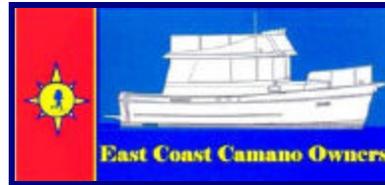


# Camano 31 Owner's Handbook



Camanos at 2008 Rendezvous, Solomon Is, MD

**This handbook is an updated version of a handbook supplied with all new boats from Camano Marine Ltd., which produced 268 Camano 28/31s, before being sold to Bracewell Marine Group in 2007, which built one Camano 31. Camano Yachts America acquired the Camano molds from Bracewell in 2008 and started building Camano 31s in Washington State. The original handbook was written by Keith Wood, whose Camano 28/31 was Nutmeg (Hull 21), with help from other Camano owners. The handbook was digitized and updated in April 2009 by Al Rossiter Jr., Rathmacknee II (Hull 158), for members of East Coast Camano Owners. Please send corrections and suggested additions to [info@eastcoastcamanoowners.com](mailto:info@eastcoastcamanoowners.com).**

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## DESIGN AND CONSTRUCTION

### **Name**

The Camano started out with two models – the Troll (with a flying bridge) and Gnome (without the flybridge). The Gnome was later discontinued and the Troll was called a Camano 28 and renamed the Camano 31 for marketing purposes in the early 2000s. The boat is 28 feet length on deck and 31 feet overall, including the swim platform and anchor roller.

### **Engine**

The Camano was designed for diesel power. Most of the Camano 28s (now called Camano 31s) have been equipped with Volvo diesel engines. Very early Camanos had four-cylinder Volvo engines but this soon gave way to the 150 HP six-cylinder turbo-charged engine, and more recently, a 200 HP Volvo six-cylinder turbo-charged and after-cooled engine (TAMD41P) was installed as standard equipment. The TAMD41P was replaced with the four-cylinder D4 in 2007. In 2009, the Yanmar 6BY was standard with the Volvo D4 optional. This manual refers to the TAMD41P, because it is the most common Camano 31 engine.

### **Fuel System**

The standard fuel capacity of each Camano was 92.4 US gallons through hull 179. The twin port and starboard aluminum tanks were increased in size beginning with Hull 180, holding a total of 130 US gallons. For purposes of calculating range it is normal to allow at least 10% reserve for fuel not picked up at the bottom. The outlet valve is located at the aft, lower inboard corner and the engine can be run with both valves open. The fuel is then supplied to the Racor fuel filter (newer Camano 31s have twin Racors), the lift pump, the engine fuel filter, the injector pump and the fuel injectors. Excess fuel is then returned to the fuel tanks via the fuel return lines. The fuel return line is fitted with valves to control the return fuel flow to either or both the port and starboard tanks. Regular scheduled servicing of the engine requires the replacement of both the Racors and the engine fuel filter. Whenever this is done it is always necessary to vent the fuel system. Single Racor filters have a central plunger that allows you to manually fill the filter with fuel. When changing the fuel filters on the dual Racor filter, the lift pump on the engine must be used to re-prime the system since it does not have the plunger type priming pump found on the single Racor filters. Be sure to open the vent first in order to bleed off the air. Similarly, the engine fuel filter can be filled with fuel by using the lift pump adjacent to the filter. Again, be sure to open the vent at the top of the engine fuel filter in order to bleed off air trapped in the system.

If you run out of fuel or do other repairs that allow air into the injector pump or the injectors themselves you will have to bleed them before you can start the engine. At this point it might be wise to call in the cavalry and watch how this is done. At some point, you should learn how to bleed the fuel system yourself.

*Useful Tip: When underway with your boat on plane the fuel gauge readings may be misleading since the fuel tends to collect at the back of the tank. Bring the boat off plane to get a more accurate indication of the remaining fuel on board.*

There are times when weight distribution on the boat can be uneven and the boat will have a slight list to the heavier side. Since fluids insist on finding their own level, the distribution of fuel will also be uneven. (Please see the more comprehensive discussion about trimming the boat). What is important with the fuel, however, is that if one tank contains more than the other, as the fuel is used up, you could start pulling air into the fuel system from the tank with the least fuel. To avoid this, shut off the tank with the least fuel and wait for things to even out.

### **Cooling System**

As the boat's engine warms up, fresh water coolant is heated and circulated by the water pump to a heat exchanger. Raw water is brought into the boat via a thru-hull fitting and pumped by the raw water pump to the Volvo sea strainer and then the heat exchanger. The sea water carries the engine heat away, eventually delivering it to the water lift muffler and then overboard. Since aluminum and other metals are used in the engine's fresh water cooling system, use an antifreeze with a 7 or 8 metal rating when topping-up or replacing the coolant. It is particularly important that the antifreeze be aluminum compatible, so check it carefully. Volvo coolant is recommended

### **Electrical System**

Like most boats, the Camano has a 12-volt DC electrical system dedicated to the operation of the boat. She also has a 110-volt AC shore power system that provides support for the 12-volt system as well as the optional operation of some of the more power hungry devices on board.

### **Power Panel**

The power panel is located in the main salon, aft of the helm station on the starboard side. Disconnect the shore power if it becomes necessary to open the power panel -- there is a 110-volt AC current open on the back of the panel. The power panel is divided into AC and DC. The AC is located inside the white lines so marked. The rest of the panel is DC. The AC side consists of a main circuit breaker and the other breakers controlling the battery charger, AC receptacles and so on. The DC side consists of a battery switch and a series of circuit breakers that provide power to the various 12-volt components of the boat. For these components to operate, except for the furnace (if so equipped) and bilge pumps, the battery switch must be turned on. A row of switches across the bottom of the panel control the cockpit lights, (the aft cabin light breaker must be on) the running and anchor lights (the navigation light breaker must be on) and, importantly, the forward bilge pump and the engine-room bilge pump, and in new boats, the lazarette bilge pump. It should be noted that the bilge pumps operate on three way switches, "auto", "on" and "off" and should be left in the "auto" position at all times. If for some reason you want to remove water from the bilge before there is enough to activate the float switch, simply push the bilge pump switch to "on" and most of the water will be evacuated. An alarm will sound at the helm stations when either of the bilge pumps is activated.

The panel also has an ammeter that reads out the number of amps being drawn on the 12-volt system at any one time. In addition, a voltmeter, with a three-position switch, gives a direct reading of the state of charge of the batteries. With the switch in the middle position, the voltmeter is turned off but when the switch is pushed to the aft position you get a reading on the state of the starter battery. Pushing the switch to the forward position gives a reading of the house battery (ies). Also keep in mind that the starter battery is wired to a voltmeter in the Volvo panel on the helm. Unfortunately, it isn't as accurate as the one on the power panel.

Two lights on the AC side of the panel indicate correct or incorrect polarity when the system is attached to shore. After plugging into shore power, check and make sure that the green light (correct polarity) is on. If the red light (incorrect polarity) is on, you should check the dock side power connection to make sure it is properly in place. If, having done this, the red light is still on then the dock side power is incorrectly wired and should not be used.

### ***DC Power***

The very early Camanos had a two-battery system consisting of one starter and one house battery. This quickly changed, however, and now the majority of Camanos have a three 12-volt battery system. In these instances, two are house batteries and the third a starter battery. Some boats have a five-battery system (four house batteries and a starter). In all boats, the starter battery is kept separate from the house batteries either by a battery combiner or a battery separator, which despite their names, do the same thing. Suffice it to say, the starter battery will not be affected by continuous use of the DC system while the boat is without shore power. Even if you run your house batteries flat, the starter battery will still be charged and will get you going. The battery switch has been changed to a simple "On/Off" configuration. The switch operates the house batteries as a single bank and is not connected to the starter battery.

If your boat has the optional four-house battery system, the shore power battery charger will be 40 amp instead of 20 amp and there will be an extra alternator mounted on the port side of the engine.

*Useful Tip: Always carry battery jumper cables to enable a start from the house batteries should a starter battery fail.*

### ***AC Power***

AC power is brought into the boat through the exterior shore power inlet located just above the starboard side decks in the proximity of the helm station. Power is distributed to the battery charger, AC outlets, refrigerator, hot water heater and any other 110-volt appliances installed in the boat. Useful Tip: When you are out cruising it is a good idea to have the refrigerator's AC and DC breakers in the "on" position. In this way, the fridge will automatically switch between AC and DC depending on whether you are connected to shore power or underway to your next moorage.

Be careful, however, if you leave the fridge on for long periods of time with the boat unattended. If the boat loses its shore power, the fridge will automatically switch over to battery power and then run your house batteries down to about 10 volts. At this point the fridge will sense the voltage drop and switch itself off. Unfortunately, if the batteries are left in this discharged state for an extended length of time they will be ruined. For this reason, if you must leave the boat for a few days with the fridge on, switch the refrigerator's AC breaker to the "on" position and its DC breaker to the "off" position. Obviously, if you do lose power, the refrigerator will defrost but this is probably better than having the refrigerator defrost and the batteries run down if the boat is unattended for a few days.

### ***Domestic Water***

The Camano carries approximately 67 U.S. gallons of fresh water between two tanks located forward of the fuel tanks on both the port and starboard sides. Each tank is equipped with a shut-off valve that allows for water to be drawn from either tank, which is helpful when trimming the boat. Fresh water is circulated throughout the boat by a single water pump whose circuit breaker (labeled "Water

Pressure") is located on the power panel. There is an additional switch panel in the galley. This panel has a "Propane" switch and a "Water Pressure" switch and provides an additional control for both systems. The water is divided into a hot and cold water system downstream from the pump and both are then delivered to the galley and head. The hot water is produced by the circulation of hot water from the engine through the hot water tank, or by way of a 110-volt immersion coil in the tank when connected to shore power. The immersion heater can be switched on and off by the "Hot Water" breaker on the AC power panel.

*Useful Tip: It is a good idea when underway to turn the galley "Water Pressure" switch to the "off" position. When the boat is on plane, water will accumulate in the back of the tanks. If the tanks are low on water, the water pump will continue running to try to maintain pressure throughout the system. By switching the galley switch to "off", this will save the water pump from running continuously (and potentially burning out).*

## **Head**

Camanoes are fitted with a variety of toilets. Some have a marine electric toilet and a three-way discharge system. Water is brought in via a thru-hull fitting. A second thru-hull fitting for the toilet discharge is located in the same area. Not only is the toilet designed to discharge directly overboard, it can also discharge into a holding tank with an approximate capacity of approximately 14.5 U.S. gallons. Other Camanoes have a manual toilet that empties into the holding tank, and some new models have a Vacuflush toilet that empties into the holding tank. The holding tank, located under the removable decking under the galley steps, takes only toilet discharge and is not plumbed into the grey water system. The tank can be emptied either at a pump out station via the "waste" deck plate (starboard side only) or by being pumped overboard via an optional macerator pump. This pump is fitted with a hold down button and can empty the tank in about 30 seconds or so. The button in early boats is located on the shelf above the pump and on later models at the helm station on the starboard wall. Keep the button pressed until the discharge noise changes. You don't have to worry about adjusting any valves when you pump out the holding tank. It is important that the holding tank and its pump be flushed with fresh water at a minimum of every three months (more often in warmer parts of the world) in order to prevent the pump's impeller from sticking and then cracking when reused. Run some fresh water from the toilet into the holding tank and then press the button on the pump to empty the tank over the side. Finally, when using the toilet it is best to continue to pump out the bowl for about 10 seconds after it is clear. This will ensure that the hoses will always be clear of sewage

*Useful tip: If you operate your boat in sea water, you might want to close the intake valve and use fresh water to flush the toilet. This prevents tiny sea life from getting into the system and dying, creating unpleasant odors. Vacuflush toilets always use fresh water.*

## **PERFORMANCE**

### **Power, Weight and Drag**

Regardless of the engine size, performance is going to be significantly affected by the overall weight of the boat and the condition of her bottom. The best way to find out how these two variables (weight and drag) are affecting your boat's performance is by checking, on a regular basis, the engine's maximum RPM under load. In other words, you are going to have to take her out and, while underway,

run the engine up to full throttle and then read the tachometer to determine the maximum RPM. If you are carrying a full load of fuel and water plus enough spare parts to build another boat, your engine's RPM will be considerably lower than if you were running light. Similarly, if you allow more and more marine growth on the boat's bottom and prop, your maximum RPM will gradually decrease.

### **Maximum RPM**

According to the manufacturer, your Volvo diesel engine can be operated at 10% (approximately 400 RPM) below maximum with no detrimental effect. You must take care, however, because this is where you can run into trouble. This engine is rated for a maximum of 3900 RPM, which you should always be able to achieve in a fully loaded condition and with a clean hull bottom. If you find your engine's maximum RPM to be 3900 at the beginning of the season and run the engine for the rest of the year at 3500 RPM, it is likely that at some point, because of increased bottom growth, your maximum RPM has dropped to something lower than 3900 and you will be over working your engine without realizing it. To avoid this, check out your boat's top RPM once a month and stay a minimum of 400 RPM below it in order to be safe. Remember that this is your absolute upper cruising speed and a limitation that you should not go beyond. Anything below that should be considered your actual cruising speed.

*Useful Tip: If the maximum RPM decreases by 150 RPM or more during the course of a season then it is likely because of (1) a foul bottom, (2) added weight, and, less likely, (3) incomplete combustion (black smoke) or (4) restricted air intake (black smoke).*

It is also worth keeping in mind that as the weight and/or the drag of the boat increases the more performance is negatively affected and the more fuel you will burn regardless of cruising speed. Similarly, regardless of the weight or drag, the higher the cruising speed of your boat, the more fuel it will consume per mile. Obviously, since most things in boating are a compromise, you will have to juggle the three variables (weight, drag and cruising speed) to accomplish your goals.

Given the foregoing, a significant increase in range is easily achieved by making long passages at slow speed. Keep in mind that high speed and long range are mutually exclusive -- if you have one, you can't have the other. If you wanted to increase your range while running on plane, you would have to increase your fuel load, the weight of which would reduce your speed and increase your fuel consumption. Obviously, any attempt to combine high speed and long range will quickly reach a point of rapidly diminishing returns.

If more range is required for the few long runs you wish to make, you are better off to add temporary fuel storage rather than add more permanent capacity. Which brings up another point. If you are not at dock and in the middle of a petroleum-free zone, how do you transfer your extra fuel into the fuel tanks? If you try to fill them from the aft deck with a five-gallon Jerry can, you will have the pleasure of knowing what happens when you pour oil on troubled waters. Instead, use a long hose, fitted with a funnel that will reach from the bridge deck into the fuel tank deck plate openings.

*Useful Tip: There is an area in the engine room above the prop shaft and against the aft bulkhead to secure extra fuel by inserting a plywood shelf. Be sure the fuel is well restrained.*

## **Trimming the Boat**

The Camano was purposely designed to have two fuel tanks and two water tanks symmetrically positioned with one of each as far outboard as possible on the port side and the other two as far outboard as possible on the starboard side. The fuel tanks are connected to each other so that as fuel is used, it is drawn from both tanks equally. The same is true of the water tanks. When the tanks are full, their weight and position in the boat have a marked dampening effect on the boat's roll, which can make for a much smoother ride or evening at anchor. Under ideal conditions this is a great system. When most people go cruising, however, they simply stow all their supplies wherever they can find space, fill up with fuel and water and get underway. Not much thought is given to how things are stowed or how the boat will sit in the water. It doesn't take long, however, for a noticeable list to develop as fuel and water begin to be used and everyone sits on the port side to have dinner.

Since the fuel and water tanks are positioned as far to port and starboard as possible their fluid levels can be noticeably affected by shifts of weight in the boat. Consider this: when the captain and first mate sit on the port side to have dinner, their combined weight will tend to lower that side of the boat. This means that the fuel and water tanks on the port side are lower than the fuel and water tanks on the starboard side. Given that fluids always seek their own level, water and diesel fuel will flow over to the port side just to even things out. When the captain and first mate get up from dinner the list remains. They could spend the rest of the evening sitting on the starboard side in order to get the fluids to run back, but more often than not they spend the rest of the trip at a slight angle. If, as a Camano owner, you want to avoid a permanent crick in your neck you should trim the boat to keep it on an even keel.

Each of the four tanks has a shut off valve that allows you to choose which tank will be the one to provide you with fuel or water. As an example, suppose you are sitting at anchor and the boat is listing to port. Shut off the starboard water tank and use only the water in the port tank. As the water is used up, the port side will become lighter and the boat will begin to right herself. As the boat rights herself the fuel in the port fuel tank will begin to transfer back over to the starboard tank and eventually the boat will be level. Obviously, you can trim the boat underway by closing off the fuel supply from the tank with the least fuel and drawing only from the fuller tank. You could even go one step further and close the fuel return valve to the fuller tank so that you would be drawing from one tank and returning to the other. Be careful when doing this because you could overfill one tank and pump fuel overboard through the vent.

*Useful Tip: If the foregoing discussion of the art of valve manipulation caused your eyes to glaze over consider this way of trimming your boat. Leave the fuel valves untouched (open). Close one water tank. Keep the boat trimmed by alternating the water tanks about every one-third of their capacity. It may not be pretty but it works.*

## **BOAT HANDLING**

If you are unfamiliar with the single drive/bow thruster system, welcome to the ultimate in boat maneuverability. With this combination, you have total control over both the stern and the bow. This means that, in effect, you can move your boat sideways allowing you access to moorage spots you might otherwise pass-up. The procedure is simple but worth practicing until you get the hang of it. For example, suppose you are coming in for a starboard docking and have maneuvered yourself into a position parallel to the dock but still 3 feet away. Even if the boat has no way on, you can still easily

put her right up to the dock. Put the wheel hard over to port and leave it there. You can then bring the stern in toward the dock by moving the boat ahead. If you have little room to maneuver, take off forward way and put the boat astern to regain your position. Putting on forward way again will bring the stern even closer to the dock. If you keep going ahead and astern in this manner the boat will come snugly up to the dock. The bow thruster, of course, is used judiciously to bring the bow alongside also. Obviously, you would use the opposite procedure when doing a port side docking.

As is often the case, docking can involve variables that cause your eyes to widen. If a wind or current is pushing you off the dock you will have to move the throttle to a setting somewhat higher, but no more than 1000 RPM, in order to overcome the opposing forces. Be aware when doing this that repeated shifting in and out of gear at engine speeds above 850 RPM puts the transmission under considerable stress.

*Useful Tip: The Camano is generally set up to dock on the starboard side. The starboard helm station allows for good visibility, the shore power receptacle is easily accessible, and the left-hand prop tends to draw the stern into the dock.*

Leaving the dock is also greatly assisted by the bow thruster. If you have lots of room, put the rudder amidships and use the bow thruster to bring the bow away from the dock and then put on forward way. Take care when leaving a starboard docking that you do not have the rudder to port since this will swing the stern (and the swim grid) into the dock. Obviously, the opposite is true if you had a port side docking.

If you are moored on your starboard side with precious little room for maneuvering away from the dock, you can do so by using the opposite of what you did to put it against the dock. Turn the wheel to starboard and then use the power forward and reverse procedure along with the bow thruster. The boat will move sideways to port. This is also useful when the wind or current is moving you toward the dock.

*Useful Tip: It takes six complete turns of the wheel to move the rudder from starboard stop to port stop. To put the rudder amidships, simply rotate the wheel three complete turns from either hard-over port or starboard.*

In addition, to docking and undocking, the bow thruster is of enormous help when backing the boat down a dock finger or into a berth. Simply put the wheel amidships, put the boat underway slowly astern and use the bow thruster to steer. You can even steer the boat in a forward direction simply by leaving the wheel amidships and using the bow thruster. Operate the bow thruster in short bursts - once started, the bow coasts sideways.

Over and above its stability and sea worthiness, the Keelform Hull offers the ability to operate easily and efficiently at any speed from dead slow to full plane. And that, in rough weather, makes boating a lot safer and much more fun. As a general rule, when underway in rough weather, it is often most comfortable to maintain a speed somewhere in the range of 10 to 12 knots. This speed lifts the bow and improves stability considerably more than that experienced at 8 knots. Increasing the speed to more than 12 knots will further improve stability but this can reduce comfort if you are pounding into head seas. It is probably best to find your own level of comfort when traveling in head or beam seas but it

will usually be around 10 knots or higher. In following or quartering seas you can use the whole range of speed capabilities of the boat to "time the waves". In these conditions it is best to try and run in the wave trough but if the wave period is such that your speed is not compatible, then the safest alternative is to slow down. When running on plane in a following sea, concentrate all of your attention on wave conditions. Sometimes you can appear to be progressing along very comfortably while being quickly overtaken by a wave from behind that could cause your boat to broach.

## START-UP

### Before Leaving the Dock

Over the years, most boaters develop a routine that they always follow when they are getting ready to leave the dock. The same is also true for when they are underway or returning to port. Since every boat is different, we thought we would be presumptuous and include a list of dockside tasks that we think should be included in every Camano owner's routine.

#### *Engine*

- ? engine oil check
- ? thru hull open
- ? coolant level OK

#### *Electrical*

- ? shore power cord off and stowed
- ? batteries switch on
- ? bow thruster switch on
- ? fuel gauge check
- ? fresh water pump off
- ? bilge pumps on auto
- ? propane alarm on

#### *Hull*

- ? V-berth hatch closed
- ? hull port lights closed
- ? cabin port lights closed

Some of the foregoing are pretty obvious, some less so, but they are all important. As an example, if you were running the boat with only 5 or 6 inches of water in the tanks, it is quite possible that as the boat comes up on plane, the water will run to the back of the tanks leaving the lines to the water pump dry. The pump, not sensing any pressure, will switch on and will continue to run until the boat comes down from plane. At this point, water will re-enter the hoses, pressure will come up to normal and the pump will switch off. You will never hear the water pump over the noise of the engine and you will never know that you have been running a dry pump for however many hours you have been running the boat. Similarly, if you operate the boat with the hull port lights open you will be assured of an uncomfortable berth that night. More importantly, however, if you are on the bridge and the hull port

lights are open you could go a long way to swamping the boat before you became aware of the problem.

### **Getting Underway**

For most of us, pulling away from the dock brings another set of tasks. Here is our list.

- ? secure all lines
- ? fenders in board and secured
- ? transom gate closed
- ? salon door closed
- ? close salon windows when on the bridge
- ? key in bridge ignition when on the bridge

Even in hot weather it is a good idea to cruise with the salon door closed. The forward movement of the boat sometimes creates a low pressure area in the cockpit and diesel fumes and salt spray can render the aft curtains somewhat grimy by the end of a boating season. Interestingly, leaving the aft window open doesn't seem to have the same negative effect. Having a key in the bridge ignition switch when you are operating the boat from up top is also a good idea. It saves a mad scramble down to the main salon if you ever have to shut the engine down in a hurry.

## **GENERAL MAINTENANCE**

Although the Camano was designed to allow you to spend your time cruising, there are some tasks that can't be avoided.

### **Hull**

Where possible both during and after a cruise, take a few moments to hose down the boat with fresh water. The simple fact is that salt is highly corrosive and, over time, will mar the gelcoat and every other part of the boat. Hosing the salt off will go a long way to save rebuffering the boat's surfaces in order to bring back the shine. When hosing the boat, avoid directing water into the engine air intake vents (the rectangular flush cover on the upper hull side in the area of the aft cabin bulkhead) and the wiring cover on the bridge. This is also a good time to make sure that the roof drains and the deck and hatch (lazarette) drains are free of leaves or other debris. Also, it wouldn't hurt to check and make sure that the drains in the anchor locker are not plugged. The same applies to the limber holes in the engine room. A good waxing at least twice a year is more or less mandatory and regular washing not far behind. When you wash the boat try to avoid using detergents -- they take off the wax. You will save yourself a lot of work if you use washing compounds that contain wax, such as Turtle Wax Car Wash. In high UV areas, such as the Southeast, the Mid-Atlantic states, Texas and Southern California, it is advisable to increase your wax and wash routine to 3-4 times per year.

The rub rails are easily cleaned with acetone, which has recently been declared benign to the environment, but you have to work quickly. Pour a little acetone onto a cloth, wipe a small section of the rub rail and then polish that same section with a clean cloth. Once the rails are restored to their original shiny black finish, protect them with a Teflon wax.

*Useful Tip: Be careful when using acetone -- it softens gelcoat if left on too long. Stains can be problematic but we have found that Kleen Glo works well. This is a mildly abrasive compound so you have to be careful when using it.*

Whenever you drill a hole in the hull, i.e., when fitting canvas, etc., always be sure to seal the hole in order to prevent water getting into the core of the structure.

### **Gelcoat Repairs**

It seems that no matter how hard you try, you cannot avoid scratches to the gelcoat. Fortunately, repairing these blemishes is not all that difficult. Each boat is shipped with a can of gelcoat which should be stored out of direct light at a cool, constant temperature. It will have a shelf life of about a year. It is important to remember that the gelcoat is not simply painted on over the scratch or nick. It must be mixed with a catalyst, applied to the surface and allowed to cure and then sanded down to a finish. The sanding is done with a block with progressively finer grits of sandpaper starting at about 180 to take it flush to the surface and then progressing through about 200 grit stages before ending with about 1000 grit wet/dry sandpaper. Once it is sanded down it can be finished with polishing compound and a thorough waxing. If you are not familiar with the process, however, it might be best to hire a professional and get him to show you the catalyzing and sanding procedure so that you will be well prepared for any future attempts.

### **Windows and Plastic**

Windows seem to be particularly difficult to clean and keep clean in a marine environment. It doesn't seem that products such as Windex do all that much. Methyl hydrate in a spray bottle sometimes works. It is probably best, however, to use a mild soap solution on the windows and clean it off well when you have finished. When you are out cruising, it might be easiest to remove salt spray from the windows by rinsing them with fresh water rather than trying to use some cleaner.

There are some good products around for cleaning plastic, the bridge windscreen for example, and one in particular is Novus Plastic Polish No. 1, which can be obtained from most plastic supply stores. Alternately, your dealer can recommend a product that works well in your area.

## **SCHEDULED MAINTENANCE**

Every Camano comes complete with manuals that cover every piece of equipment on board. That includes the engine. Please read the engine manual, especially the regular maintenance part to determine exactly what the manufacturer recommends. What we are including here is a suggestion about scheduled maintenance that might be of some help in the practicalities of operating and maintaining your boat.

**NOTE: The engine must be serviced and inspected by an authorized Volvo dealer between the first 20 and 50 hours of operation in order to validate the warranty.**

### *Daily Check*

- ? Engine oil level
- ? Coolant
- ? Sea water filter Bilge for oil or water
- ? Racor filter bowl for water

### ***14-Day Check***

- ? Check for water in Racor fuel filter
- ? Electrolyte level in battery (if lead-acid)

The rate at which battery electrolyte goes down is almost directly proportional to the number of times the battery is cycled (discharged and recharged). If cruising for you means spending most of your nights at anchor where you rely on your house batteries for power, then you will cycle your batteries much more often than those of us who spend our time connected to shore power. Whatever your practice, pay attention to the electrolyte level of the batteries and you will soon come to know how often you need to top them up. And remember, use only distilled water when you top up the batteries -- they will last longer. AGM batteries are sealed and maintenance-free.

### ***100 Hour Service (or every six months)***

- ? Change oil in engine and change oil filter

### ***200 Hour Service (or every year)***

- ? Check valve clearance
- ? Check and/or replace V-belts
- ? Change air filter
- ? Check cooling system
- ? Check battery terminals
- ? Change engine fuel filter
- ? Change Racor fuel filter (You may find it necessary to change the Racor filter element more often if you suffer from poor quality fuel.)

### **Spare Parts**

It is a good idea to carry a full set of spare parts whenever you go cruising. Having a spare raw water strainer to replace the one you dropped overboard when cleaning it, can make all the difference between a successful trip and a frustrating wait in the middle of nowhere. Here is our list:

- ? Deck plate cap
- ? Engine fuel filter
- ? Racor fuel filter
- ? V-Belts
- ? Raw water impeller
- ? Raw water strainer
- ? Thermostats

## **TROUBLESHOOTING**

Although we pride ourselves on the quality and reliability of the Camano, things can sometimes go wrong. If something should happen, check out the following suggestions -- they are by no means complete but they may be of some help.

Our suggestions below will be too little for some and too much for others. Choose your level of technical comfort when you start trouble shooting and try to avoid things that might cause you to reach for Roloids. Boating is supposed to be fun.

### **Use Caution When Cranking**

The engine and oil cooling system used in the Camano is not unlike the system used in most boats having inboard engines. Raw water is brought into the boat via the thru-hull fitting at the forward end of the engine. This water travels through a series of heat exchangers (oil, transmission, turbo, fresh water, etc.) before passing through the exhaust manifold to the water lift muffler and then overboard. Importantly, the raw water not only cools the engine, it also cools the exhaust gases and, along with the water lift muffler, suppresses exhaust noise. The pressure from the exhaust drives the water up a pipe in the water lift muffler (hence the name) and then overboard. What you need to keep in mind is that: raw water can only be discharged overboard by the exhaust of a running engine. This means that if you are cranking the engine without the engine starting, you will be pumping raw water through the engine and you will start to fill up the water lift muffler. Once full, the water will then begin to fill the hoses feeding the water lift muffler. Eventually, if you keep on cranking the engine, the water will back up until it reaches the exhaust manifold. If the water gets into the manifold and if any of the engine exhaust valves are open (and some of them will be), water will enter the piston cylinder. As the engine turns over, the exhaust valve will close, the engine will come onto its compression stroke and disaster will strike. You will either bend one or more connecting rods or break the crankshaft.

**IF THE ENGINE WILL NOT START, NEVER CRANK IT FOR MORE THAN A COMBINED TOTAL OF 30 SECONDS WITHOUT CLOSING THE RAW WATER INTAKE. ONCE THE ENGINE STARTS; IMMEDIATELY OPEN THE RAW WATER INTAKE.**

### **Failure to Crank**

- ? Dead Battery
- ? Loose battery cable or ground wire
- ? Faulty ignition key switch
- ? Jammed starter motor
- ? Open circuited starter motor
- ? Solenoid defective
- ? Seized engine
- ? Water in the cylinders

*Useful Tip: OK, the last two are only remote possibilities but they do exist. If you draw a complete blank (absolutely nothing happens) when you turn the key, you might try shorting something, i.e., a screw driver, across the solenoid at the starter, which may get you started by bypassing the switch and the rest of the wiring. Make sure the transmission is in neutral before trying this. Overall, however, unless you are really familiar with starter motors, solenoids and DC circuits, best to call someone who is. You could exchange the starter battery for one you know is fully charged or use your jumper cables from the house batteries, but apart from that it might be best to stay off uncharted waters.*

### **Failure to Start**

- ? Fuel tanks empty
- ? Fuel tank valves closed

- ? Plugged Racor fuel filter
- ? Plugged engine fuel filter
- ? Air in fuel lines
- ? Engine cranks too slowly
- ? Engine too cold
- ? Plugged air filter

If the engine refuses to start as it normally does, stop trying and assess what is going on. If you keep on cranking in the hope that the engine will suddenly spring to life, it is likely that you will kill the battery before your dreams come true. Take a few moments to check some of the more obvious causes. If the engine will only crank slowly, the chances are that the battery is low or the terminals need cleaning. If it has been really cold and the boat has been without heat, it could be that the compression temperatures are too low to cause the fuel to ignite. Try warming up the boat, or at least the engine if auxiliary power is available. And remember, starter fluids can be deadly to pistons and connecting rods, so if you must use them, do so sparingly. In terms of probabilities, however, the most likely cause of the engine not starting would be electrical -- the battery, the starter, etc. The second most likely cause would be air in the fuel system.

### **Poor Starting**

- ? Plugged Racor filter
- ? Plugged engine fuel filter
- ? Dirty fuel
- ? Poor fuel quality
- ? Plugged air filter
- ? Battery low

Without repeating all of the above, it is most likely that problems of poor starting arise out of an insufficient fuel or air supply to the engine. And of those two, it is most likely a problem with the fuel. Check to make sure that the valves at the fuel tanks are open and that you have plenty of fuel on board. Follow the fuel lines from the tanks to the Racor fuel filter to make sure there are no leaks (you will probably be able to smell the diesel fuel if a leak exists). If a leak exists, then air can be introduced into the fuel system disabling the fuel injectors. Check the Racor filter and drain if necessary. Check the lines to the lift pump, the engine fuel filter and the injectors. If air has been introduced into the fuel system, you will have to bleed the injectors before they can do their job.

Make sure that the fuel-return lines are OK and that the return line valves are open.

### **Engine Smoke**

In this day and age, marine diesel engines produce a clear exhaust. There really shouldn't be any visible smoke coming out of the exhaust when you are underway. Obviously, there is an emission of blue-grey smoke associated with engine start-up but this clears up quickly. And, as everyone knows, that trail of white smoke that follows you as you are motoring along is actually condensation that disappears in less than 50 feet of travel. If you experience unusual and persistent smoke problems, check some more.

### ***Black Smoke***

- ? Dirty fuel
- ? Poor fuel quality
- ? Plugged air filter
- ? Engine overload (i.e., rope in prop)

Black smoke occurs from the incomplete combustion of fuel. If your engine is emitting a little black smoke while you are underway, then it is probably time for a good servicing. If black smoke persists when the engine is no longer under load, consider yourself under notice to have it checked immediately.

### ***Blue Smoke***

- ? Worn or stuck piston rings
- ? Worn valve guides
- ? High crankcase oil level
- ? Elevated oil pressure
- ? Turbo charger problems

Blue smoke occurs when the engine's lubricating oil is burned. This means that somehow and somewhere oil is entering the combustion chamber in a manner not intended. You may need help on this one.

### ***White Smoke***

- ? Defective fuel injector
- ? Cracked cylinder head
- ? Leaking head gasket

White smoke usually occurs in conjunction with a poorly running engine. Mostly it will be caused by water in the combustion chamber as a result of a leaking gasket, cracked cylinder head or the like. It can also be caused by unburned, atomized fuel in the exhaust when a cylinder fails to fire. Remember, however, that condensation in the exhaust is normal, particularly in cool weather. The idea here, of course, is to make a mental note of what is normal and keep an eye out for the unusual. If the engine is purring and the readings are all normal, you have nothing to worry about.

### **Overheating**

If your engine overheating alarm sounds, immediately check your temperature gauge. If the reading is normal then in all probability you have an alarm sending unit problem. In this case, you can continue on your way and replace the unit at the first opportunity. You can deactivate the alarm by removing the electrical connection attached to the sending unit. If, on the other hand, your temperature gauge is above normal then you have an overheating problem. Immediately shut down the engine. Then, the first thing to do includes checking out some of the more likely causes, such as the closed seacock or insufficient coolant. If nothing is immediately obvious, check to make sure that the raw water system isn't plugged by checking for water being discharged through the exhaust at the transom. If you find water in the engine bilge you are likely to have a leak in either the fresh or raw water cooling system.

You can usually determine from which by the type of coolant in the bilge. If all else fails, a taste test will tell you if it is antifreeze or raw water. Possible causes:

- ? Closed sea cock
- ? Coolant level low
- ? Oil level low
- ? Defective raw water impeller
- ? Defective engine coolant pump
- ? Plugged raw water filter
- ? Defective thermostat
- ? Blown head gasket
- ? Engine overload
- ? Faulty temperature sensor

### ***Fresh Water System***

Check to make sure that you have a sufficient amount of coolant in the engine. Each Volvo engine has a coolant expansion chamber and you should be able to see some coolant in the bottom of the plastic expansion tank. If the coolant is down enough to cause the engine to overheat it probably means that you have a leak somewhere and you should check this out. It is possible that the leak is slow and could have been going on for some time before the level dropped to the point where the overheating alarm was activated. Indeed, there may be no sign of coolant in the bilge if the leak was small enough that the coolant was being evaporated by a hot engine before it could drip into the bilge. In the case of a very slow leak, you can probably top up the coolant and return to port without difficulty.

*Useful Tip: If the leak is not major you might want to consider adding a coolant sealer to the fresh water cooling system. This will often keep things dry for a long time but you should keep a close watch on the trouble spot. Have proper repairs done if further leaks show up.*

If fresh water coolant has collected under the engine it could be because of a significant leak and you should carefully check the engine where parts are joined by a gasket or an 'O' ring, as well as the engine water pump and all associated hoses.

### ***Raw Water System***

Salt water (fresh water on rivers and lakes) is brought to the engine through a hole in the bottom of the boat. On some Camanos, that seawater intake is protected by a basic strainer. There is a pump at the forward end of the engine which pushes the water through a more elaborate raw water strainer, several heat exchangers (engine oil cooler, transmission oil cooler, turbo air after cooler, the engine water cooler, and turbo water jacket) and then on to the water lift muffler. The engine exhaust then pushes the raw water through the exhaust pipe and back to the sea. If there is raw water in the bilge, follow all of the hoses from the thru-hull all the way to the water lift muffler for possible leaks.

Overheating can be caused by a blockage at the raw water intake (seaweed or a plastic bag etc.), a failed impeller, a failed pump, or a blockage of the sea strainer. Checking the sea strainer is easy. So is checking the impeller. Take off the impeller cover plate (being very careful not to damage the fragile paper gasket) and make sure the rubber impeller isn't broken or torn. If it is, replace the impeller. That's why you carry a spare. If the sea strainer and impeller are fine, then you might want to check the raw water intake. Check to see if you can close the ball valve. If you can't then the odds are you have

something in the hose. You can haul the boat and check it from the outside or take off the hose right where it attaches to the pump and see if you can probe for foreign objects. Keep in mind that the pump is just about at sea level and that lowering the hose will cause sea water to come flooding in once you have removed the blockage. In areas of active marine growth such as barnacles or Zebra mussels, it is possible for enough of these invaders to grow inside the thru-hull, seacock or the hose to cause reduced water flow. Sometimes, the reduction is severe enough to cause an overheating situation. If this happens while underway, and you are sure that this is the cause, you can generally operate the boat at lower RPMs in order to make it to shelter. After that, it is either a diving session for you or to may prefer to hire the services of a local diver to sort things out. If you are still having problems, it might be best at this point to call your favorite mechanic.

### **Loss of Power**

- ? Plugged Racor fuel filter
- ? Plugged engine fuel filter
- ? Air in fuel lines
- ? Dirty fuel
- ? Poor fuel quality
- ? Plugged air filter
- ? Overloaded engine (i.e. rope around the prop)

Surprisingly, there are some mechanics out there that are not aware that the Volvo engine has an engine fuel filter located close to the lift pump. It is important that this filter is changed at least every 200 hours and you should make sure that it is done. In addition, it is important that you carry spare elements for these filters and that you know how to change them yourself. If you have a mechanic do the servicing it's a good idea to watch him change the filters at least once. The fact is you could easily take on bad fuel and not know it until too late. If this should happen, your first indication will be when the engine RPM begins to drop while underway or where the RPM keeps rising and falling without the throttle lever being moved. If this should happen to you while you are out cruising, you should be able to make it to an anchorage or dock at reduced speed where you can safely make the necessary changes. Obviously, if this happens to you, it will be necessary to change the filter much more frequently than the recommended 200 hours. In order to avoid tainted fuel, always try to fuel at known stations or at least busy ones that don't have fuel stored over long periods of time.

### **Low Oil Pressure**

- ? Low oil level
- ? Wrong viscosity oil
- ? Diesel dilution of oil
- ? Defective pressure gauge

If the low oil pressure alarm is activated or the pressure gauge shows nothing, shut the engine down immediately. There is only one reason for ignoring this advice -- you are in the middle of Heart Attack Narrows and at immediate risk of dying. Don't ever assume that there is something wrong with the alarm -- the damage you can do to the engine is massive. The most common cause for the loss of oil pressure is a lack of oil. (You did check the oil before leaving, right?) Another cause could result from fuel somehow finding its way into the oil and diluting it. This not only results in the dilution of the oil but the oil level can visibly rise when checked on the dipstick. If the problem is not immediately

obvious and easily remedied, get on the radio and get some help. Most of the other causes for your problems are internal mechanical failure.

### **Rising Oil Level**

- ? Diesel dilution of oil
- ? Blown head gasket/cracked head
- ? Water in cylinders

### **Loss of Steering**

If you suddenly lose steering, the most likely cause is a loss of hydraulic fluid. Fortunately, this rarely happens, and even if it does, you can take steps to at least temporarily remedy the problem and get back to port safely. If you have lost hydraulic fluid, it is almost certain to have occurred because one of the hydraulic line fittings came loose. The fittings are located behind the bookshelf on the starboard side of the salon. Other fittings are at the helm pumps, the autopilot pump (if installed as an option on your boat) located in the forward, starboard engine room (or behind the power panel on some boats), and the steering ram in the lazarette. Locate the loose fitting (there should be fluid all around it) and tighten it to make sure the system is no longer leaking. Fill the helm pump with the proper hydraulic fluid if you have some on board. If you don't, you can use engine oil or even water. Believe it or not you could even use the air in the hydraulic system to steer the boat. It will be very mushy but it will work and you will be able to maneuver if you take your time. If you use something other than the proper steering fluid you should replace whatever you have used with the proper hydraulic fluid (as recommended by the manufacturer) as soon as possible. If the incorrect fluid is left in the steering system the seals will eventually give up the ghost and you will have a major expense on your hands. Once in port, call the manufacturer and find out the correct procedure for flushing out the steering system and replacing the fluid.

### **Water in the Bilges**

Every Camano is equipped with an automatic pump in the engine bilge directly below the shaft ahead of the shaft seal. A second pump is located beneath the holding tank that is covered by removable decking underneath the galley steps at the galley deck level. Newer boats have a third pump in the lazarette.

#### ***Engine Bilge***

Invariably, water in the engine bilge is the result of leakage through the screw down cap on the raw water strainer. All Volvo engines installed in Camanos have the raw water strainer sitting just above the raw water pump at the forward end of the engine. When the cap is replaced after cleaning the strainer, it must be snugged down by hand until it is as tight as possible otherwise it will leak. You will really have to lean on it if you want a dry bilge.

*Useful Tip: Use a little Vaseline on the threads and the top sealing surface of the raw water strainer in order to get a better seal.*

If you find salt stains around and below the strainer, they are most likely from a leaking cap and not because of a problem with the water pump. Clean up any salt, double check that the cap is really tight and check again later. If the problem persists, you may have to replace the strainer or have the pump assessed.

### ***Hot Water System***

Water can also collect in the bilge and around the stringers in the area of the hot water heater (port side at the forward engine room bulkhead). A removable plastic container (port side against forward engine room bulkhead) is used to catch the overflow from the domestic hot water pressure relief system.

*Useful Tip: If you spend most of your nights in marinas or use the boat for day trips, you can eliminate the overflow of water from the hot water heater by turning off the water heater valves on the front of the Volvo engine. These valves are attached to red hoses that circulate the engine coolant through a heat exchanger in the water heater, thereby heating the water. If you have these valves closed and later decide you will need hot water, open the valves at least 45 minutes prior to reaching your anchorage. This provides sufficient time for the water to heat.*

### ***Shaft Seal***

Camano's are fitted with a dripless shaft seal and have dry bilges. Condensation can account for small amounts of water in the bilge. This is normal and should not be a source of concern.

### ***Shower Pump***

A shower pump has been installed which discharges shower water overboard without allowing any into the bilge. This pump is controlled by a switch outboard and below the mirror in the head. It can be run dry for short periods, so you can turn it on just before showering and off when you finish. This switch, by the way, gets its power from the breaker on the electrical panel marked "Head."

### ***Domestic Water***

A leak in the domestic water system, if it occurs, should be fairly obvious although it can occur anywhere lines are fitted. If the water pump runs continuously or cycles on and off when no water is being used then you have a problem. If the pump is turned off, you won't know about a leak until you find things floating. In most instances, however, leaks will appear at the tubing connections and can often be fixed by tightening the fittings. It is unlikely that the lines will burst should they freeze -- the tubing and fittings are made of a plastic that will accept some expansion. Freezing can happen, however, and steps should be taken to prevent this during the winter months.

## **SPRING HAULOUT**

This is the one time of the year where you have a chance to go over the boat, give her a detailed inspection, and get her ready for the coming season. If, like the boats of most Camano owners, yours is in the water year round, it would probably be a good idea to haul her after the initial growth spurt of most marine life that occurs in early spring. If you wait for the initial flurry to be over you will have fewer bottom fouling problems for the rest of that boating season.

### **Haul-out**

If your boat comes out of the water hanging on slings under a Travel Lift or a crane, it is important that the slings be properly positioned. There are decals showing exactly where the slings should be placed but in case yours came off this is what you do. The sling under the bow is placed under the V-berth bulkhead. This bulkhead is in line with the second bow rail stanchion counting the first stanchion as the one closest to the head and galley port lights. The stern sling is placed under the main door (salon)

bulkhead. Care should be taken to make sure that the sling does not go aft of this bulkhead otherwise it would catch the wrong part of the keel.

### **Block and Pressure Wash**

Once out of the water, the boat should be put on blocks so that she is level. If she sits with the bow down, the bridge deck could collect water that could get into the wiring. As soon as the boat is on blocks, pressure-wash the bottom to clean off all the marine growth. Don't leave the pressure washing to the next day -- once the bottom dries, the growth is much more difficult to remove.

### **Bottom Paint**

Once the bottom is clean and dry you can get ready to apply the paint. Make sure that all flaking paint is removed and then take the time to lightly sand the bottom. Do not sand into the gelcoat -- just abrade the surface.

### **Zincs**

Once the bottom painting is finished you can replace the zincs. Zincs are normally found behind the bow thruster prop, on prop shaft, skeg and transom. Be sure the zincs are attached to clean metal and not against freshly painted surfaces. It is not unusual after a year in the water to find the zincs totally gone. This is particularly true if you are moored in an electrically "hot" marina where stray electric currents eat up zinc at a high rate of speed. It may be that you should keep a close eye on the zincs, the one on the transom being most visible, and replace the zincs even if you are not due for your annual haul-out. You could also put on bigger zincs but this may not always be practical. To make sure that your zincs are doing their job you should also check the bonding system. The green wires throughout the boat are bonded to the engine and everything under water. You can easily check the bonding with a multimeter to make sure that there is electrical continuity between the various components. If there is a break in continuity, then you have to check for a loose connection, corrosion or some other cause.

*When replacing the shaft zinc be sure that the zinc is tightly against the propeller in order to allow at least 3/16 of an inch between the zinc and the cutlass bearing. The potential problem here is that as the engine RPM increase, the engine and the whole shaft tend to move forward slightly because of the increased torque. If there is insufficient space between the zinc and the cutlass bearing, the zinc will begin to chew away the fiberglass where the shaft exits the keel.*

### **Steering**

Every spring you should give your steering system a quick once over and check the steering fluid levels just to make sure that everything is in good shape. Start with the upper helm pump if your boat has a flybridge (Troll) and simply remove the knurled fitting on the pump. You should be able to see fluid. On the Gnome, check the pump at the main station helm. On Trolls, never remove the lower helm plug in order to check the fluid level. Doing so will drain all the fluid from the upper system onto your carpet. Be careful not to turn the wheel while you are doing the inspection. If the fluid level is up to the base of the opening then all is well and you don't have any leaks. If the fluid is down you should check all of the hydraulic fittings to see if any are weeping. If you find one, tighten the fitting, clean it off, and be sure to check it again once the boat is back in the water. Even though you have probably found the culprit, it's a good idea to check the rest of the connections just to be on the safe side. Fittings are located behind the bookshelf on the starboard side of the salon, on the helm pumps, and the steering ram in the lazaretto. If the boat has an autopilot you will have fittings at that pump also.

## WINTERIZING

In the Pacific Northwest and South, cruising is a year-round activity. We are fortunate that only minor adjustments have to be made to cope with most winters. If you plan to leave your boat in the water and use it whenever the weather permits there are a few things we think you should do in order to keep your boat in prime condition.

### Year Round Boating

Generally speaking, there are only a few precautions you need to take to keep all the boat's systems operative. If moored in colder climates while the boat is at dock it is a good idea to use electric heaters to prevent freeze up. Simple 100 watt heaters can be placed under the forward end of the engine, the aft end of the engine (with particular concern for the after cooler and transmission cooler), the head and the galley (under the sink) leaving all of the doors open. It is also a good idea to place one of these heaters near the water lift muffler (in a pinch light bulbs will do the job but they are not as efficient and are far less reliable) which usually has about 3 inches of water sitting in the bottom.

Whatever way you do it, make sure that unnecessary appliances are switched off before you leave the boat. If, for example, you leave the hot water heater on it will cycle on and off, along with the heaters you have installed, and if together these draw more power than the shore power circuitry can handle, the breakers will shut down everything and you will be without any shore power.

Keep in mind that the foregoing is the minimum you should use in areas where it can go below freezing. If you have ample and secure shore power you may wish to supplement your heaters with thermostatically controlled electric heaters.

If your boat has an air conditioner, you may want to winterize that. Simply remove the water intake hose from the strainer, and pour non-toxic (pink) antifreeze through it with the air running. The antifreeze will be pumped through the system and out the thru-hull on the port side. Shut the system down and reattach the hose to the strainer.

If your boat has a cockpit shower, it is a good idea to drain it for the winter (if in a colder climate) while still leaving the rest of the domestic water system fully functional. Find a container to catch the water you are about to drain and then disconnect the grey plastic pipes where they "T" into the pipes under the galley sink. Have a helper open the taps at the shower while you hold the container to catch the water that drains out of the shower system. Now close the stop valves that feed the "T" connection and reattach the tubing. In the spring you need only open the stop valves and you are ready to go. If you are in an area that regularly loses power during winter storms (or for reasons not readily obvious to the untrained observer), you may wish to fully winterize your boat just to be on the safe side.

### Winter on the Hard

If you plan to haul the boat for the winter and you will be around to keep an eye on it, you should be able to maintain it in much the same fashion as when it was in the water. The main difference here is that the boat will not be in the relatively warmer water when temperatures plunge. That being the case, it is probably a good idea to drain the domestic water system, install the heaters as suggested above and remember to check the boat frequently.

## **Winter on the Hard (in really cold places)**

If you plan on leaving the boat in very cold climates or are unable to check it periodically, you might want to take some extra steps to safeguard your investment. Most importantly, you should prevent your boat from freezing up by draining all of the water on the boat or by replacing it with antifreeze. There are three systems you need to protect: the engine; the domestic water; and, the head. Plus the air conditioner, if you have one.

### ***Engine***

Check the engine's internal coolant system (fresh water system) to make sure it is protected to well below the expected low temperature for your part of the country. Replace the coolant with an appropriate antifreeze mixture if there is any doubt about its ability to resist freezing. Next, the raw water (seawater) system must be purged and the contents replaced with antifreeze. To do this, recruit two helpers and tell them as little as possible. Place one end of a hose in a large bucket filled with antifreeze and the other end snugly against the raw water intake fitting in the hull (haul the boat first). Place one helper at the exhaust outlet at the transom with a bucket to catch the antifreeze and the other helper at the helm to start the engine. Once the antifreeze starts to appear at the exhaust, shut down the engine. The engine and the rest of the cooling system are now protected.

At the engine water feed to the shaft seal, clamp off the hose with a vise grip to prevent the antifreeze from running out the shaft. Use 2 thin pieces of wood to avoid the jaws of the vise grip damaging the hose.

When first starting the engine again you will be pumping this antifreeze out the exhaust. In order to prevent releasing the antifreeze into the environment, it may be easiest to purge the system by using the same procedure prior to launching, only pumping fresh water through.

### ***Domestic Water***

If you decide to drain the water, use the domestic pump to remove as much as possible. Disconnect the supply lines attached to the tanks, disconnect the lines to the pump and open all faucets. Run the pump for a short period to empty all water and then drain the hot water tank. A wet/dry vacuum cleaner is very handy for this task. If that sounds like too much trouble, you can replace all the water with a potable type of antifreeze. First, drain the tanks by opening one or more faucets. Shut the faucets and then pour enough potable antifreeze into the tanks to more than fill the hot water heater, which has a capacity of 6 U.S. gallons). Open each faucet, one at a time, both hot and cold, including the cockpit shower if you have one, and close them once the antifreeze appears. Remember that if you fill the system with antifreeze, you have to drain it and flush the system with fresh water before you start cruising again. Even though the antifreeze is potable, some people find that they can taste it forever after. If that is the case on your boat, best to drain the system.

### ***Head***

To winterize the toilet and pumpout system that has a Y valve, refill your bucket with antifreeze and get your recruits back on the job. The recruit who started the engine earlier, now gets to stick one end of a hose in the bucket and the other against the toilet intake fitting in the hull (the smaller of the two fittings on the hull bottom). The volunteer from the transom now operates the toilet, drawing antifreeze into the system. Turn the Y valve to the holding tank position and direct antifreeze into the tank. When you have enough antifreeze in the tank, operate the pumpout system until the volunteer on the outside

can see antifreeze coming out of the discharge vent. If your boat has a Vacuflush toilet installed, do not use alcohol-based anti-freeze to winterize the head. It is not compatible with the hose used for this installation.

One last point before we leave this section: Take out all of the batteries and store them somewhere that they can be checked and charged as necessary.

## **COMPONENTS AND OTHER FUNDAMENTALS**

Every Camano was delivered with a binder containing wiring diagrams, electrical schematics, instruction manuals, warranties and other information supplied by the manufacturer of every component in the boat. Please refer to these documents if you have any questions about the operation on any of these pieces of equipment. Our intention, in this section, is not to repeat what is already there but to point out a few things that are not included in the documentation and offer a few tips that might be of help at some point in the future. Both standard and optional equipment is listed below, and therefore not all of the following will pertain to your boat.

### **Access to Components**

Every piece of equipment on the Camano can be accessed easily and quickly no matter where it is located. For example, all drawer boxes, bookshelves, and cupboards can be easily removed by unscrewing four screws and pulling the drawer box, bookshelf or cupboard out. In the v-berth the drawer box can be removed, along with the hatch cover under the mattress to gain access to the bow thruster. The bookshelf on the starboard salon wall can be removed to reveal the hydraulic lines for the steering. The mirror in the head drops down exposing the electronics and wiring arrays in the helm. The cover (with screws showing) in the head outboard and below the mirror is for access to wiring should it be needed. In other words, there is nothing in the boat that is not accessible and serviceable.

### **AC Outlets**

The standard installation is for five AC outlets on each boat. One is located on the top of the v-berth shelf on the port side, another in the galley hull side forward along with the inverter outlet, if so equipped, a third on the side of the cupboard above the fridge, the fourth on the starboard salon wall near the book shelf, and last but not least, in the engine room on the forward bulkhead. You will find that the AC outlet in the salon is fitted with a Ground Fault Circuit Interrupt (GFCI). The rest of the outlets are connected to this as well. That is, the one GFCI is connected to all outlets and serves the whole boat.

### **Autopilot**

For those boats equipped with a Camano installed autopilot, it is important to know that the fluxgate compass is installed at the bottom of the hanging locker. In some East Coast boats, the fluxgate compass is installed beneath the steps leading to the galley. In order for the compass to work accurately it is important that all ferrous metal objects be kept at least a couple of feet away. Most autopilots have a tendency to over steer the closer the boat heading comes to magnetic North and this tendency becomes more obvious the faster the boat is traveling. If this is happening on your boat it may be necessary to lower the gain control or run at a lower speed to reduce the problem. The tendency to over-steer is more pronounced when operating in the higher latitudes, which is a point worth knowing when you are trying to find your way around Glacier Bay.

For the ultimate in hands- free boating, autopilots can be interfaced with most GPS units.

### **Battery Charger**

Each Camano is equipped with a modern electronic battery charger, which operates when connected to shore power and the battery charger circuit breaker is turned on. Modern chargers are now capable of sensing the charge condition of the batteries and will bring them up to full charge without overcharging. It is advisable to leave electronic chargers on when plugged into shore power. This was not the case with the older type of ferroresonant chargers that have a tendency to over charge batteries if connected for long periods of time. It is worth getting into the habit of checking the battery charger whenever you are in the engine room.

### **Bilge Pumps**

All Camanos have automatic pumps installed in the engine room and under the holding tank. Newer models have a third pump in the lazarette. These pumps are powered directly from the house battery and are not wired through the battery switch on the power panel. The reason for this wiring arrangement is to allow you to leave the boat with the main battery switch off yet leave the pumps with the capacity to be turned on through the float switch when about an inch of water accumulates in the bilge. Remember, however, for this to happen, the bilge switch on the electric panel must be in the "auto" position.

### **Bow Thruster**

The bow thruster needs little in the way of servicing. Check your owner's manual to learn more about it. If you are about to leave the dock at some point and find that the bow thruster doesn't work, you may have inadvertently hit the on-off switch on the control panel or you started the engine without turning the battery switch on. The bow thruster is powered by the house batteries. If the thruster is switched on and the battery switch is on and it still refuses to co-operate, check the in-line fuse in the control wire at the thruster motor. This fuse is to protect the wiring to the controls and can be replaced with any fuse ranging from 2 to 10 amps.

### **Chain Locker**

The chain locker is accessible through a door on the forward bulkhead in the v-berth. Make sure you keep the chain locker drain open in order to avoid water pooling (and eventually smelling) inside the locker. A vinyl flap has been installed and hangs inside the chain locker door. It's there to keep mud from collecting on the door and sliding down and onto the fabric in the v-berth. Push the flap away from the bottom of the locker to gain access.

### **Depth Sounder**

Sometimes depth sounders and their speed indicator impellers will become fouled with marine growth. It will do no harm, when you haul the boat to clean and paint the bottom, if you apply a single coat of bottom paint on the depth sounder and around the paddle wheel for the speedometer. If your boat is fitted with two depth sounders (one on the helm and one on the bridge) you should remember to turn off the one you are not using. Two sounders operating at the same time may interfere with each other.

## **Door Lock**

Sooner or later you are going to lock yourself out of the boat. No matter how mighty your resolve, it will happen. Hide a key somewhere on the outside of the boat. Don't forget that when you first unlock the door, not only must you release the locking pin in the middle of the handle, but you must also turn the handle for the lock to fully disengage.

## **Force 10 Galley Range**

The Force 10 stove with oven has a battery operated electronic ignition system for lighting the burners whereas the two-burner model has a piezo-electric ignition system. The battery is located on the underside of the stove at the bottom front right hand corner. The burner rack lifts up and is provided with a small leg at the top left-hand side that can be lowered to hold the rack up while you clean underneath. To open the oven, lift the handle and allow the door to drop down and slide in under the oven.

## **Fuel Additives**

Environmental protection laws, particularly in the United States, have resulted in the reduction of the sulfur content in diesel fuels. The overall effect has been to reduce the lubricating properties of diesel fuels and has resulted in some fuel injection pump failures. Although Bosch, the injection pump manufacturer, and Volvo Penta do not recommend after market fuel additives they have selected fuel additives that may be used "until the new fuels reflect a satisfactory lubricity characteristic". In any event, the additives they mention specifically are "Performance Formula" manufactured by Standyne Diesel Systems Part 429409C, and "Lubricity Plus" manufactured by FPPF. Be sure to follow the instructions when using either product.

## **Fuel Filter, Racor**

The Racor fuel filter, which is the first filter after the fuel tanks, has an even more important function than filtering the fuel. It acts as a water-fuel separator. It does this by forcing the heavier water to settle into the bottom of the filter's transparent bowl. When you do your regular inspections, check the bottom of the bowl for a differently colored substance (water). If you see anything at all, you should drain the bowl (check the Racor owner's manual). This is important because there will be damage to the fuel injectors if any water gets into them. To avoid water in your fuel, keep the tanks topped up (especially in cold weather) if the boat is to be idle for a while. This will prevent condensation from forming inside the tanks.

## **Fuel Tanks**

The fuel tanks may be filled at each side deck filler by reaching from the cockpit. If you fill only one side, the fuel will transfer across from one tank to the other but this is very slow given the small 3/8th inch line.

## **Hatch (V-Berth)**

Make sure the hatch is always closed when underway unless conditions are very calm and the ventilation is needed. If you are going to leave the boat for any length of time it is always a good idea to have the hatch opened just a crack, in the "open and locked" position, to allow for air circulation.

## **Hot Water Heater**

Fresh water is heated by the engine when the boat is underway. Two hoses, with shut off valves are located at the forward end of the engine and go directly to the hot water heat exchanger that heats the domestic water. When shore power is available, hot water is also provided through an electric heater. The heater draws a significant amount of power and, when used along with other applications, can overload 15 amp shore power systems. It should be turned off if you are relying on shore power to keep the boat warm during winter.

## **Inverter**

The inverter takes power from the house batteries and converts the 12 volts DC into 110 volts AC. There is no connection between the inverter and shore power -- they are completely independent of each other. The inverter is located behind the power panel and the switch is located on the inboard side of the helm on the vertical face. The only outlet for the inverter is in the galley alongside the shore power outlet. If you want to use the microwave or any 110-volt appliance while underway or at anchor, this is the only outlet that you can use. The system has been deliberately designed this way so that none of the 110-volt systems on the AC side of the power panel can be powered by the inverter. The reason is simple. Inverter systems that provide battery power to the main electrical panel are potentially hazardous to your batteries. If something like a hot water heater is left on when you settle down for the night at your favorite anchorage, your batteries will be completely discharged in a matter of minutes. This is why your system can only power whatever you knowingly plug into it. You should be aware of the power your inverter is taking from your batteries while you are using it. For larger loads you might want to run the engine at about 1000 RPM for about double the time of the load involved so your batteries will stay at the previous level of charge. In the standby mode, the inverter draws very little power. If you are anchored out one night and hear a high pitched buzz coming from behind the electrical power panel, it is probably the inverter telling you that the batteries are low and that it should be turned off. If you want to install another inverter outlet somewhere on the boat, there is an empty socket on the inverter that makes this a relatively simple job.

## **Microwave Oven**

The microwave oven can be operated either through the inverter (if so equipped) or by shore power by plugging it into the appropriate outlet on the galley wall. If you use the microwave on the inverter, run the engine about twice as long as the microwave was run if you wish to recharge the batteries to their previous charge.

## **Propane Alarm**

The propane alarm should always be switched on at the main panel whenever anyone is onboard. When first turned on the alarm will emit several beeps until it senses normal conditions. It will then become quiet until it senses a problem. It will not shut off the propane supply, it is only an audible warning.

## **Propane Tank and Pressure Gauge**

The propane tank is located in the propane locker under the bridge stairs in the cockpit. Although the locker is fitted with a drain, it is a good idea to open the locker cover and allow it to air out. A fair amount of condensation can accumulate around the propane tank. The gauge on the tank is for testing purposes only, it does not indicate the amount of propane left in the tank. To test the system, turn the tank valve on momentarily and then back to closed. The gauge will show the pressure in the system

and will read somewhere between 100 and 150 PSI. Don't worry about the number, what you need to check is whether the pressure drops to zero in the next 20 minutes or so. If it does, you have a leak somewhere in the system. It is important that you find the leak and correct it immediately. You can do this by checking all of the connections in the system with soapy water. Brush soapy water on the connections and if bubbles appear you have located a leak. Don't stop there, there may be others. Check every single connection at the tank and the stove. If it still leaks the hose must be checked for cracks or holes. Access to the hose is gained through the dinette seat and by removing the wall panels inside. You should also remove the dish locker.

In order to check the stove connections on Force 10 oven models, lift the burner rack. This will reveal a series of holes on the vertical surfaces on each side of the stove. The stove is attached to the galley counter with several screws on each side. Remove the screws and pull the stove aft a few inches and check the propane connections by brushing them with soapy water. On the Force 10 two burner without oven models, access can be gained from the cupboard below the stove. You should test the propane system every week of use, and a minimum of every three months if you are not using it. When you pressure test the system it is normal for the pressure to drop very slowly over a much longer period of time and if this is the case on your boat you have nothing to worry about.

OBVIOUSLY, YOU SHOULD NEVER CHECK FOR GAS LEAKS WITH AN OPEN FLAME.

### **Refrigerator**

The Nova Cool refrigerator will operate on either 12 volts DC or 110 Volts AC. When attached to shore power and both the DC and AC switches are on, the fridge will sense this and automatically go to AC power. When shore power is disconnected the fridge will automatically switch over to DC power. Remember, however, if you are going to leave the boat for any length of time that you should turn the DC switch off. Normally, the fridge is hinged on the right hand side. This can, however, make it very difficult to remove the catch tray below the freezer. If it drives you nuts, you can easily hinge the fridge door on the other side, you just have to be careful because if it swings open the door will crash into the door of the head.

### **Rudder Stuffing Box**

Every time you go into the lazarette check for water around the rudder stuffing box. If you find any (it will be a milky white color) then the stuffing box should be tightened. This consists of loosening the lock nut, tightening the packing and then re-tightening the lock nut. Since there is no high-speed movement, there is no heat involved when the rudder is turned. For this reason, you may decide to tighten it enough to stop all drips and accept a slight increase in steering effort.

### **Steering**

All hydraulic steering connections are located behind the bookshelf on the starboard side of the salon, at the helm pumps, the steering ram in the lazarette, and the auto pilot pump (if so equipped and installed by Camano) in the forward starboard engine room. You can check the steering fluid level on the Troll by removing the knurled fitting at the upper helm pump. On the Gnome you would check the lower helm pump. On the Troll the lower helm pump has a plug in it and removing this will drain all the oil from the upper station onto your carpet. Be careful not to move the wheel while doing the inspection. The oil level should be maintained to the base of the opening. Use only the fluid recommended

## **Underwater Thru-hull Fittings**

There are three thru-hull fittings in all boats fitted with a "Y" valve system. Each fitting has a ball valve that can be opened and closed. The ball valves, at an absolute minimum, should be opened and closed at each 100-hour servicing. They should always be left closed if the boat is to be unattended for a long period or if there is any danger of freezing. Once again, this is a minimum requirement. Some people argue that the valves should be closed whenever you leave the boat.

*Useful Tip: Whenever you close the engine thru-hull fitting (raw water intake) drop your engine ignition key over the ball valve handle. This way, when you retrieve the key, you will always remember to open the ball valve before starting the engine.*

## **Transmission**

You can check the transmission oil level by taking out the screw-in dipstick on the raised portion of the transmission housing. See the engine manual for details. Check the oil level by inserting the stick without screwing it down. The oil should be clear. If it is cloudy or milky, or if the level is too high, you could have water entering from the oil cooler.

## **Water Tanks**

The water tanks are situated in the engine room ahead of the fuel tanks on both the port and starboard side. Since the water tanks are made of a translucent plastic, the water level in each tank can be seen from the engine room. The tanks may be filled from either side deck if you open the supply valves at the front of the tanks. However, it is quicker to fill each tank from its own deck fill. You can reach the deck fills from inside the cabin through double sliding side windows.

## **Webasto Furnace**

It is wired directly to the house batteries and not through the main power panel. Be sure to turn the furnace off when leaving the boat -- turning the battery switch off will not stop the furnace from cycling on and off. In all boats the furnace will sense if the house batteries are low and will shut itself off automatically. Even though the furnace shuts down, the batteries will be in a discharged state when you return to the boat. If you don't get back for several days your batteries could suffer serious damage.

If you choose to leave your furnace on low as a backup during cold weather, do so only if you are confident that your shore power is reliable and be sure your battery charger is on. The furnace is very economical and uses a negligible amount of fuel.

If you like to get cozy and raft up to other Camanos, keep in mind that the furnace exhaust is located on the port side just slightly ahead of the cockpit. If you don't keep a safe distance from the furnace exhaust you could wind up with blistered gelcoat on some cold night. We have found strategically placed fenders do a good job of protecting the hulls of visiting boats.

## **A FINAL WORD**

At the risk of annoying you, we would like to close with the three most important recommendations in the handbook:

**Never Operate the Boat With the Hull Port Lights Open**

**Never Continue to Operate the Boat When the Oil Pressure Alarm is Activated.**

**Never Crank a Non-Starting Engine for More Than a Combined Total of 30 Seconds Without Closing the Raw Water Intake.**

**East Coast Camano Owners Association**

