator case provides a somewhat inefficient freezer (unless the thermostat is on "7"), and is rarely used for anything other than making ice. Ice can be made in the four plastic freezer bottles. Fill each bottle to the mark on the bottom and then place them horizontally on top of each other in the freezer. It takes up to six hours to freeze a single bottle on the "3" setting. The original ice cube trays supplied with the Adler Barbour produce a greater volume of ice, but each tray takes over twelve hours to freeze at the "3" setting. It is more difficult to free the cubes from these trays. These trays are aluminum cylinders with plastic inserts to separate the cubes during freezing. The trays are filled with water, then placed upright in the freezer using a metal stand.
Trouble-Shooting: Refrigeration malfunctions normally involve either a compressor that will not start or an icebox that will not get cold enough. Trouble shooting the refrigeration system can be time consuming and complex. Detailed trouble shooting instructions are included in the Adler Barbour manual separate from this document. In this section I will cover only the most common problems.

The most common problem is a ***compressor that will not start***. This can happen on initial start up of the refrigerator or after the unit has been running on a continuous basis for an extended period. This situation can be caused by a number of problems most of which are only temporary conditions.

The most common reason that will prevent the compressor from starting is ***low battery voltage***. The compressor will run until the input voltage goes below 10 volts DC. At this time the compressor will shut down to protect itself and will not restart until the input voltage rises above 11-1/2 volts DC. Check the voltage meter on the active batter at the main electrical panel. If the voltage is below 11-1/2 volts switch to the other battery. If that battery is fully charged the refrigeration compressor should come on within 60 seconds. Recharge the original battery and try to determine the reason for the discharge.

The second most common reason the compressor will not start is a ***blockage in the high-pressure hose*** coming from the condenser. This happens most often on very hot days when the compressor is cycling on and off quite often. This situation can be diagnosed at the ammeter above the icebox. When the compressor attempts to start the meter should move up approximately 6 amps and hold. If the compressor is blocked the ammeter needle will immediately drop back down to the original setting. This will be repeated every 15 to 20 seconds. The blockage could be an air lock or frozen moisture in the line. A proper correction of this problem might require a thorough purging and recharging of the entire system. This in impractical when under way with $100 of food trying to spoil and not really necessary in most cases.

To clear this blockage turn the unit off at the circuit breaker and leave it off for at least 15 minutes. This allows the blockage in the hose to dissipate and the pressures equalize in the hoses. Turn the circuit breaker back on and check at the ammeter above the icebox to see if the compressor restarts. If the needle swings up 6 amps and holds the compressor blockage as cleared (at least for now). If the needle immediately drops back down the blockage is persisting. Repeat this procedure leaving the unit off for up 30 minutes this time. You should also start looking for some place cold to store your food at the end of the sail. Even on a hot day a fully chilled icebox should remain cold enough to preserve most food for up to twelve (12) hours. If, after several attempts, the unit still refuses to start it is time to seek service from an authorized Adler-Barbour dealer.

Maintenance: There is no preventive maintenance required for the refrigeration system. The Adler-Barbour manual covers remedial maintenance (e.g. re-charging).

c) Galley Sink

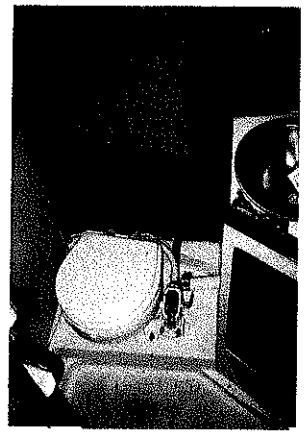
The galley sink has two faucets, one for fresh water and one for salt water. The fresh water faucet is chrome and is operated by the foot pump directly below the sink. The salt-water faucet is bronze and is operated by the foot pump beneath the stove. The salt-water pump is normally disconnected and used only for washing during long trips to reduce the demand for fresh water. As long as the salt-water hose is kept clean, this faucet can be used to draw water for cooking when in unpolluted waters. Even then I would pump several gallons of water through the faucet before collecting any for cooking.

Maintenance: Maintenance of the pumps and hoses is covered in the plumbing section, below. The salt-water pump, hose and faucet should be cleaned with a disinfectant (e.g. liquid bleach) at least twice each year. To clean the salt water system close the seacock, loosen the hose clamp on the hose, and pull it from the nipple on the seacock. Stick the end of the hose into a container of disinfectant and pump until the disinfectant runs freely from the faucet. Replace and secure the hose to the seacock. Allow the salt water system to set with the disinfectant over night then flush it with salt water until the disinfectant odor disappears. When the boat is stored for the winter fill the salt water system with a mild solution of disinfectant and leave the disinfectant in the system while the boat is stored, then flush in the spring.

d) Fan

The galley fan is located above the stove. It is a rotating fan, which is controlled by the lever on the fan housing. The fan is turned on and off by the switch on the auxiliary electrical panel behind the companionway ladder.

C. Head



The head compartment is on the port side of the cabin just aft of the forward cabin. The head consists of a manual toilet, sink and two storage cabinets. The storage cabinet outboard of the sink is dry and suitable for storing toiletries. The larger cabinet behind the toilet is not dry. The overflow tube from the freshwater tank vents into this cabinet. There only articles that are sealed in water-tight containers or those that can be allowed to get wet should be stored in this cabinet.

a) Toilet

The toilet is the original Wilcox-Crittenden Head Mate. This is a relatively inexpensive head, but it has served reasonably well given the age of the vessel. There are two draw backs to the head: (1) the pump tends to leak slightly and must be repacked periodically; and (2) the joker valve tends to jam when a lot of solids are pumped at once. The primary solids that will jam the toilet are paper products (e.g. toilet paper and sanitary napkins). When the toilet jams or packs in you have a very nasty job on your hands - one that has been done on only two occasions, but even that is too many.
By following two rules, the toilet should give minimal troubles:

1. **Never flush more than two wads of toilet paper at a time. You may have to pump a lot of flush water through the head, but you won't have to deal with the nasty end of the toilet hose.**

2. **Never flush any paper product, other than toilet paper, through the toilet. This especially means no sanitary napkins.**

There are two hoses connected to the toilet. The smaller hose (3/4" ID) is the seawater intake and connects to the 3/4" seacock under the sink. This seacock is also used for the sink drain and the intake for the deck wash down pump. The larger hose (1-1/2" ID) is the exhaust hose - this is the nasty one. The exhaust hose runs from the back of the head pump housing into the closet behind the head and then to the holding tank under the starboard berth in the forward cabin.

b) Holding Tank

The holding tank has a capacity of 6 gallons. The pump out receptacle is located in the bottom of the anchor well on deck. The holding tank is also vented to the anchor well. The holding tank can also be emptied overboard, where legal, using the macerator pump which is connected to the 1 1/4" seacock under the sink in the head. A pull switch under the sink controls the pump. Do not operate the pump when the discharge seacock is closed. The discharge seacock should only be opened when operating the macerator pump. There is no anti-siphon valve on the hose from the seacock to the pump. If left open the seacock will allow water to enter the hose and eventually fill the holding tank to overflow with seawater.

Operation: Before using the head insure that the intake seacock under the sink is open. First raise the intake shut off valve on top of the pump housing to the upright position. This should allow seawater to start to flow into the bowl. You can help this flow along with a few pumps on the pump handle. Once the bowl is about 1/3 filled with water close the valve by pushing it back to horizontal. Now the toilet is ready for use.
When you are ready to flush raise the intake valve to the upright position and start to pump. As a rule of thumb it takes 6 to 10 pumps to evacuate the bowl. You can feel solids as resistance when they pass through the pump housing. You want to pump only enough to insure that all waste moves out of the bowl. This means some waste will normally be left in the hose from the head to the holding tank. This is necessary to prevent prematurely filling the holding tank.
When you are finished, and all waste has been pumped from the bowl, close the intake valve and pump until the bowl is empty of water.

Emptying the Holding Tank: The only way to legally empty the holding tank in coastal waters is at a pump out station. The pump out receptacle is in the bottom center of the anchor well at the bow. Remove the anchors and then using a deck plate tool remove the receptacle cover. Insert the pump out hose into the receptacle and start the pump out. While the pump out is in process pump seawater through the head into the holding tank. This insures that any waste left in the hoses is pumped out of the boat.
Where legal the holding tank can be pumped overboard using the macerator pump. First turn on the pump breaker on the secondary electrical panel behind the galley sink. This is the bottom breaker on the panel and also controls the deck wash down pump. Next open the 1 ¼" seacock under the head sink. Now activate the pump by pulling the switch under the sink. You should be able to hear the pump operate. While the pump is active use the head pump to flush the hoses and the holding tank with seawater. It normally takes no more than three minutes to completely empty the holding tank. Then push in the switch to turn off the pump and close the seacock.

c) Sink

A hand operated fresh water pump serves the sink in the head. The pump lever is swung backwards and forwards to move water into the sink. The sink drains into the 3/4" seacock used for the head intake and the deck wash down pump.

d) Fan

The head is equipped with a small 12 volt fan that can be used make the head a little more comfortable on hot days. The switch for the fan is on the base. The fan can be swung in an arc to direct the airflow. This fan draws several amps so be sure to turn it off when you leave the head.

D. Navigation Station

The navigation station is located on the port side of the main cabin just aft of the settee berth. The station consists of a removable chart table, an electronics panel, a chart shelf, a tool rack, and a repeater for the Autohelm instruments.

a) Instrument Repeater

An Autohelm Multifunction instrument display is located on instrument pod above the chart table. This instrument allows the navigator to monitor any of the deck instruments from below. The navigator can also use this repeater to display computed results from more than one instrument (e.g., VMG, true wind direction/speed, etc.). Refer to the Autohelm manual for the detailed operating procedures for this instrument.

b) VHF Radio

The ICOM M56 VHF radio is located on the electronics panel outboard of the chart table. Refer to the ICOM manual for operations procedures.

c) Stereo

A Sony CD/AM/FM stereo is mounted on the electronics panel next to the VHF radio. There are four speakers connected to the stereo, two on each side of the main cabin behind the settees. The stereo is connected to a Sony 40Amp power amplifier mounted on the aft side of the bulkhead aft of the electronics panel. A Panasonic 6-CD changer is mounted under the outboard overhead behind the port settee (between the speakers. The control head for the CD changer is also located on the electronics panel. Refer to the Sony and Panasonic manuals for operating procedures.