FOREWORD

CONGRATULATIONS!

Your Bertram's unique design and the care taken in its manufacturing mean it should give you outstanding performance and many years of boating pleasure. Your Bertram is built of the finest materials, hand crafted to Bertram's demanding quality standards. It is factory tested and thoroughly inspected.

As durable as it is, your Bertram will benefit from reasonable care. A yacht is a complex mechanism, and it will require preventive and corrective maintenance, minor adjustments, and repairs. This operator's manual helps explain the operation and required maintenance of the many electrical, mechanical, and electro-mechanical systems on your yacht.

The better you understand your Bertram, the more pleasure you will get from it. We recommend that you read this manual thoroughly and keep it on board for reference. If any points are not clear, your Bertram dealer will be glad to assist you.

This manual is not intended to replace years of boating experience or the excellent classes on safe boating taught by the U. S. Coast Guard Auxiliary and the U.S. Power Squadron, but we have included some material that covers some aspects of safe boating.

ABOUT THIS MANUAL

This manual is divided into three parts.

Part I gives a history of the Bertram Yacht, and includes three glossaries of nautical, wave and weather terms.

Part II locates and describes the equipment and systems that make up your Bertram. Part II also discusses the operation of the equipment and systems.

Part III contains maintenance, troubleshooting, and service information.

In addition to this operator's manual you will find two packets of information:

1) docking plan, electrical systems wiring diagrams and any necessary mechanical drawings;

2) user's manuals and operating instructions supplied by the manufacturer of each major mechanical, electrical, and comfort equipment component.

These will help you to get a better understanding of the systems on your Bertram and how they operate. They will also be extremely valuable to the technicians who service your Bertram.

WARNINGS, CAUTIONS AND NOTES

Throughout this manual you will find special information in the form of warnings, cautions, and notes. These are intended to alert you to possible dangers to yourself, the crew or passengers, and/or to your vessel. **Read these special information items carefully.**

Just reading a warning or a caution note within a box will not eliminate the danger(s). Pay close attention to these warnings, and exercise "good seamanship." **YOU are the most important factor in preventing accidents.**

Here is the format for the Warnings, Cautions and Notes you will see in this manual:

--- See Part III for Maintenance Information ---

FAILURE TO HEED A WARNING MAY RESULT IN DEATH OR SERIOUS INJURY.

Failure to heed a CAUTION may result in injury and/or damage to the vessel.

NOTE:
A note is intended to emphasize important information.

U.S. COAST GUARD REGULATIONS

If your Bertram is to be operated in waters regulated by the U.S. Coast Guard, there are certain requirements you must meet. These are discussed in the Coast Guard publication *Federal Requirements for Recreational Boats*.

Some -- but not all -- of the items you are required to carry are furnished as standard equipment on your vessel.

If you are operating in U.S. territorial inland waters, Coast Guard regulations require that all boats of 12 meters (39.4 feet) or more in length carry aboard a copy of the USCG publication *Navigation Rules, International -- Inland*. Bertram recommends that all boats operating in these waters carry a copy.

NOTE:
U.S. Coast Guard regulations state that it is the responsibility of the vessel owner to be sure all required equipment is on board and in proper working order.

A FEW WORDS ABOUT MAINTENANCE

Some of the on-board systems and equipment require scheduled *preventive* maintenance not covered in your collection of manufacturer's manuals. Such scheduled maintenance is covered in this manual in **Part III: Maintenance.**

Part III also includes recommended troubleshooting techniques, recommended storage and refloating procedures, plus other special maintenance procedures.

When your Bertram does require service, we suggest you first contact your Bertram dealer. He is trained to help you, and our factory service representatives are available to assist him if needed.

We wish you many years of pleasurable yachting with your Bertram.

--- See Part III for Maintenance Information ---

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SECTION I - THE BERTRAM YACHT BACKGROUND

Bertram Yacht is widely accepted as the number one pleasure boat manufacturer in the world. Bertram Yacht itself dates back to 1960, although the inspiration for the Bertram yacht line came earlier -- in July of 1958 -- at trials for the America's Cup Race.

IMPRESSIVE PERFORMANCE

Richard Bertram, a highly successful Miami yacht broker, watched a 24-foot tender ferrying crews and sails around the harbor during the trials.

Bertram was impressed with the tender's smooth ride, the ease with which it maneuvered, and the stability it demonstrated in heavy seas. The radical "Hunter" design was a 24-foot full-length, deep "V" hull by C. Raymond Hunt.

Richard Bertram recognized this was a major breakthrough in boat design, and commissioned Hunt to design and build a similarly shaped hull in the form of a wooden 31-footer to be completed in 1960.

Even though this 31-footer was never intended to be an ocean racing boat, she performed so well on her shakedown cruise that Bertram entered her in the 1960 Miami to Nassau Ocean Powerboat Race.

A NEW RECORD

With Bertram as the pilot and veteran race boat driver Sam Griffith as crew, "Moppie" (named after Mrs. Bertram) won this race in record time under boating conditions so severe that only one other boat even finished the race that day. This surprising victory demonstrated to an amazed boating public that a deep "V" hull design could plane and still maintain high speeds in rough seas.

Richard Bertram recognized the possibilities of this Hunt designed hull and put his resources and reputation behind the newly-formed Bertram Yacht Company.

DESIGN INNOVATIONS

The new hull design was just the beginning of a long list of innovations. At a time when wood, steel, and aluminum dominated the boat building industry, Richard Bertram used the hull of his victorious 31-footer as a plug to construct a mold. He built his new boat from fiber reinforced plastic (FRP), a relatively new material to the pleasure boating industry.

The first 31-foot model was the sensation of the 1961 New York National Boat Show, and Bertram found himself with a year's production sold out in advance.

INTEGRATED MANUFACTURING

With production of the 31-footer well under way and several additional models on the drawing boards, Bertram Yacht Company became a division of the Nautec Corporation.

In November of 1962, a new manufacturing facility was completed at Bertram's present location, about one mile east of Florida's Miami International Airport.

Six years later, the California-based Whittaker Corporation acquired Bertram Yacht. With Whittaker's support, Bertram was able to expand and become a leader in the pleasure boat industry.

In March of 1985, Whittaker sold its interest in Bertram Yacht and other marine-related manufacturing operations. Today, Bertram Yacht is a division of Bertram-Trojan, Inc. and manufactures models from 28 to 54 feet in length, with larger boats on the way.

See Part III For Maintenance Information

A DEDICATION TO EXCELLENCE

Over the years, most of Bertram's boat construction has been dedicated to building the highest quality recreational power boats available. However, Bertram has also built a variety of commercial and military power boats for many domestic and foreign customers.

Bertram power boats are a product of offshore power boat racing, and Bertram has continued its dedication to high performance products. While not currently active on the racing circuit, this company has built racing hulls for others.

The Bertram philosophy is that this continued exposure to racing has been one way to maintain the enthusiasm and motivation in the design areas of hull performance.

One of the engineering and design areas where this basically conservative engineering-oriented company has led the way was as one of the early users of balsa core construction in decks and superstructures beginning in 1965.

Bertram was also one of the first in this industry to use aluminum decks and superstructure on fiberglass boats. This was used on the 58-foot yacht and on commercial vessels.

Bertram was also first in the design and use of fiberglass fuel tanks and was also the first production boat company to make its own aluminum window frames.

The results of continuing design research, material applications research, and construction methods research are applied to Bertram's primary products, and the search for the best way to produce fine power boats continues.

See Part III For Maintenance Information

SECTION II - YACHTING TERMINOLOGY

ABOUT THIS SECTION...

There are three Glossaries included here for your reference.

Glossary 1 covers terms and definitions peculiar to boating.

Glossary 2 explains terms used to describe Waves.

Glossary 3 covers terminology used in describing Weather.

None of the glossaries is comprehensive. For additional information, we recommend you refer to sources such as Chapman's *Piloting, Seamanship and Small Boat Handling;* DeKerchove's *International Maritime Dictionary;* and the wide variety of U.S. Coast Guard Auxiliary and U.S. Power Squadron publications.

GLOSSARY 1: YACHTING TERMS

Abaft. Toward the back of the vessel. The transom is said to be abaft the cabin.

Abeam. Alongside; directly off one side of the vessel.

Above. Higher in the vessel. To go up to the next deck in a vessel is to go above.

Adapter. A coupling or device that permits fittings of different sizes to be joined.

Aft. Toward the stern.

After End. The stern.

After Peak. The compartment furthest aft.

Aftermost. Nearest the stern.

Aground. Stuck fast to the bottom.

Ahead. Forward; when the vessel is going ahead, it is moving forward.

Aloft. Above the deck; if you go up a mast or into the rigging, you are going aloft.

Amidship or Admidships. Midway between the bow and stern, or midway between the port side and the starboard side.

Ampere. The standard unit used to measure the strength of an electrical current. Abbreviated "Amp" or "A".

Anchor. A mechanical device used -- with an anchor line -- to hold a vessel in a desired position.

Anchor Line. The line connecting a vessel to its anchor. It may be all rope, all chain, or rope and a length of chain.

Anchor Rode. See Anchor Line.

Anchor Ball. A black, circular, day signal hoisted to show that a vessel is anchored. Replaced at dusk by the anchor light.

Astern. When the vessel is moving backward, it is going astern.

Athwartships. Along a line running perpendicular to the keel.

Batten. A strip of wood or metal used to secure tarpaulin(s) in place over a hatch.

Batten Down. To secure for rough weather.

Beam. 1. The widest distance across a vessel from the outside skin on one side to the outside skin on the other; 2. A transverse structural member that stiffens and supports a portion of the deck.

Beam Wind. A wind blowing from the side of the vessel, approximately perpendicular to the longitudinal axis of the vessel.

Belay. 1. To make fast or secure, as to belay a line; 2. to cancel or stop an action, as "Belay that last order".

Below. Lower in the vessel; to go below is to go to a lower deck or go into the cabin.

Bend. A type of knot.

Bilge. The lowest interior area of a hull, used to collect water that seeps or leaks in.

Bilge Pump. A pump intended to remove spray, rainwater, and the normal accumulation of water due to seepage and spillage; it is not intended for damage control.

Binnacle. The stand or support for a magnetic compass.

Bitter End (of the line). 1. The last part of a rope or chain; 2. the inboard end of the anchor rode.

Bollard. A single post on a dock, pier, or wharf used to secure a vessel's lines.

Bonding. 1. Electrically connecting exposed, metallic, non-current-carrying parts to the main engine block; 2. cementing together, as with an adhesive.

Bow. The front end of a vessel.

Bottom. The portion of the hull below the bilge.

Break Out. Take out of storage and prepare for use.

Bridge. The main operational control center of a vessel.

Broach. To be thrown broadside into the trough of waves out of effective control.

Bulkhead. An interior wall or partition.

Bulwark. Portion of the hull extending above the deck.

Camber. Transverse (athwartships) curvature of the deck.

Capstan. A machine, similar to a winch but with a vertical axis, that moves a cylindrical device (called a "gypsy") on a shaft for hauling up an anchor.

Centerline. The fore-and-aft line at the middle of the vessel.

Chain Locker. See Rope Locker. Space or compartment where anchor line is stowed.

Chine. The line where the bottom of a vessel meets the side. If this turn is rounded, it is a "soft" chine. If the turn is squared off, it is a "hard" chine.

Chock. 1. A fitting or hole in a railing or deck through which a mooring or anchor rode runs; 2. a wedge used to secure something in place.

Circuit Breaker. A circuit protection device used to interrupt an electrical circuit when the current flow exceeds a preset level.

Cleat. A double ended deck fitting to which lines are secured.

Coaming. Raised lip around a hatch, intended to keep water from coming in through the hatchway.

Cockpit. An exposed deck area (usually aft) that is substantially lower than the vessel's adjacent weather deck.

Companionway. The steps or ladder leading downward from a deck.

Compartment. A subdivision of space or room in a vessel.

Covering Board. The top surface of the sides and transom on a vessel.

Cradle. A frame or support for moving a vessel when it is out of the water.

Dead Ahead. Directly in front of the vessel is dead ahead.

Dead Reckoning. A navigational technique that measures from a last known to the present estimated position based on time, speed, and direction. Abbreviated DR.

Deck. The floor in a vessel.

Dinghy. A small boat (less than 20 feet) used in moving between ship and shore.

Displacement. The weight of water displaced by the vessel's hull.

Displacement Hull. A hull that displaces a volume of water equal to the weight of the vessel at all times. Such a hull is designed to run *in* the water rather than on top of the water as does a planing hull. When a displacement hull moves through the water, it pushes the water out of its way. The water flows around the hull and fills the "hole" the vessel leaves astern.

Dock. A pier or wharf to which vessels are moored.

Documented Yacht. A vessel of five or more net tons that is owned by a United States citizen, is used exclusively for pleasure, and has valid marine documentation issued by the U.S. Coast Guard. A

documented yacht does not show state identification numbers.

Dog. A small metal fitting (clamp) used to secure (close) ports, hatches and doors.

Dog Down. To tighten the dogs or clamps on a port, hatch, or door.

Doors. Access ways through bulkheads are doors. Doors may or may not be watertight.

Draft. 1. The depth of a vessel from the actual waterline to the bottom of the vessel's lowest part (e.g., the propeller tip or rudder); 2. the depth of water necessary to float a vessel. Draft may vary with vessel loading and may vary in similar vessels depending on equipment installed.

Drift. The speed of a current measured in knots.

Dye Marker. A brightly colored chemical that spreads when released in water to attract attention, as to a man overboard.

Evaporator. That part of a refrigerating (air conditioning) device where the liquid refrigerant is evaporated to absorb heat and produce cooling.

Even Keel. To be floating evenly without listing (leaning) to either side.

Exhaust System. The means by which the hot engine or generator exhaust gases are moved from that engine to an outboard terminus and released into the atmosphere.

Fathom. Six feet.

Fender. A device (usually of rubber or plastic) placed to absorb the impact of contact between vessels or between a vessel and the dock.

Fiberglass. Fiber reinforced plastic (FRP).

Fish. A zinc plate, lowered overboard, used to reduce corrosion.

Flare. 1. The outboard curve of the hull as it comes up the side from the waterline, the reverse of **Tumble Home**; 2. a pyrotechnic device, usually rocket propelled, used for emergency signaling at sea.

Flat. A small, partial deck, built to support a piece of equipment or machinery.

Flemish. To coil down a line on deck in a flat, circular, concentric arrangement.

Flotsam. Floating wreckage or trash.

Flybridge (flying bridge). A steering and speed control station located above the main cabin or salon.

Following Sea. Waves moving in the same general direction as your vessel.

Fore-and-Aft. In line with the longitudinal centerline of a vessel.

Forefoot. The forward part of a vessel's keel that curves upward to meet the stem.

Forward. Toward the bow.

Frame. A built up rib that supports the deck and hull and gives the vessel transverse strength.

Freeboard. The height of a vessel's deck above the water line.

Galley. The kitchen or food preparation area.

Galvanic Corrosion. Corrosion that results from the difference in electrical potential between dissimilar metals immersed in a conductive solution (such as salt water). If the metals touch or are otherwise electrically connected, the difference in potential produces an electron flow between them. This results in gradual destruction of the less-corrosion-resistant metal.

Gasket. A strip of sealing material, usually rubber or rubber-like material, set along the edge of a water/gas tight door, port, or hatch.

Gelcoat. The thin finish layer of pigmented plastic covering a fiberglass vessel.

Gland. The movable part of a stuffing box which, when tightened, compresses the packing.

Ground (electrical). The electrical potential of the earth's surface, which is zero.

Ground Speed. A vessel's speed over the earth's surface.

Ground Tackle. A general term for the anchor, anchor lines, and other fittings used to secure a vessel at anchor.

Gunwale. 1. The line where the an upper deck and the hull meet; 2. the upper edge of a vessel's side.

Halyard. A light line used to hoist a flag or pennant.

Hatch. 1. An opening in the deck or sole that forms an entrance to a compartment (also called a **hatchway**); 2. a cover for a hatch.

Hardtop. A permanent cover over the cabin above the main deck; the deck of the flybridge.

Head. A shipboard toilet or lavatory area which may or may not include a shower.

Heading. The direction that a vessel is pointed with reference to true, magnetic, or compass north.

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

Heavy Weather. Stormy weather with high seas and high winds.

Helm. The apparatus by which the vessel is steered.

Helmsman. Steersman; the one who is at the helm steering the vessel.

Hitch. A type of knot.

Hull. The body of a vessel including the shell, framing, decks, bulkheads, stanchions, keel, and floors.

Inboard. 1. From either side of a vessel to the fore-and-aft centerline; 2. the dock side of a moored vessel.

Inland Rules. Nautical "Rules-of-the-Road" that apply in U.S. lakes, rivers, and coastal waters.

International Rules. Nautical "Rules-of-the-Road" that apply by international agreement to the high seas.

Jetsam. Refuse that sinks when thrown overboard.

Kedge. An anchor set out from a grounded vessel, usually astern, to (1) keep her from being driven further aground and (2) assist in refloating her.

Keel. The main centerline structural member running fore and aft along the bottom of the vessel; the backbone.

Knot. 1. A maritime unit of speed equal to one nautical mile (6,080 feet) per hour, as compared to a statute mile (5,280 feet); 2. a collective term for hitches and bends.

Ladder. Steps or stairs.

Latitude. Angular distance on the earth's surface north or south of the equator, measured in degrees, minutes, and seconds.

Lazarette. Storage compartment cut into the deck at the stern.

Leadline. A weighted line used to take depth measurements.

Lee. The direction away from that of the wind; the downwind side.

Leeward. Away from the wind; downwind.

Length at Water Line (LWL). The length of a vessel measured at the water line from bow to stern. This dimension changes depending on how high or low a vessel is riding in the water.

Length over all (LOA). A vessel's straight line length from bow to stern. This dimension does not change regardless of how a vessel rides in the water.

Limber hole. Drainage hole for bilge water along the keel and stringers.

List. Incline to port or starboard.

Longitude. Angular distance on the earth's surface east or west of a reference line (the prime meridian) passing through Greenwich, England. Longitude is measured in degrees, minutes, and seconds.

Longitudinal. Lengthwise; running along the length of the vessel.

Lubber Line. A mark or line on the compass parallel to the keel and indicating forward.

Mast. A pole or tube used to support lights, radar devices, flags, etc.

Main Deck. The principal and highest deck of the hull.

Midship. 1. Aligned with the longitudinal axis of the vessel, as "Rudder is midship."; 2. at the center of the vessel.

Moor. To anchor or secure a vessel with chain(s) or line(s) to shore, a dock, a buoy, etc.

Mooring Bitt. Standards, placed in pairs, to which mooring lines are made fast.

Mooring Line. The line with which a vessel is secured to a mooring place.

*** See Part III for Maintenance Information ***

Navigation Lights. A set of red, green, and/-or white lights which must be shown by all vessels between dusk and dawn to show course, size, and position. They are required unless moored or at anchor in a recognized anchorage.

Overhead. A vessel's ceiling or roof.

Outboard. 1. From the fore-and-aft centerline of a vessel toward either side; 2. the seaward side of a moored vessel.

Overboard. Over the side of a vessel, usually into the water.

Passageway. A corridor or hallway.

Pilaster. A rectangular structural support column which is an extension of the port and starboard aft cabin sides and which supports the hardtop and the flybridge.

Pitch. 1. The vertical (up and down) motion of a vessel's bow in a seaway, about the athwartships axis; 2. the axial advance of a propellor during one complete revolution.

Pitchpoling. Tipping end over end after striking an obstruction or running down a wave and burying the bow; somersaulting.

Planing Hull. A hull designed to ride on top of the water at cruise. At slow speeds, a planing hull will displace water the same as a displacement hull. At higher speeds, a planing hull lifts up onto the water's surface, as a hydroplane, shortening the water line length and reducing drag.

Port. The left side of a vessel (looking forward).

Port Beam. The left center of a vessel.

Port Bow. The forward left area of the vessel.

Port Quarter. The left rear area of the vessel.

Pounding. The action of waves as they repeatedly raise a grounded vessel and drop it against the seabed, a reef, etc.

Propeller. The screw-like revolving device that drives the vessel through the water.

Propeller Action. The force exerted by the propeller. The force causes displacement of water and pushes the vessel ahead. A propeller creates a suction screw current and a discharge screw current.

Pulpit. An extension on the bow, originally used to support a harpooner; in pleasure vessels, used primarily to ease anchoring.

Rope Locker. Space or compartment where the anchor line is stowed.

Rudder. A movable, vertical fin extending into the water at the stern of a vessel, used for steering.

Salon (Saloon). The main social cabin on a vessel, usually the largest area, sometimes called the deckhouse.

Scupper. A drain from the edge of a deck, discharging overboard.

Seacock. A positive action shut-off valve connected directly to the hull seawater intake and discharge piping.

Secure. To fasten down.

Shaft. The cylindrical member that connects the engine/transmission to the propeller.

Shaft Log. A reinforcing structural member at the hull bottom where the propeller shaft penetrates the hull.

Sheer. The top of the hull's curvature at the deck line.

Sheer Strake. The upper edge of the hull, just below the deck.

Shoal. An area of shallow water.

Silencer. A specially designed baffled chamber installed in an exhaust system to reduce noise; a muffler.

Sole. Small boat term for deck, as in "cabin sole".

Stanchion. A vertical structural support member between decks.

Starboard. The right side of a vessel (looking forward).

Starboard Beam. The right-center of a vessel.

Starboard Bow. The front right area of a vessel.

Starboard Quarter. The right rear area of a vessel.

Steerageway. The lowest speed at which a vessel can steer.

Stem. The extreme leading edge of a vessel's hull.

Stern. The back of a vessel is the stern.

Strainer. A coarse filter used to keep objects out of an intake port (such as the cooling water intake).

Stringer. A fore and aft continuous member used to give a vessel longitudinal strength.

Strut. A propeller shaft support that hangs below the hull.

Stuffing box. Device to prevent leakage around a moving part (such as a propeller shaft or a rudder shaft) that passes through a hole in the vessel; it contains stuffing material and a packing gland.

Sump. A pit or well into which water drains (i.e., the shower sump or engine room sump).

Sump Pump. A pump intended to remove the water collected in a sump.

Superstructure. Structures extending above the weather deck.

Topside. Above decks. To go up to the top deck in a vessel is to go topside.

Toxic. Poisonous (as carbon monoxide).

Transom. A wide, flattened, or slightly curved stern.

Transverse. Across the vessel; athwartships.

Trim. A term used to describe the way a vessel rides in the water. A change in trim is defined as a change in the difference between the forward and aft drafts. If a vessel is trimmed with the stern lower, it is "trimmed by the stern".

Tumble Home. The shape of the hull as it moves outboard going down from the gunwale to the waterline; the opposite of flare.

Watch. A duty period at sea, normally 4 hours. Here are a day's watches:

First watch 2000 - 2400 (8 pm - midnight)
Midwatch 0000 - 0400 (midnight - 4 am)
Morning watch 0400 - 0800 (4 - 8 am)
Forenoon watch 0800 - 1200 (8 am - noon)
Afternoon watch 1200 - 1600 (noon - 4 pm)
First dogwatch 1600 - 1800 (4 - 6 pm)
Second dogwatch 1800 - 2000 (6 - 8 pm)

Water Line. The line of the water's surface on the hull when the vessel is afloat.

Water Line Length. See Length at Water Line.

Water Tight. Sealed to prevent passage of water.

Weather Deck. A deck with no overhead protection.

Web Frame. A frame with a deep web, usually a main strength member.

Wet Exhaust. An exhaust system where cooling seawater is mixed with exhaust gases just after the riser and this mixture is ejected from ports at the stern.

Windlass. Machine used to hoist the anchor(s).

*** See Part III for Maintenance Information ***

GLOSSARY 2: WAVE TERMS

Adiabatic. A change of volume or pressure without gain or loss of heat.

Breaker. A single breaking, plunging or spilling wave.

Breaker Line. The outer limit of the surf. Note that breakers may not all be in a line. They can occur outside the breaker line and seem to come from nowhere.

Comber. A wave on the point of breaking. A comber has a thin line of white water on its crest, known as "feathering".

Crest. The top of a wave breaker or swell.

Fetch. The unobstructed distance that the wind can blow over the water to make waves.

Foam Crest. The top of the foaming water that speeds toward the beach after a wave has broken, popularly known as "white water".

Following Sea. Waves moving in the same general direction as your vessel.

Frequency. The number of crests passing a fixed point in a given time.

Period. The time it takes for two successive crests to pass a fixed point.

Series. A group of waves which seem to travel together and at about the same speed.

Surf. A number of breakers in a continuous line.

Surf Zone. The area near shore where breaking occurs continuously in varying intensities.

Trough. The valley between waves.

Waves. Periodic disturbances of the sea's surface, caused by wind, seaquakes, and the gravitational pull of the moon and the sun.

Wave Gradient. A wave's slope or angle from trough to crest.

Wave Height. The distance from the bottom of a wave's trough to the top of its crest.

Wave Length. The distance from one wave crest to the next in the same series of waves.

GLOSSARY 3: WEATHER TERMS

Air Mass. A region of the lower atmosphere in which air is similar in pressure, temperature, and humidity. Although its shape may change from day to day, an air mass generally moves across the continent like an invisible ice floe.

Air Pressure. A measure of the force exerted by the atmosphere above. Pressure differences between air masses cause winds that move from a high pressure area to a low pressure area.

Internationally, air pressure is measured in millibars, but many barometers in use are calibrated in the old standard, inches of mercury (in. Hg). Inches of mercury can be converted to millibars by multiplying the reading by 33.86.
Sea level standard air pressure is 1013.2 millibars (29.92 in. Hg) at 70oF. Barometers have read as high as 1050 millibars (31 in. Hg), and the eye of a hurricane has produced readings well below 930 millibars (27.47 in. Hg).
Front. The line along which opposing warm and cold air masses meet, generally producing a band of wet, stormy weather. Four types of fronts are associated with weather forecasting:

Cold Front. A front produced when a cold, high-pressure mass overtakes a warm, low-pressure area. The denser cold air wedges under the warm air, creating clouds and rain. If the low is already unstable and turbulent, there may be rapid development of heavy thundershowers accompanied by high, gusty winds. Behind the front, temperatures drop and skies are clear.

Warm Front. A front produced when a warm low pressure air mass meets and rides up and over a colder high pressure mass. As with a cold front, clouds and rain will appear, but in a warm front they will appear with less violence.

Stationary Front. A front produced when neither the high or the low is moving much. This type of front will produce some clouds and rain.

Occluded Front. This is the condition where two fronts collide. Usually the cold front overtakes a slower moving warm front, causing a complex weather system that lifts the warm front and produces heavy clouds and rain.

High. A center of pressure surrounded by lower pressure, caused by a mass of cooler, sinking, drier air. This raises ground level air pressure, producing clear skies and good weather.

Summer highs can produce sustained hot weather. Winter highs mean cold weather, since there are no night clouds to trap the heat.
Some highs become semi-permanent weather features during particular times of the year and have recognizable names.
Isobar. Weather map line that connects all local points of equal air pressure. Isobars are usually closed lines, and they generally define high or low pressure air masses. Winds tend to:

1) blow parallel to the isobars;
2) flow between masses of different pressures;

NOTE:
On the weather map, the greater the pressure difference, the closer the isobars and the stronger the winds.

3) move outward from the center in high pressure air masses and clockwise (in the North American continental area); and
4) move in toward the center in low pressure areas and counter-clockwise (in the North American continental area).
Isotherm. A line on a weather map similar to an isobar except that an isotherm connects points of equal temperature.

Low. The absence of an air mass and the warmer, moist, rising air generally means clouds, precipitation, and stormy weather. Hurricanes are examples of extremely concentrated low pressure systems.

Ridge. An elongated high pressure finger extending out from a high.

Trough. An elongated low-pressure area extending out from a low. A trough usually means unsettled weather.

*** See Part III for Maintenance Information ***

SECTION I - TECHNICAL DATA

A. VESSEL SPECIFICATIONS

VESSEL NAME

OWNER'S NAME

OWNER'S ADDRESS

HAILING PORT

HULL NO. | DOOR KEY NO. | REGISTRATION NO.

LENGTH OVERALL	49 feet, 10 inches
BEAM	16 feet, 4-1/2 inches
DRAFT	4 feet, 0 inches
FUEL CAPACITY	535 U.S. Gallons Aft 510 U.S. Gallons Forward
WATER CAPACITY	175 U.S. Gallons
TONNAGE MEASUREMENT (a volume unit of measure)	GROSS = 45.76 *(approx.)* NET = 36.61 *(approx.)*
DISPLACEMENT (in pounds)	Full fuel & water, 6 people & 1000 pounds of gear = 59,500 *(approx.)* 2/3 fuel & water, 6 people & 1000 pounds of gear = 56,531 *(approx.)*

Table II-I-1: Propulsion System Operating Specifications

FUNCTION	APPROXIMATE READING OR SETTING
ENGINE OIL	
Pressure: at Idle (600 rpm)	10 psig
at 1200 rpm	22 psig minimum
at 1800 rpm	40 psig minimum
Normal Operating Range	50 to 90 psig
Temperature: Normal Operating Range	200°F to 250°F
TRANSMISSION OIL	
Pressure: at Cruising rpm	240 to 260 psig
Normal Oil Temperature Range at Cooler Inlet	140°F to 180°F
COOLANT TEMPERATURE	
Cruising rpm	180°F to 185°F
TACHOMETER (Engine rpm)	
Idle (in Neutral)	650 rpm
Idle (in Gear)	550 rpm
Recommended Maximum Cruising	2100 rpm
Maximum Throttle	2300 rpm

Table II-I-2.: Propulsion System Alarm Settings

FUNCTION	APPROXIMATE SETTING
Engine Oil Low Pressure	12 psig
Engine Coolant High Temperature	203°F +/- 8°F
Engine Cooling Seawater High Temperature	180°F
Transmission Oil High Temperature	203°F +/- 8°F

B. MAIN ENGINES and TRANSMISSIONS

Table II-I-1 lists Propulsion System Operating Specifications; Table II-I-2 lists Propulsion System Alarm Settings.

Engine Manufacturer	MAN
Model Number	D2840 LXE
_____ Port Engine Serial No.	_____ Stbd Engine Serial No.
Gear Manufacturer	ZF
Gear Model	BW165
Gear Ratio	1.5:1
_____ Port Gear Serial No.	_____ Stbd Gear Serial No.
Maximum Engine rpm with Trolling Valves Engaged	1000 rpm
Primary Fuel Filter Manufacturer & Element Number	RACOR 2020SM
Secondary Fuel Filter Manufacturer & Element Number	MAN 81.12503-0054
Lubricating Oil Filter Manufacturer & Element Number	MAN 51.05504-0086
Air Filter/Turbocharger Silencer Manufacturer & Element Number	(*Information to be available soon.*)
For MAN Engine Service, call:	1-800-843-6267; in Florida, call 305-972-1550

C. LUBRICATING OIL TRANSFER SYSTEM (Optional)

Tank Capacity	40 gallons
Pump Flow Rate	2 Gallons per Minute

D. ENGINE BATTERIES

Manufacturer, Model, Voltage	Surrette 8ST-205, 8 Volts
Capacity	205 Amp hours
Reserve Capacity	380 Amp hours
Cold Cranking Capacity	900 Ampere hours

E. PROPELLER SHAFTS

Material	Stainless steel
Diameter	2.5 inches
Length	124.25 inches
Bertram Part Number	08C9432

F. PROPELLERS

Manufacturer	Federal (Michigan)
Style	4-Blade Cupped (Equipoise)
Diameter	28 inches
Pitch	32
Material	Nibral
Port Rotation	Left Hand (Bertram Part Number 08S30149-39)
Starboard Rotation	Right Hand (Bertram Part Number 08S30149-40)

G. DIESEL GENERATORS

Manufacturer, Model, Capacity	Onan 8.0 MDKD-3R/1B, 8.0 kW
_____ Port Generator Serial No.	_____ Starboard Generator Serial No.
Output	120/240 Vac, Single Phase, 60 Hz
Fuel Filter Element Number	Onan# 149-1914-04 or Racor# C-25
Lube Oil Filter Number	185-2123

H. GENERATOR BATTERIES

Manufacturer, Model, Voltage	Surrette 8D-210-300, 12 Volts
Capacity	210 Ampere hours
Reserve Capacity	390 Ampere hours
Cold Cranking Capacity	900 Ampere hours

One battery per bank, one bank per generator.

I. FUEL TANKS

The table below shows the relationship between the fuel guage indication and the approximate number of gallons (fuel tank label capacity) of fuel in the tank.

Table II-I-3: Fuel Gauge Readings vs Tank Gallonage

Gauge Reading	Forward Tank	After Tank
Full	510 gallons	535 gallons
3/4	340 gallons	415 gallons
1/2	174 gallons	205 gallons
1/4	87 gallons	38 gallons
Empty	0 gallons	0 gallons

Note: Usable fuel is considered to be 90% of fuel tank label capacity.

J. BILGE AND SUMP PUMPS

PUMP	RATED CAPACITY
Bilge Pumps	1,750 gallons per hour
Engine Room Sump Pump	330 gallons per hour
Shower Sump pump	550 gallons per hour
Optional Engine Driven Auxiliary Bilge Pump	900 gallons per hour at 775 rpm 1,680 gallons per hour at 1,400 rpm

NOTE:
To prolong the pump life do not operate bilge pump if there is no water in the bilge.

K. VENTILATION AND EXHAUST BLOWERS

Head Exhaust Blowers	Two (2) 150 cubic feet per minute (CFM), 32 Vdc (in port and starboard heads)
Head Ventilation Blowers	Two (2) 55 CFM, 120 Vac (in port and starboard head)
Galley Exhaust Blower	One (1) 110 CFM, 120 Vac
Engine-compartment Heat Removal Blowers	Two (2) 240 CFM, 120 Vac, thermostatically controlled (ON at 110°F and OFF at 90°F) with manual override switch
A.c. Generator Compartment Heat Removal Blowers	Two (2) 110 CFM, 120 Vac, thermostatically controlled (ON at 110°F and OFF at 90°F) with manual override switch

L. NAVIGATION LIGHTS

NOTE:

Light Bulb Replacement: To comply with U.S. Coast Guard regulations and with the international rules "COLREGS", it is important that the correct bulbs be used when replacing burned out bulbs in your navigation lights. The table below lists the replacement navigation light bulbs required for your Bertram.

Table II-I-4: Replacement Navigation Light Bulbs

LIGHT(S)	REPLACEMENT BULBS
Side & Bow (Aqua-Signal)	12V, 25W Aqua-Signal Part #904-00002 Bertram Part Nr. 141661
Bow (Perko)	12V, 8cp (candle power) Bertram Part # 141616
Stern	12V. 12cp, Perko Part # 70-1 (211-2) Bertram Part Nr. 141617
Anchor	12V, 6cp Bertram Part # 14034

M. PERFORMANCE CHARTS: FACTORY-GENERATED

NOTE:
The factory-generated charts on this and the following page are to be used as examples only.

Performance data -- Boat Speed (in statute miles per hour), Range (in statute miles), and Fuel usage (in gallons per hour) -- are taken on a new test boat under ideal conditions with a clean bottom and 10 to 12 foot water depth.

Many factors may affect actual performance obtained. These may include, but are not limited to, installation of certain options, presence of a tuna tower, boat loading and trim, weather conditions, water depth, engine and boat condition, propeller condition, manufacturing tolerances, and other factors.

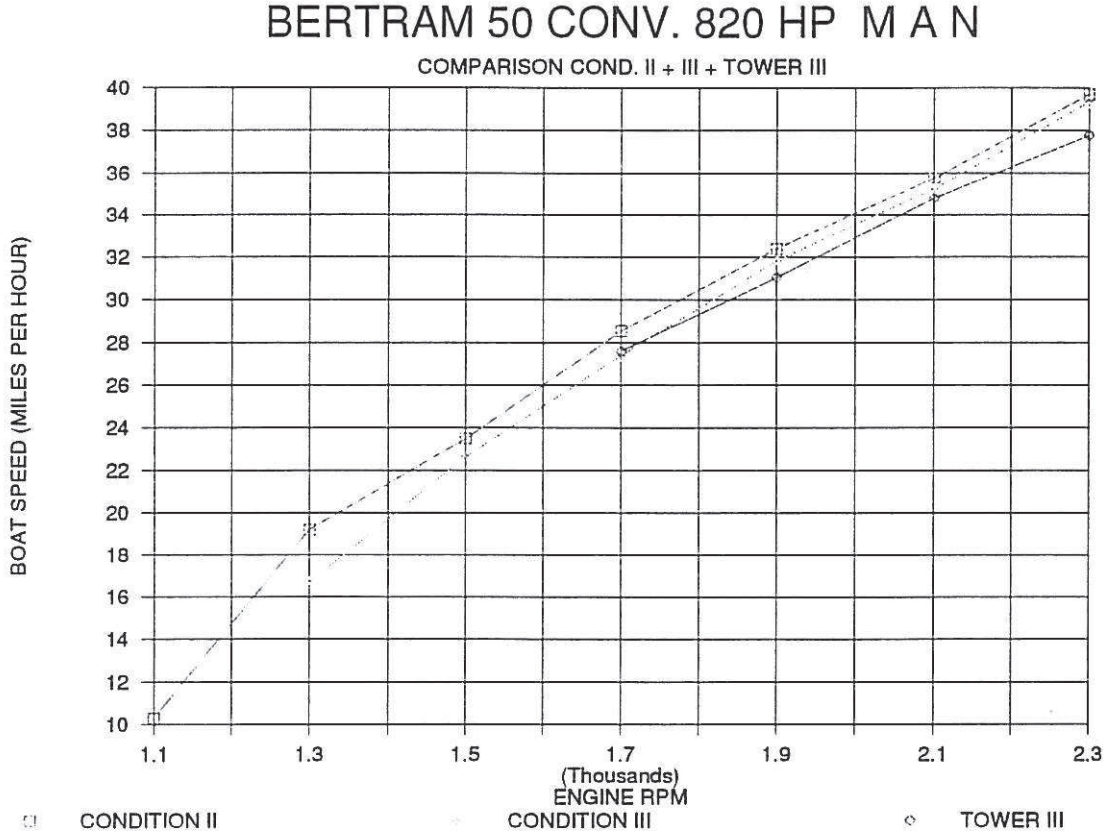
Based on prudent seamanship, Range is calculated on 90% of the fuel tank label capacity.

The first three charts, Boat Speed, Range, and Fuel usage, are furnished as examples. *They should be used only as examples.*

The last three charts are left blank for you to plot in curves of data you obtain on your own boat.

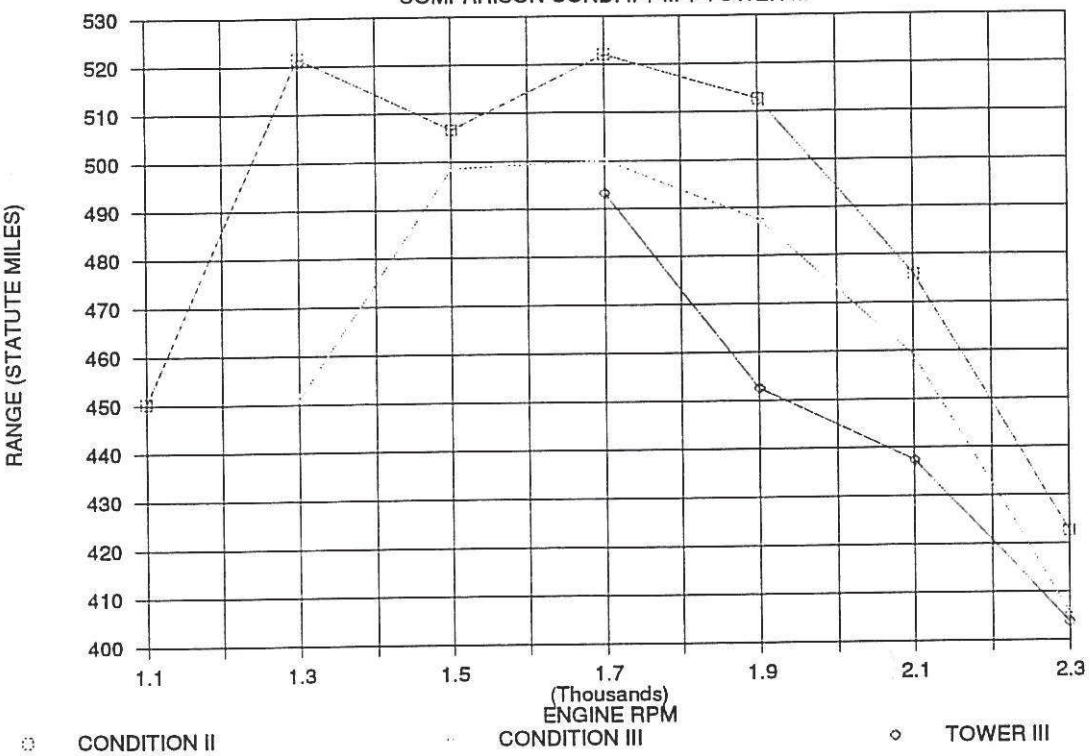
NOTE:
You should use the charts you have generated with your own vessel when planning your trips.

Condition II = 2/3 fuel and water, six people, 1000 pounds of gear
Condition III = full fuel and water, six people, 1000 pounds of gear
Tower III = full fuel and water, six people, 1000 pounds of gear, full tower



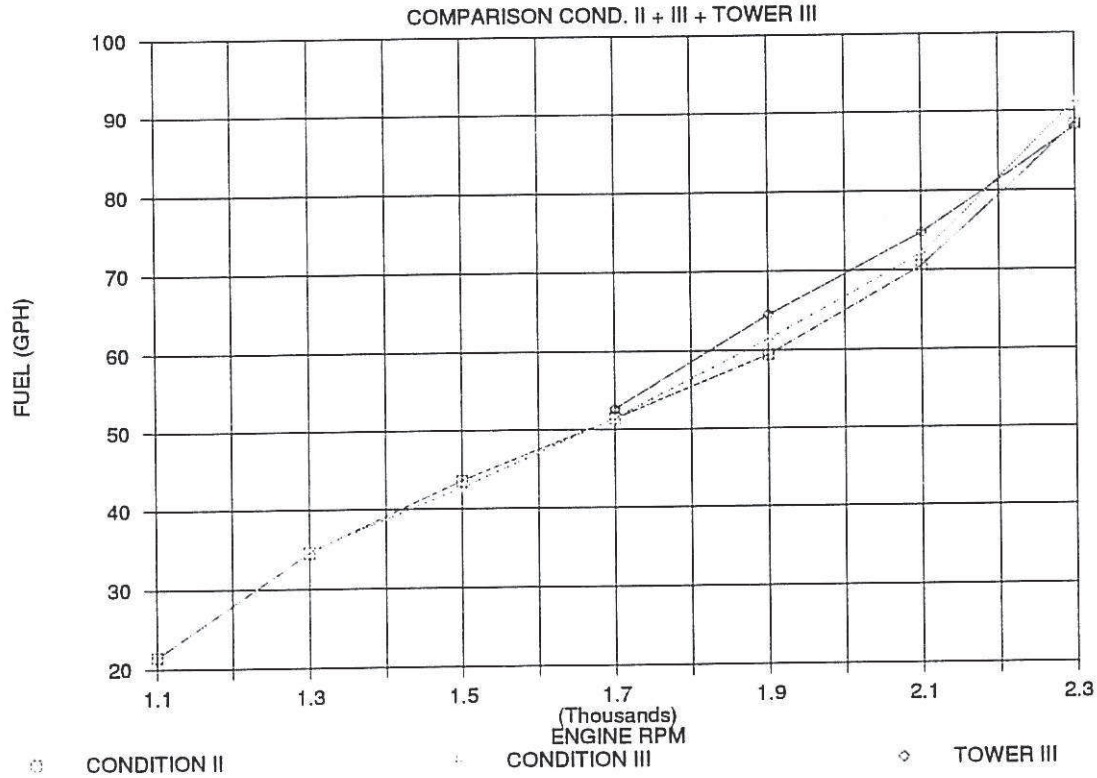
BERTRAM 50 CONV. 820 HP M A N

COMPARISON COND. II + III + TOWER III



BERTRAM 50 CONV. 820 HP M A N

COMPARISON COND. II + III + TOWER III



N. PERFORMANCE CHARTS: OWNER-GENERATED

Performance data -- Boat Speed (in statute miles per hour), Range (in statute miles), and Fuel usage (in gallons per hour) -- are taken on a new test boat under ideal conditions, with a clean bottom and 10 to 12 foot water depth.

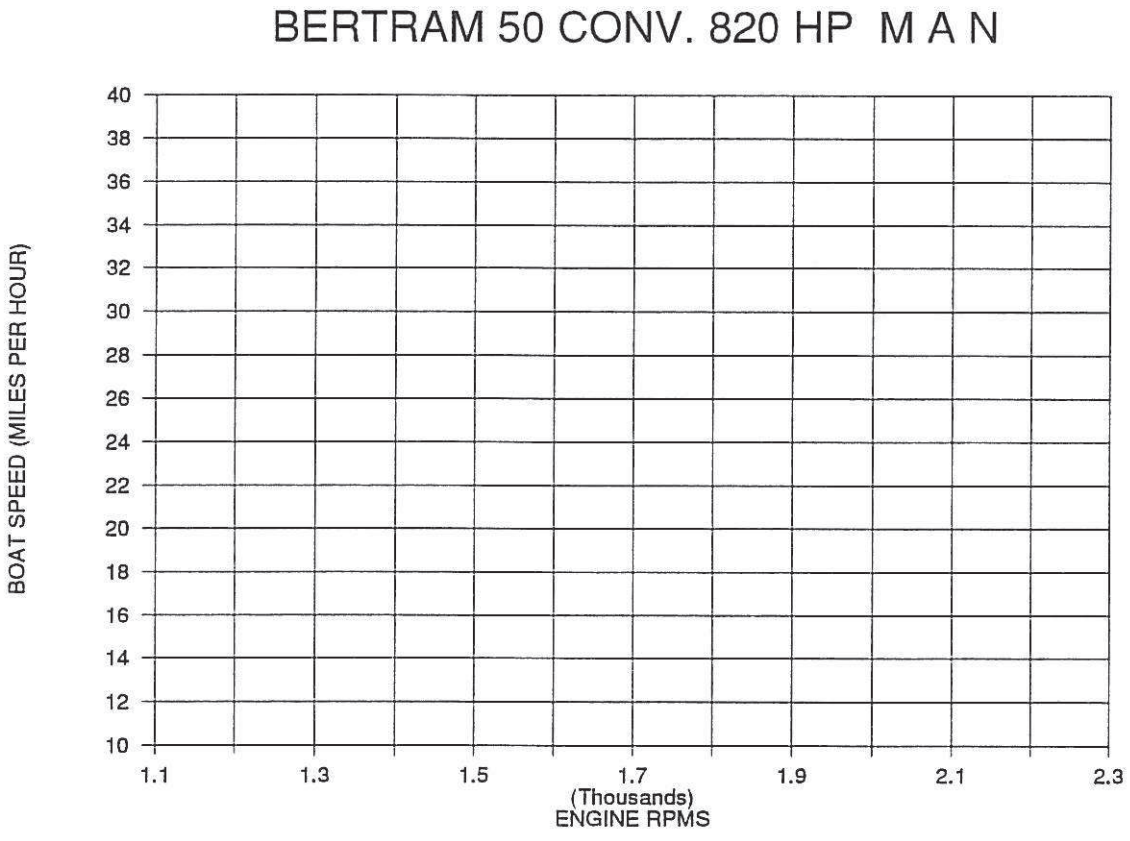
Many factors may affect actual performance obtained. These may include, but are not limited to, installation of certain options, presence of a tuna tower, boat loading and trim, weather conditions, water depth, engine and boat condition, propeller condition, manufacturing tolerances, and other factors.

Based on prudent seamanship, Range is calculated on 90% of the fuel tank label capacity.

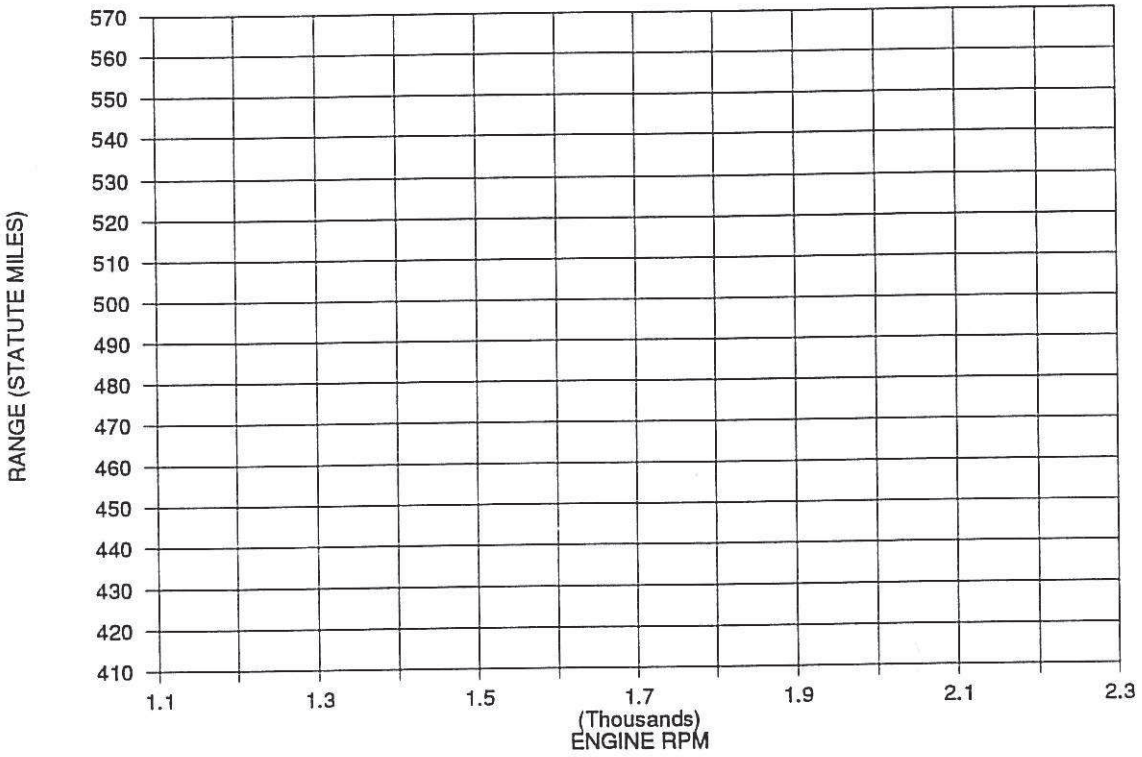
The three charts on the previous pages are furnished as examples. *They should be used only as examples.*

The three charts on this and the following page are left blank for you to plot in curves of data you obtain on your own boat.

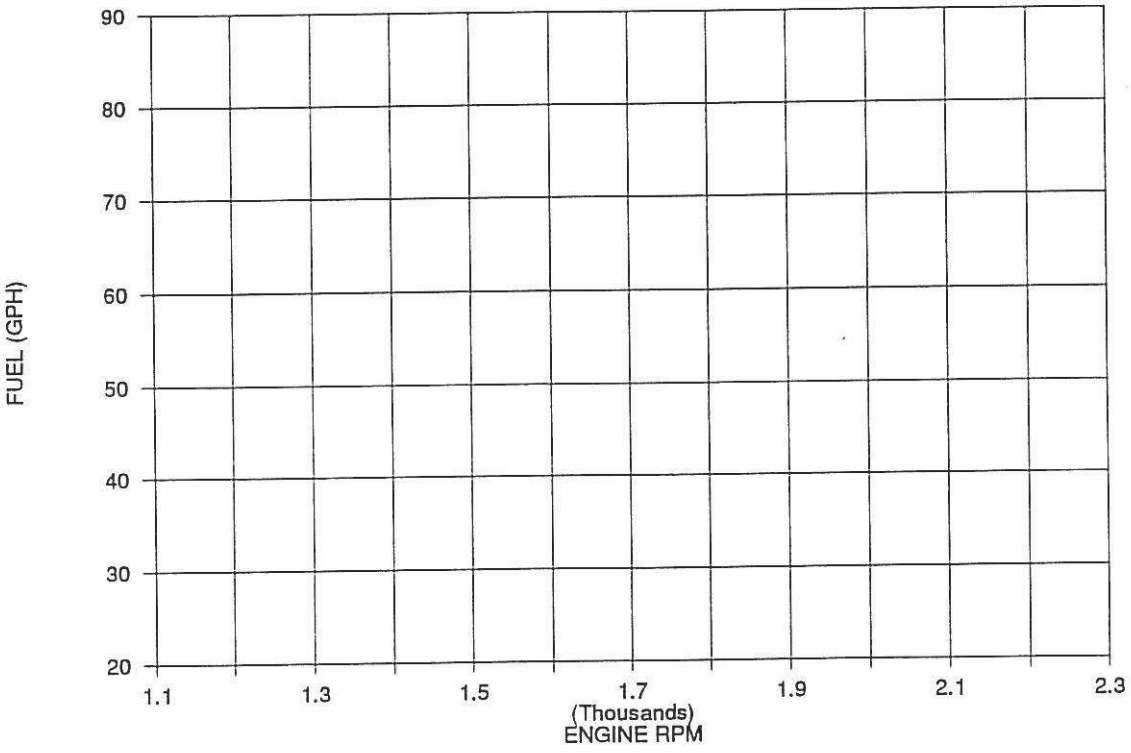
NOTE:
You should use the charts you have generated with your own vessel when planning your trips.



BERTRAM 50 CONV. 820 HP M A N



BERTRAM 50 CONV. 820 HP M A N



*** See Part III for Maintenance Information ***

SECTION I - TECHNICAL DATA

A. VESSEL SPECIFICATIONS

VESSEL NAME

OWNER'S NAME

OWNER'S ADDRESS

HAILING PORT

HULL NO. | DOOR KEY NO. | REGISTRATION NO.

LENGTH OVERALL	49 feet, 10 inches
BEAM	16 feet, 4-1/2 inches
DRAFT	4 feet, 0 inches
FUEL CAPACITY	535 U.S. Gallons Aft 510 U.S. Gallons Forward
WATER CAPACITY	175 U.S. Gallons
TONNAGE MEASUREMENT (a volume unit of measure)	Gross = 45.76 Net = 36.61
DISPLACEMENT (in pounds)	Full fuel & water, 6 people, & 1,000 pounds of gear = 59,500 2/3 fuel & water, 6 people, & 1,000 pounds of gear = 56,531

Table II-I-1: Propulsion System Operating Specifications

FUNCTION	APPROXIMATE READING OR SETTING
ENGINE OIL	
Pressure: at Idle (600 rpm)	10 psig
at 1200 rpm	32 to 52 psig
at 1800 rpm	49 to 70 psig
Normal Operating Range	32 to 70 psig
Temperature: Normal Operating Range	200°F to 250°F
TRANSMISSION OIL	
Pressure: at Cruising rpm	130 psig
In Reverse at 1500 rpm	110 psig
Normal Oil Temperature Range at Cooler Inlet	180°F to 200°F
COOLANT TEMPERATURE	
Cruising rpm	160°F to 185°F
TACHOMETER (Engine rpm)	
Idle (in Neutral)	600 to 650 rpm
Idle (in Gear)	500 to 550 rpm
Recommended Maximum Cruising	2100 rpm
Maximum Throttle	2300 rpm

Table II-I-2: Propulsion System Alarm Settings

FUNCTION	APPROXIMATE SETTING
Engine Oil Low Pressure	4 psig
Engine Coolant High Temperature	210°F
Engine Cooling Seawater High Temperature	180°F
Transmission Oil High Temperature	225°F

B. MAIN ENGINES and TRANSMISSIONS

Refer to the tables below for Propulsion System Operating Specifications and Alarm Settings.

Engine Manufacturer	Detroit Diesel Corp.
Engine Model Number	GM8V92TA
_____ Port Engine Serial No.	_____ Stbd Engine Serial No.
Gear Manufacturer	General Motors Corp. (Allison Division)
Gear Model	MH
Gear Ratio	1.54:1
_____ Port Gear Serial No.	_____ Starboard Gear Serial No.
Gear Oil Filter	AC PF-147
Primary Fuel Filter Manufacturer & Element Number	RACOR 2020SM
Secondary Fuel Filter Manufacturer & Element Number	A.C. TP-540X
Lubricating Oil Filter Manufacturer & Element Number	A.C. PF-911
Air Filter/Turbocharger Silencer Manufacturer & Element Number	Donaldson P12-4860

C. LUBRICATING OIL TRANSFER SYSTEM (Optional)

Tank Capacity	40 gallons
Pump Flow Rate	2 Gallons per Minute

D. ENGINE BATTERIES

Manufacturer, Model, Voltage	Surrette 8ST-205, 8 Volts
Capacity	205 Amp hours
Reserve Capacity	380 Amp hours
Cold Cranking Capacity	900 Ampere hours

E. PROPELLER SHAFTS

Material	Stainless steel
Diameter	2.5 inches
Length	124.25 inches
Bertram Part Number	08C9432

F. PROPELLERS

Manufacturer	Federal (Michigan)
Style	3-Blade Cupped (Equipoise)
Diameter	28 inches
Pitch	30
Material	Nibral
Port Rotation	Left Hand (Bertram Part Number 08S30149-37)
Starboard Rotation	Right Hand (Bertram Part Number 08S30149-38)

G. DIESEL GENERATORS

Manufacturer, Model, Capacity	ONAN 8.0 MDKD-3R/1B, 8.0 Kw
_____ Port Generator Serial No.	_____ Starboard Generator Serial No.
Output	120/240 Vac, Single Phase, 60 Hz
Fuel Filter Element Number	Onan# 149-1914-04 or Racor# C-25
Lube Oil Filter Number	185-2123

H. GENERATOR BATTERIES

Manufacturer, Model, Voltage	Surrette 8D-210-300, 12 Volts
Capacity	210 Ampere hours
Reserve Capacity	390 Ampere hours
Cold Cranking Capacity	900 Ampere hours

One battery per bank, one bank per generator.

I. FUEL TANKS

The table below shows the relationship between the fuel guage indication and the approximate number of gallons (fuel tank label capacity) of fuel in the tank.

Table II-I-3: Fuel Gauge Readings vs Tank Gallonage

Gauge Reading	Forward Tank	After Tank
Full	510 gallons	535 gallons
3/4	340 gallons	415 gallons
1/2	174 gallons	205 gallons
1/4	87 gallons	38 gallons
Empty	0 gallons	0 gallons

Note: Usable fuel is considered to be 90% of fuel tank label capacity.

J. BILGE AND SUMP PUMPS

PUMP	RATED CAPACITY
Bilge Pumps	1,750 gallons per hour
Engine Room Sump Pump	330 gallons per hour
Shower Sump pump	550 gallons per hour
Optional Engine Driven Auxiliary Bilge Pump	900 gallons per hour at 775 rpm 1,680 gallons per hour at 1,400 rpm

NOTE:
To prolong the pump life do not operate bilge pump if there is no water in the bilge.

K. VENTILATION AND EXHAUST BLOWERS

Head Exhaust Blowers	Two 150 cfm (cubic feet per minute), 32 Vdc (in port and starboard heads)
Head Ventilation Blowers	Two 55 cfm, 120 Vac (in port and starboard heads)
Galley Exhaust Blower	One 110 cfm, 120 Vac
Engine Compartment Heat Removal Blowers	Two 240 cfm, 120 Vac, thermostatically controlled (ON at 110°F and OFF at 90°F) with manual override switch
A.C. Generator Compartment Heat Removal Blowers	Two 110 cfm, 120 Vac, thermostatically controlled (ON at 110 F and OFF at 90 F) with manual override switch

L. NAVIGATION LIGHTS

NOTE:

Light Bulb Replacement: To comply with U.S. Coast Guard regulations and with the international rules "COLREGS", it is important that the correct bulbs be used when replacing burned out bulbs in your navigation lights. Table II-I-4 lists the replacement navigation light bulbs required for your Bertram.

Table II-I-4: Replacement Navigation Light Bulbs

LIGHT(S)	REPLACEMENT BULBS
Side & Bow (Aqua-Signal)	12V, 25W Aqua-Signal Part #904-00002 Bertram Part Nr. 141661
Bow (Perko)	12V, 8cp (candle power) Bertram Part # 141616
Stern	12V. 12cp, Perko Part # 70-1 (211-2) Bertram Part Nr. 141617
Anchor	12V, 6cp Bertram Part # 14034

M. PERFORMANCE CHARTS: FACTORY-GENERATED

NOTE:

The factory-generated charts on this and the following page are to be used examples only.

Performance data -- Boat Speed (in statute miles per hour), Range (in statute miles), and Fuel usage (in gallons per hour) -- are taken on a new test boat under ideal conditions with a clean bottom and 10 to 12 foot water depth.

Many factors may affect actual performance obtained. These may include, but are not limited to, installation of certain options, presence of a tuna tower, boat loading and trim, weather conditions, water depth, engine and boat condition, propeller condition, manufacturing tolerances, and other factors.

Based on prudent seamanship, Range is calculated on 90% of the fuel tank label capacity.

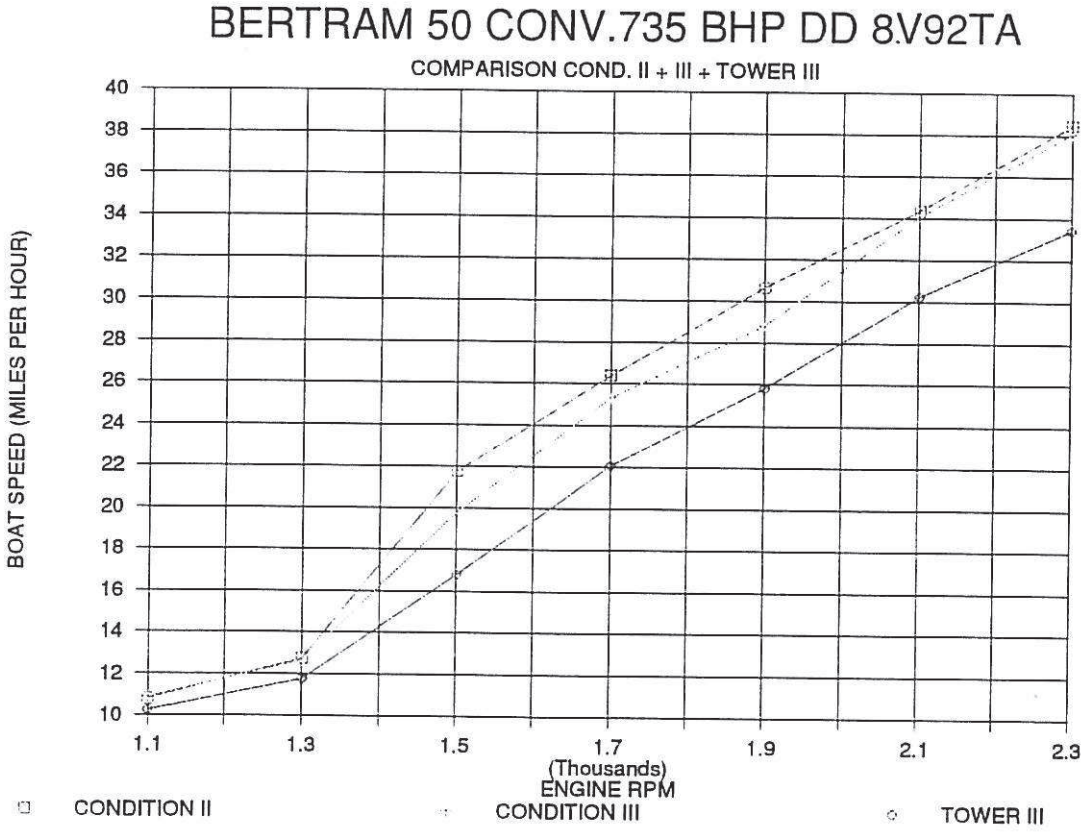
The first three charts, Boat Speed, Range, and Fuel usage, are furnished as examples. *They should be used only as examples.*

The last three charts are left blank for you to plot in curves of data you obtain on your own boat.

NOTE:

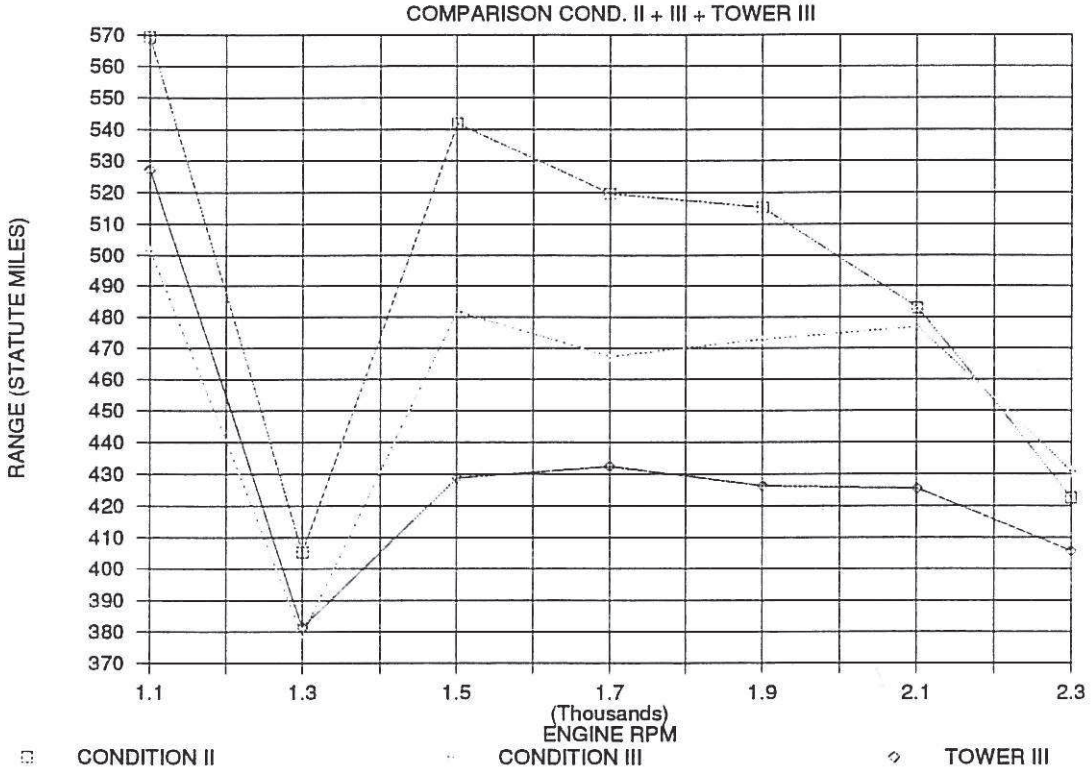
You should use the charts you have generated with your own vessel when planning your trips.

Condition II = 2/3 fuel and water, six people, 1000 pounds of gear
Condition III = full fuel and water, six people, 1000 pounds of gear
Tower III = full fuel and water, six people, 1000 pounds of gear, full tower



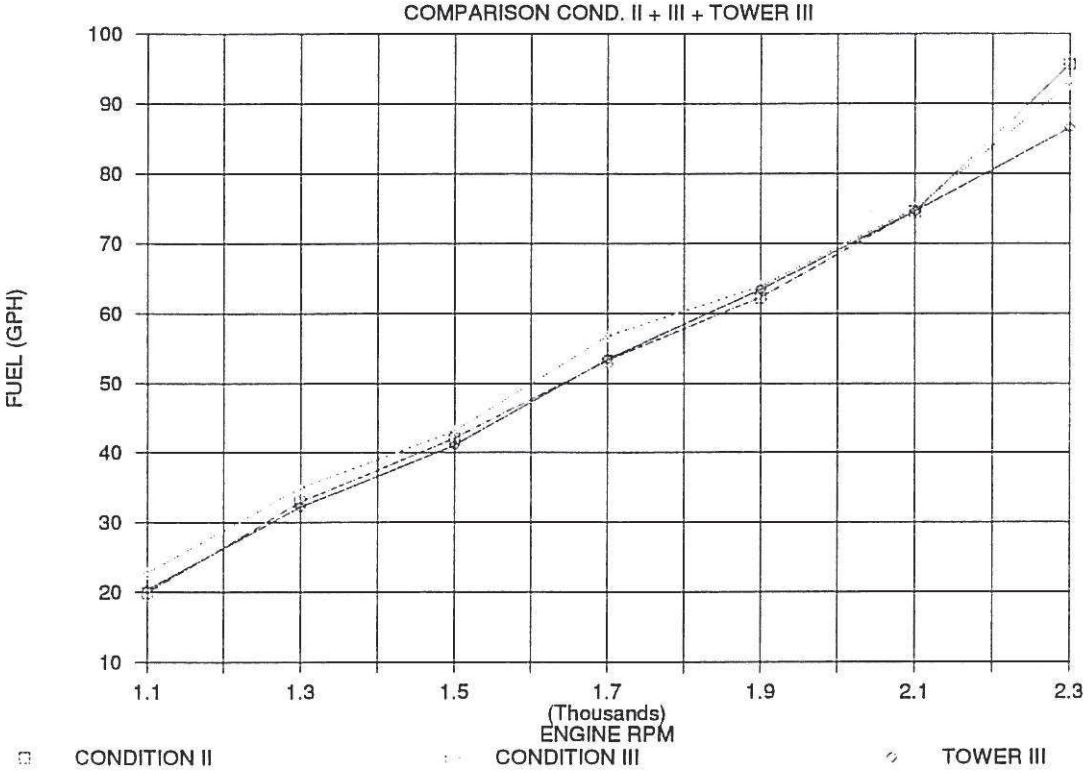
BERTRAM 50 CONV.735 BHP DD 8V92TA

COMPARISON COND. II + III + TOWER III



BERTRAM 50 CONV.735 BHP DD 8V92TA

COMPARISON COND. II + III + TOWER III



N. PERFORMANCE CHARTS: OWNER-GENERATED

Performance data -- Boat Speed (in statute miles per hour), Range (in statute miles), and Fuel usage (in gallons per hour) -- are taken on a new test boat under ideal conditions, with a clean bottom and 10 to 12 foot water depth.

Many factors may affect actual performance obtained. These may include, but are not limited to, installation of certain options, presence of a tuna tower, boat loading and trim, weather conditions, water depth, engine and boat condition, propeller condition, manufacturing tolerances, and other factors.

Based on prudent seamanship, Range is calculated on 90% of the fuel tank label capacity.

The three charts on the previous pages are furnished as examples. *They should be used only as examples.*

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NOTE:
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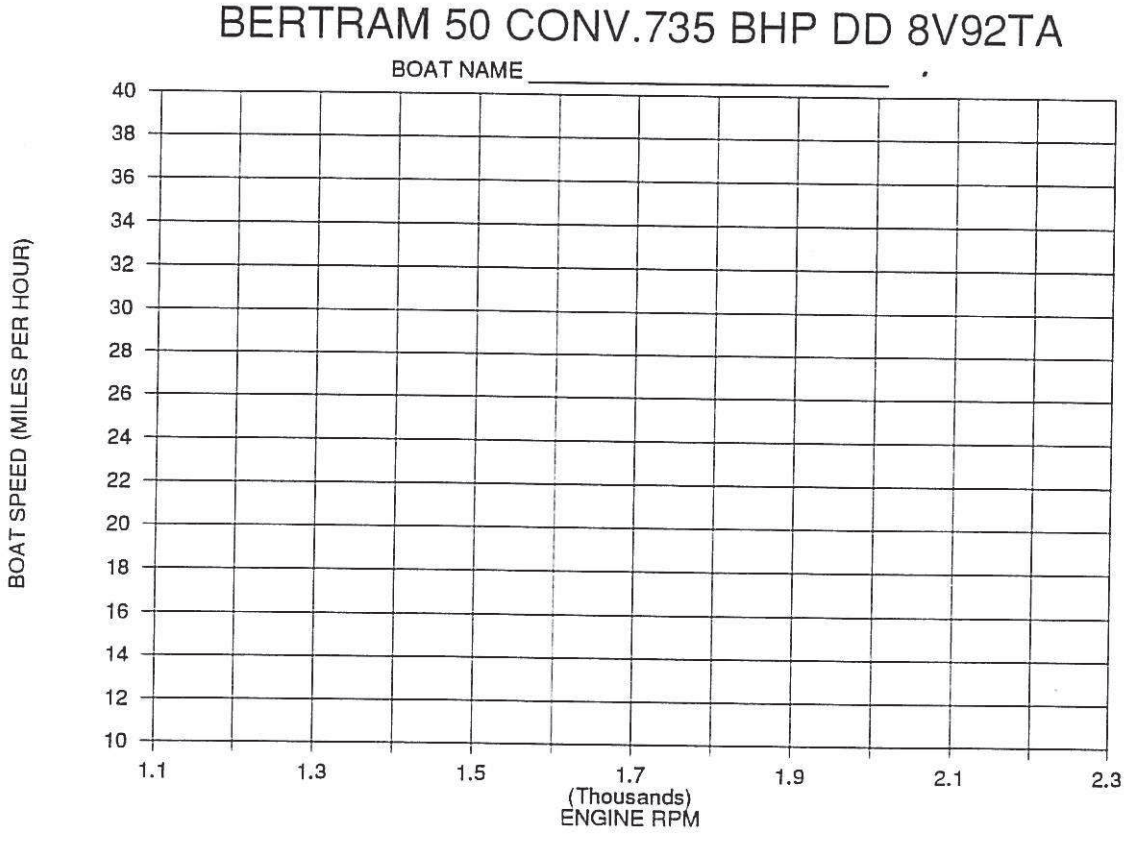
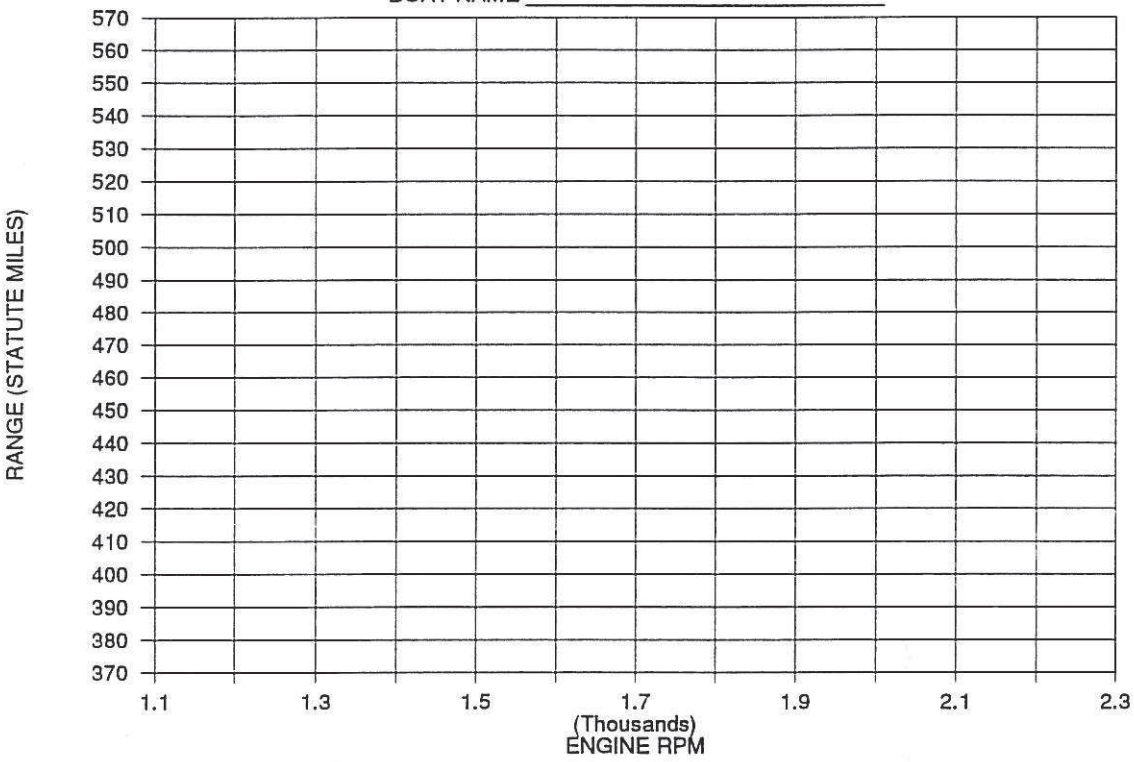


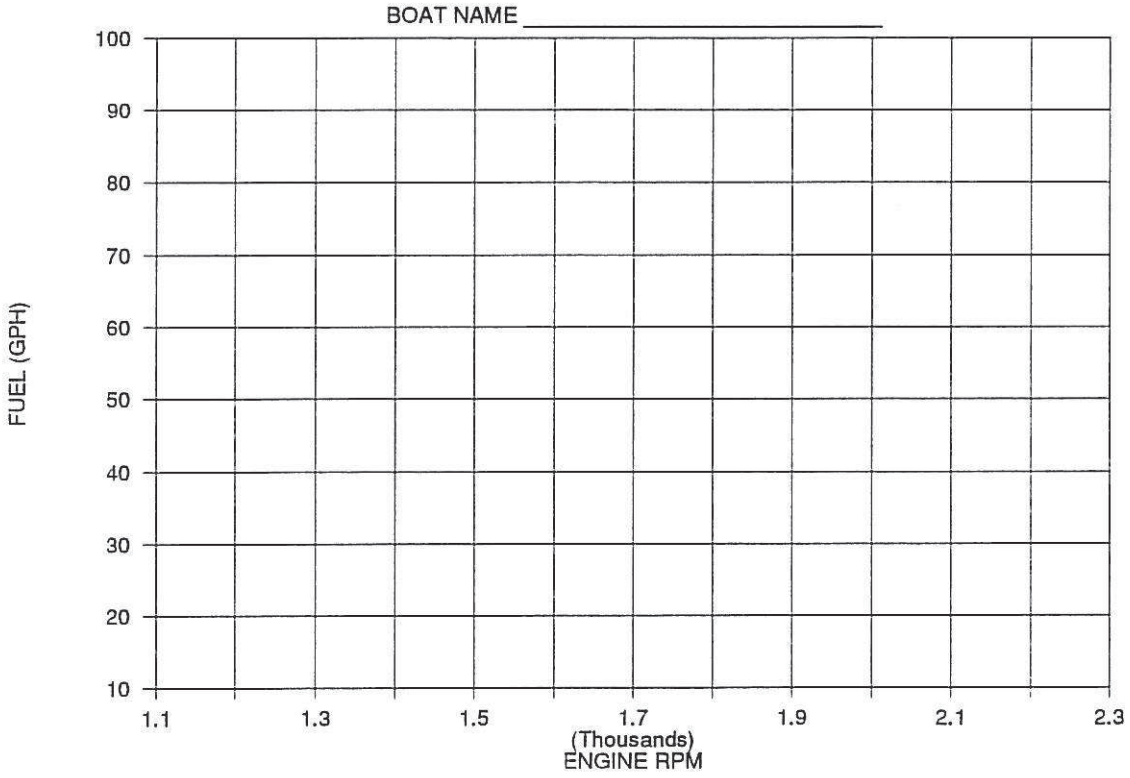
BERTRAM 50 CONV.735 BHP DD 8V92TA

BOAT NAME _____



BERTRAM 50 CONV.735 BHP DD 8V92TA

BOAT NAME _____



SECTION II - CONTROLS, INSTRUMENTS, and INDICATORS

A. GENERAL

NOTE:
Do not attempt to operate this vessel until you are thoroughly familiar with the contents of this manual and all of your vessel's on-board systems. Included in this manual are the appropriate Warnings and Cautions plus operating and maintenance information for each of your Bertram's factory-installed systems.

This Section describes your Bertrams controls, instruments and indicators, and explains how to operate the vessel. It also alerts you to precautions that will help you minimize the chances of injury to you, your guests, and/or damage to your Bertram.

B. CONTROL STATIONS

1. General

Your Bertram's underway maneuvering controls and, with a few exceptions, all of your Bertram's remaining functions are managed from the flybridge control station. The following exceptions are managed from the salon, the galley, the cockpit, the engine-compartment, and/or the staterooms,

1) some main electrical distribution functions;

2) entertainment center functions;

3) galley appliances;

4) fuel tank selection;

5) climate control functions;

6) lubrication oil transfer;

7) discharge of the Halon secondary fire extinguisher bottles.

2. Flybridge (Bridge Deck) Navigation and Engine Control Station

The instrument and switch panels are protected by hinged clear acrylic covers. Do not discard the covers. The switches are not rain-proof and electrical damage may result if water gets behind the panels.

The controls, instruments, and alarm systems on the Flybridge Control Console are shown in Figure 1 - The Flybridge Control Station. This is your vessel's main navigation and engine control station and this section discusses that equipment. However, for vessel owners heavily involved in deep sea fishing, there is an optional Cockpit Engine Control Station for your Bertram (see Subsection 3 in this Section).

The Flybridge Navigation and Engine Control Station is equipped with the following:

1) engine, transmission, and steering controls;

2) engine performance instruments;

3) engine and accessory switches;

4) alarm system indicators;

5) optional features you have ordered.

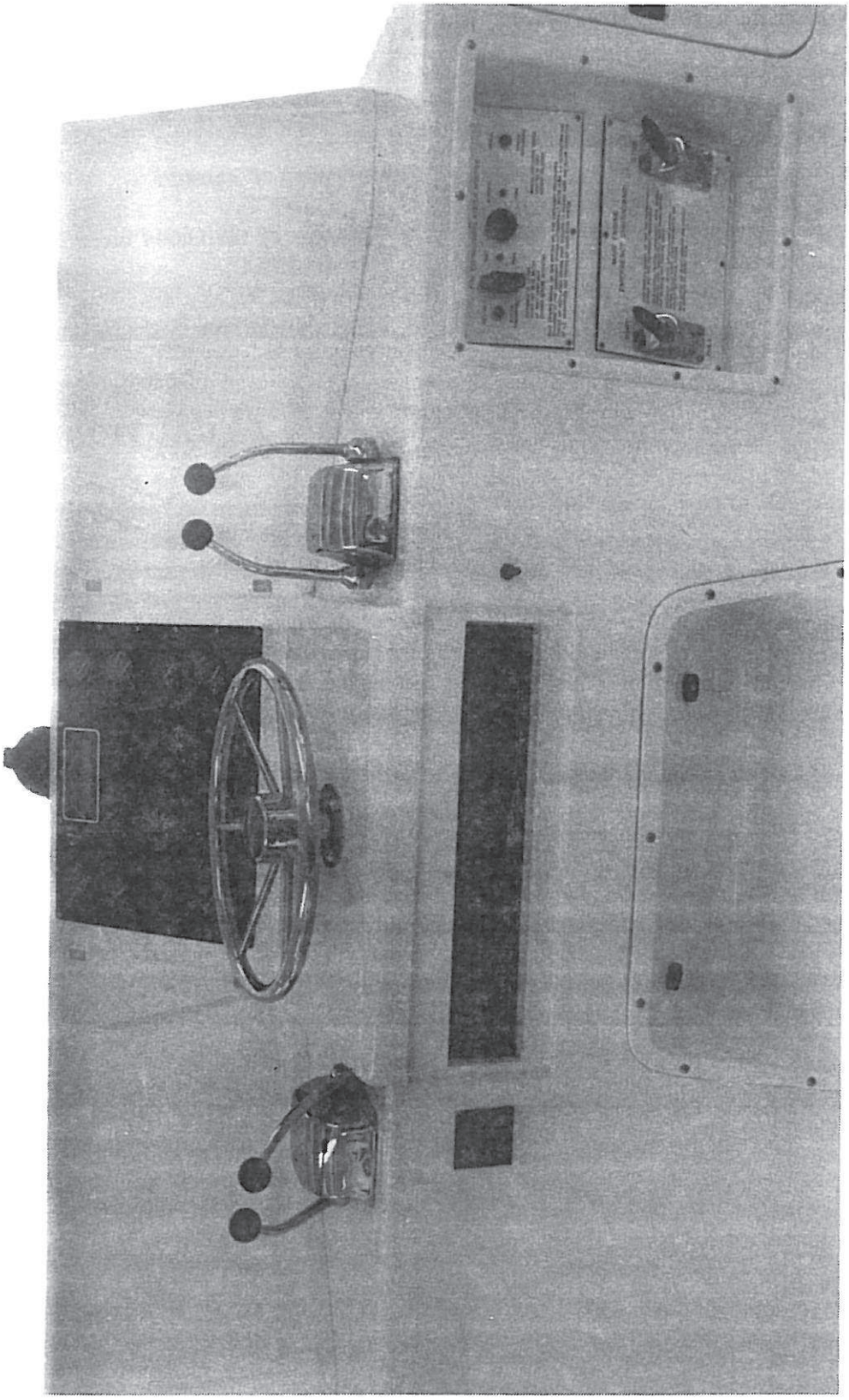


Figure 1 - The Flybridge Control Station

3. Cockpit Engine Control Station (Optional)

CAUTION

The Cockpit Engine Control Station has little or no forward visibility and no steering wheel. Therefore, use the Engine Control Station only :
1. when a lookout is on the Flybridge;
2. when the vessel is in safe, open waters;
3. when limited maneuvering with engines only is needed to aid in boating a large fish.

The optional engine control station should be used only under the following conditions:

1) a qualified lookout must be on duty on the flybridge, and this lookout must be prepared to take over control of the vessel if necessary;

2) the vessel must be operating in open seas well clear of obstructions or dangers;

3) maneuvering must be restricted to limited, low speed maneuvers performed to assist in boating a large fish.

If you have the optional cockpit engine control station, you should be well aware that this control station is -- as its name implies -- a station for engine control only. This station was not intended to be used for navigating your vessel. Although it does have dual transmission controls and dual throttle controls, it is not equipped with a steering wheel (helm), nor is it equipped with engine performance gauges, nor the alarm monitors.

C. THE SPEED AND MANEUVERING CONTROLS

1. General

As is shown in Figure 1, located on the flybridge control console are all of the controls necessary to control your Bertram's engines and maneuvering functions. These controls include:

1) throttle controls;

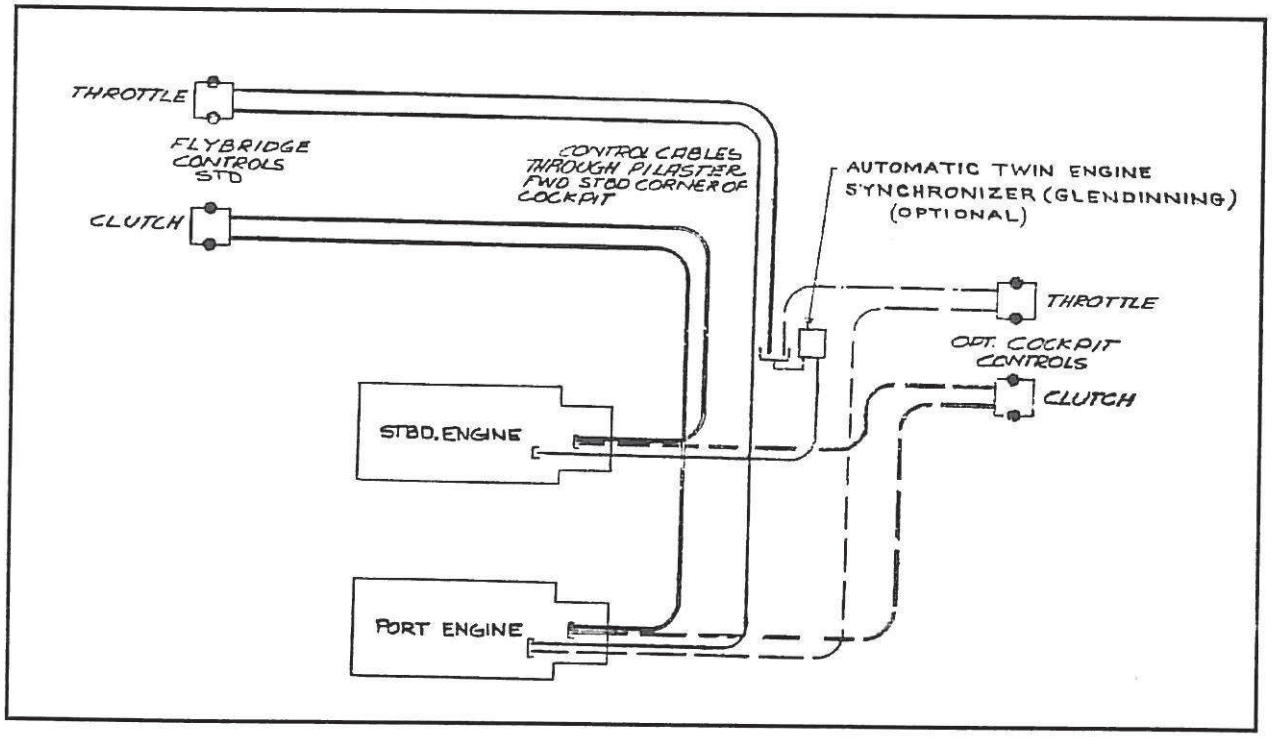


Figure 2 - Engine Clutch and Control Throttles

2) transmission controls;

3) steering controls;

4) trim tab controls.

2. Throttle Controls

CAUTION

To avoid transmission damage while maneuvering, do not shift until engine speeds have dropped to idle -- below 1,000 rpm.

The main engine throttle controls for your Bertram are on the flybridge control console, starboard of the helm. There are two types of throttle control systems: with trolling valves, and without them.

a. Without Trolling Valves

There are two levers with red knobs. Each lever controls one engine's speed and is connected to that engine's governor mechanism by a push-pull cable. The port lever controls the port engine, and the starboard lever controls the starboard engine. Push the levers forward to increase engine speed and pull back to reduce speed. The farthest aft is the "**IDLE**" position. (See Figure 2 - Engine Clutch and Throttle Controls).

b. With Trolling Valves

The trolling valves allow slippage in the marine hydraulic transmission. This allows low-speed vessel operations at higher (and cleaner-operating) engine speeds.

With trolling valves installed on your Bertram, there are two sets of throttle controls. The taller of the two levers on each control set is the throttle; the shorter lever is the trolling valve. Each set controls one engine's speed and is connected to that engine's governor mechanism by push-pull cable. The port control is for the port engine, and the starboard control is for the starboard engine.

With the trolling valves disengaged (that is, pushed all the way forward), the throttles operate as if there were no trolling valve: push the throttle levers for-

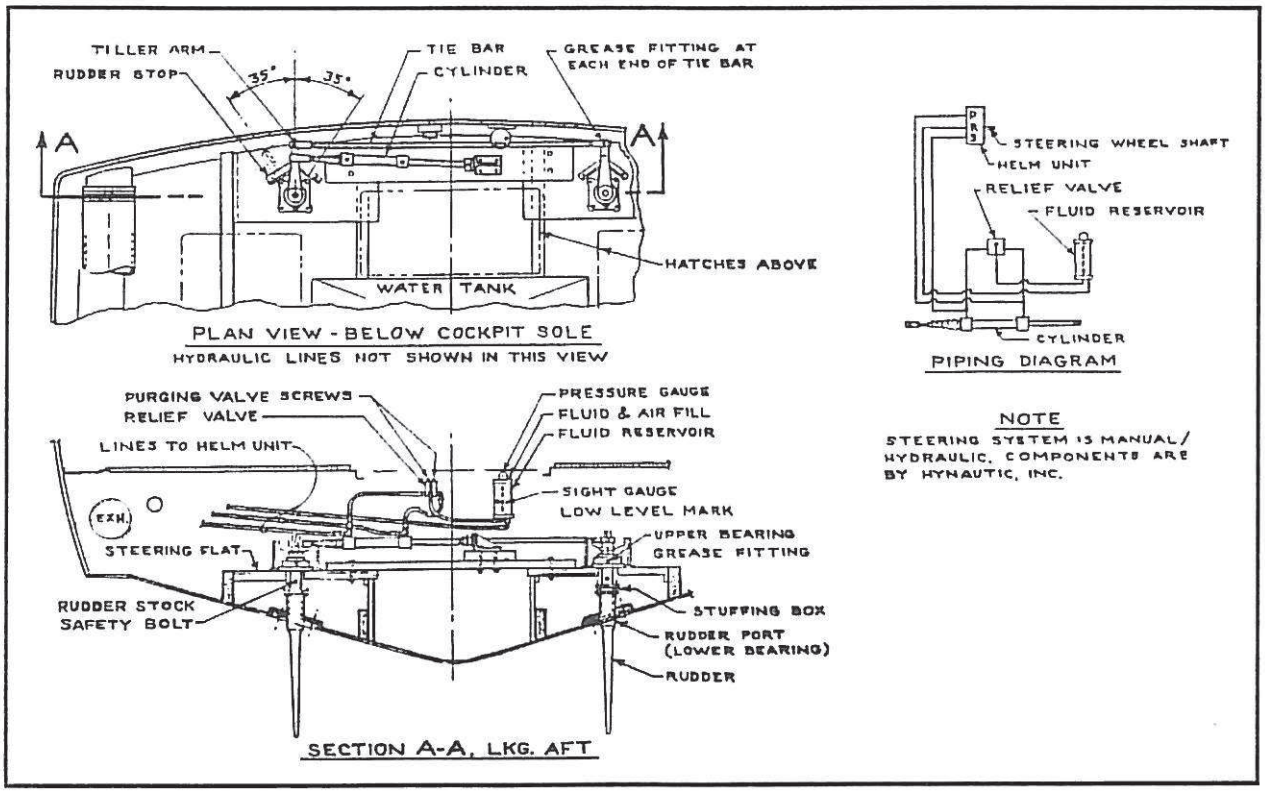


Figure 3 - Steering System

ward to increase engine speed, and pull back to reduce speed. The farthest aft is the "**IDLE**" position. (See Figure 2 - Engine Clutch and Throttle Controls).

To engage the trolling valves, throttle the engines back to idle, and pull the trolling valve levers all the way aft. Throttle movement is now restricted to a significantly lower maximum engine rpm (the maximum rpm allowed with trolling valves engaged is listed in Part II, Section I - Technical Data), and slippage in the transmissions allows very low-speed vessel operations with the engines operating at above-idle rpm.

To disengage the trolling valves, simply push the trolling valve levers all the way forward.

3. Transmission Controls

The twin clutch control levers are on the port side of the helm. If your vessel has no trolling valves, the levershave black knobs. If trolling valves are installed, they have "T" handles.

The transmission controls have a detent to let you "feel" the "**NEUTRAL**" position. Pushing a lever forward of neutral, puts that transmission(s) in forward. Conversely, pulling a lever back past neutral puts that transmission in reverse.

a) It is vital that you always throttle back your engines, let them to slow to an idle -- 1,000 rpm (revolutions per minute) or less -- and pause with the transmissions in idle before shifting gears to the opposite direction. This pause lets the hydraulic pressure within your transmissions drop to a lower level which reduces transmission wear and tear and facilitates shifting. Pausing with the engines at idle is also important to allow you to fully engage the transmission(s) in forward or reverse.

b) For maximum maneuverability, besides twin rudders, your twin-engine Bertram has propellers that counter-rotate (rotate in opposite directions) to balance engine torque and give your Bertram excellent maneuverability at low speeds.

For example, you can turn your Bertram in its own length, in either direction, in a confined area. Set one engine in forward, and the other in reverse, with rudders amidships and the throttles at or near idle (below the 1,000 rpm shift maximum). Port engine forward and starboard in reverse spins you clockwise; starboard engine forward and port in reverse spins you counter-clockwise. You can speed up the turn by applying rudder in the direction of the turn.

c) Docking parallel to a dock or pier is a good place to use your Bertram's slow-speed maneuverability. Approach the dock at minimum maneuvering speed, at a 30° angle and, if possible, against either the tide flow or wind, whichever is greater. When the bow is about five feet from the dock, put the dockside engine in neutral and the other engine in reverse. This reduces your forward movement and will bring your stern smoothly alongside the dock without a jolt. With some practice, this type of docking can usually be accomplished with minimum fuss and noise, by using the clutches alone, without steering or using the throttle.

d) At some time, it may become necessary to operate your Bertram with a single engine. Before this happens, it would be prudent to practice with first one engine, then the other, to see how your vessel handles. You will note that your vessel must be moving fairly fast after a dead stop before the rudders will "bite" the water sufficiently to make the desired course correction. You will also notice that with only one engine operating, steering while in reverse is very poor.

4. Steering Controls

Using the gears is fine for docking and similar minimum speed maneuvers; but to maneuver at normal cruising speeds your Bertram is equipped with a positive-control, no-kickback, closed and pressurized hydraulic steering system moving twin balanced rudders.

The rudders are at the stern and the flybridge control station is about amidships, so steering feel is somewhat different from a car, where the steering action takes place up front; although the results are essentially the same. However, in a vessel, the stern pivots out around a point somewhat forward of amidships. As shown in Figure 3 , your Bertram's steering system consists of:

1) axial, piston steering station pump;

2) relief valve with filters;

3) double-action slave or steering cylinder;

4) reservoir with a sight glass, the system fill location, and the system pressure gauge.

NOTE:
The technical specifications for your steering system are summarized in Table II-II-1, Steering System Specifications.

When you turn the helm (steering wheel), the axial piston pump pumps hydraulic fluid into either side of the single action, unbalanced, steering cylinder attached to the starboard rudder arm. The piston pushes or pulls the starboard rudder away from amidships. The rudders are tied together with a tie rod.

From the steering cylinder, the hydraulic fluid is piped to the relief valve. The relief valve is equipped with the system purging valves and filters. From the relief valve the hydraulic fluid is piped to the system reservoir. The reservoir has the system pressure gauge and the air and hydraulic fluid intake ports. The hydraulic fluid reservoir holds two quarts of hydraulic fluid. See Part III, Maintenance, for detailed information on refilling and purging your hydraulic steering system.

This steering system is designed and built specifically for marine use. It is also designed to prevent any outside air from entering into the reservoir. If needed, the steering system's air pressure can be recharged using an ordinary bicycle pump attached to the valve on top of the reservoir. This reservoir is located in the lazarette and has a sight glass to allow you to check its fluid level.

Your Bertram's rudders are stern mounted. This is important because when you turn the helm to make a course change, the stern changes direction first. This is because your rudders are in fact "lifting" surfaces similar to an aircraft's wing. At speed, when you put the rudders over, the lifting force generated as the water passes over the "front" and "back" surfaces of each rudder at different speeds pushes your stern out and away from the direction that you are turning. For instance, when you are getting underway from a dock or pier and you were starboard side to, if you were to put the helm "hard over" to port in an effort to move your bow away from the dock, when you then applied power equally to both engines, your rudder position would push your stern into the dock instead.

Maneuvering at speeds above "IDLE" is almost always done with rudders only and should not normally involve reversing either transmission. Your rudders are limited to a "hard over" angle of 35° from amidships, because after this limit they are ineffective as steering devices and simply increase drag on your vessel.

Once your rudders bite, your vessel pivots around a point forward of amidships. The pivot point moves with changing speed and hull attitude. Her bow pivots around a circle that is smaller than that of her

Table II-II-1 - Steering System Specifications

FUNCTION or FEATURE	CAPACITY
Steering System Hydraulic Fluid	2 Quarts
Steering System Pressurization	30 TO 40 psi
Hardover Limit	35° From Amidships
Turns Lock-to-lock	6
Relief Valve Setting	950 psi

stern with her bow initially just inside the intended turning track and her stern just outside.

At any speed above idle, she will settle smoothly into a turn due to the forces of the water on your deep "V" hull. As long as your helm is over, the lifting force of the rudders exists, and she will continue to turn. When you return the rudders to amidships, her turn will slow and her track through the water will straighten out. With a vessel of this size, particularly at slower speeds, steering slightly to the opposite direction "meeting her" can be helpful in settling her in on her new course.

5. Trim Tab Controls

WARNING

BEFORE RUNNING AN INLET OR IF BEFORE A FOLLOWING SEA, MOVE TRIM TABS TO FULL UP TO REDUCE THE RISK OF BROACHING OR PITCHPOLING.

NOTE:

Do not depress one switch "BOW DOWN" and the other "BOW UP" or hold either switch in "BOW UP" or "BOW DOWN" for an extended period as this will trip the circuit breaker which

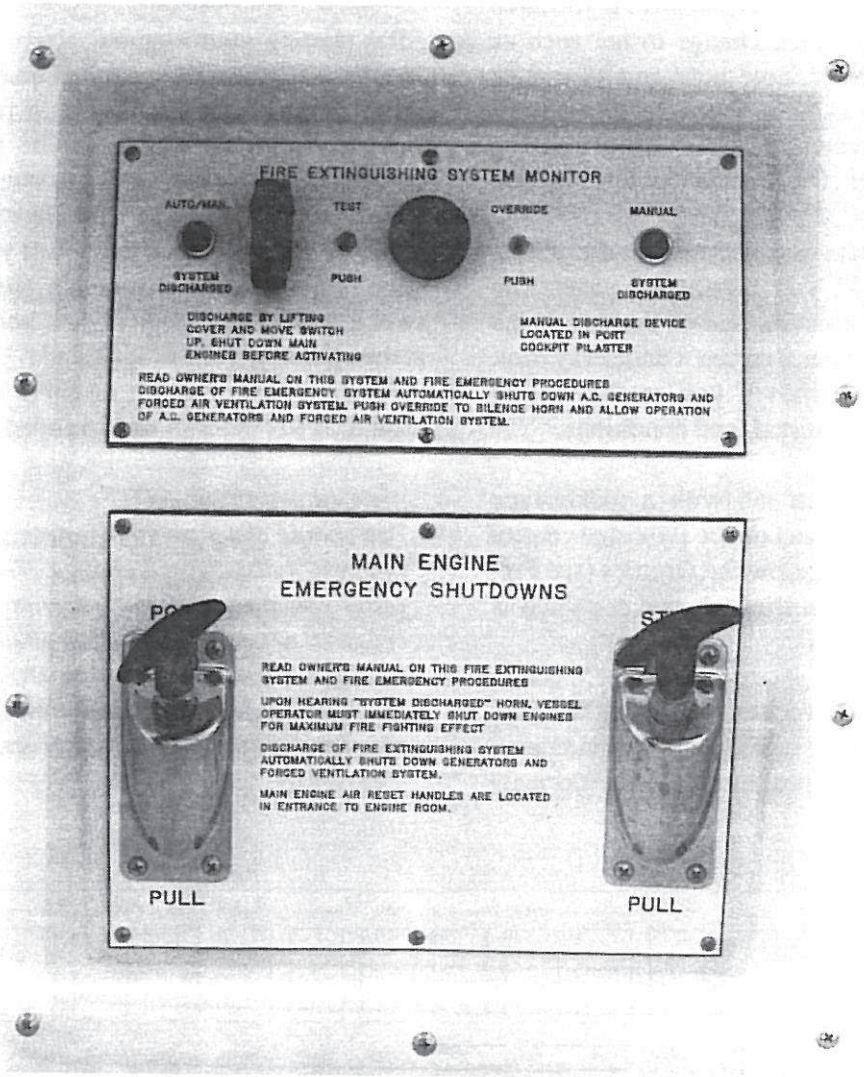


Figure 4 - Emergency Engine Stop & Fire Extinguishing System

must be manually reset to "ON" to reactivate the trim tab system.

From the first, you will find that your Bertram handles easily and creates little wake at idle speed. However, as you increase speed, she will initially increase her bow-up attitude. As your speed increases further, she will level off and will assume a planing attitude. This is her most efficient attitude: about 5 degrees bow up.

NOTE:

Do not hold your Bertram at maximum bow-up attitude any longer than absolutely necessary. For the most fuel efficient operation and the smoothest ride, the sooner she is up on plane, the better.

When you first operate your Bertram, or if you have made any significant load change to her such as adding a fishing tower, note your engine rpm at maximum bow-up attitude. Plan to cruise either under or over that speed. As a rule, Diesel cruising rpm should be about 10% less than wide open rpm.

Your trim tab system is electro-hydraulic and is powered from the 32 Vdc distribution panel. The two trim tabs (one on each side of the hull at the transom) can adjust your Bertram's underway trim. Trim tabs can also adjust if you are navigating adverse seas or with unusual load conditions.

Your operate each trim tab with a rocker-type switch mounted on a panel on the flybridge control console starboard side below the throttles (see Figure 1). The top of each trim tab rocker-switch is marked "**BOW DOWN**".

Depressing a trim tab rocker switch "**BOW UP**" causes its two hydraulic cylinders to pull in raising the trim tab up to its top position. Up is the "normal" operating position and the best for most cruising conditions and speeds.

Conversely, depressing the trim tab switch "**BOW DOWN**" extends both hydraulic cylinders, pushing the trim tab down. Holding a switch "**BOW DOWN**" lowers the trim tab to its maximum down position. Under some sea and operating conditions, some "**BOW DOWN**" trim tab can adjust your vessel's trim to a smoother riding, more fuel efficient angle. You will learn to judge the best running trim of your vessel (about 5° bow up) by watching the bow's relationship to the horizon.

Always raise both trim tabs to the **FULL UP** position prior to docking. Following this procedure helps prevent marine growth from developing on the exposed hydraulic rams.

After starting your engines, always depress both "**BOW UP**" trim tab switches ensuring that you leave dockside with trim tabs in the full up position. Once underway and clear of the harbor, as sea conditions permit, you will put your Bertram "on plane". If you want trim tabs, lightly depress the "**BOW DOWN**" switches to lower your bow. Continue to depress and release the "**BOW DOWN**" switches to gradually lower your bow until you are at the optimum 5° bow up attitude. Your speed and the sea will determine the extent to which you will want to lower the trim tabs to adjust your trim.

NOTE:

You should check on your running attitude each time you make a speed change. Normally, the faster you are going, the less trim tab is required to maintain the desired attitude. Additionally, too much "BOW DOWN" at any speed will reduce the vessel's speed and may also degrade the handling characteristics of your vessel.

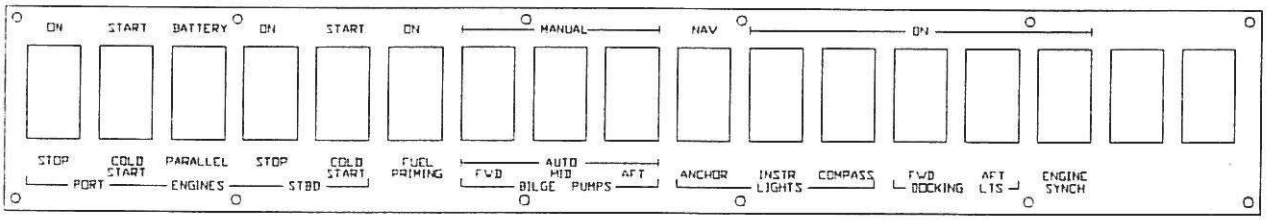


Figure 5 - The System Control Switches

While under way, you may find that your vessel lists to one side or the other which is usually due to the improper loading of gear or passengers, or due to a beam wind. Underway, your Bertram can be leveled by changing the relative positions of the trim tabs. For instance, if your vessel lists to port:

a) Depress the Starboard "**BOW UP**" switch momentarily.

b) Then depress the Port "**BOW DOWN**" switch momentarily.

c) If your first trim adjustment does not completely correct the list, repeat the operations until you are satisfied with the adjustment achieved.

d) For a list to starboard, reverse this procedure.

e) Your trim tabs are mounted on the hull where the transom meets the bottom. They are therefore vulnerable to damage if used improperly.

The following two paragraphs are suggestions that are important for the proper use of your trim tabs.

1. Except in an emergency situation, never go into reverse nor back down quickly from any speed above idle while either one or both of your trim tabs are in any position except fully up. If you do reverse or back down suddenly, it is possible that the reverse pressure of the water against the trim tabs could damage the trim tab hydraulic cylinders and/or the cylinders' internal seals.

2. Always return both trim tabs to fully up by depressing and holding the "**BOW UP**" rocker switches prior to trolling, in case it is necessary to "back down" on a fish (for the reason above).

6. Emergency Engine Stop.

CAUTION

Detroit Diesel Engine-equipped Vessels: Use the emergency stop system to shut down engines ONLY in emergencies, since shutting off the air supply to the engines could damage them. Read the manufacturer's manual on this system.

Your Bertram is powered by twin Diesel engines. Diesel engines have no ignition systems and therefore can be hard to stop under certain conditions such as a failure (or destructive fire) in the engine STOP circuitry. Under normal operating conditions, you simply hold the "**ON/OFF/STOP**" rocker switches in "**STOP**" until both engines have completely shut down. However, in case of an electrical STOP circuit failure, there is an emergency stop system (see Figure 4 - Emergency Engine Stop and Fire Extinguishing System), meant to be used with the Halon engine and ac generator compartment fixed fire extinguisher systems. The fire extinguisher system operation and its operating procedure are in Part II, Section IV, Safety Afloat.

a) MAN Engines

The components of the Emergency Engine Stop system visible to you in the engine room include two heavy duty cables (one per engine) attached to the fuel system on each engine. On the other end of each cable is a "**T**" handle located on the Main Engine Emergency Shutdown Panel onthe starboard side of the flybridge control console (see Figure 4).

If it is necessary to bring your MAN Diesel engine(s) to an emergency quick stop, and holding the "**ON/STOP**" rocker switch(es) in the "**STOP**" position fails to shut down the engine(s), pull the emergency stop "**T**" handle(s) out as far as possible. This will cut off the fuel supply to the engine(s).

The MAN emergency stop system is self-resetting.

b) Detroit Diesel Engines

The components of the Emergency Engine Stop system visible to you include two heavy duty cables (one per engine) attached to the SHUT DOWN lever mounted on each engine. On the other end of each cable is a "**T**" handle located on the Main Engine Emergency Shutdown Panel on the starboard side of the flybridge control console (see Figure 4).

Should it become necessary to bring your Detroit Diesel engine(s) to an emergency quick stop, and holding the "**ON/STOP**" rocker switch(es) in the "**STOP**" position fails to shut down the engine(s); pull the emergency stop "**T**" handle(s) out as far as

possible. This will trip the catch(es) and allow the spring loaded flapper(s) to snap closed and cut off the air supply to the engine(s).

After using the Detroit Diesel emergency stop system, you must to go into the engine compartment to reset the flapper catch on top of each engine before attempting to restart your engines.

D. SYSTEM CONTROL SWITCHES

1. General

Figure 5 - System Control Switches, shows the 17 rocker-type switches mounted on the flybridge control console switch panel including the two spares. As shown on Figure 1, this control switch panel is on the flybridge console just below the helm and is protected from the weather and salt spray by a hinged transparent cover. It is important that if scratched or otherwise damaged, this cover be replaced, not removed and discarded, since the switches are not waterproof. Electrical damage may occur if water gets into or behind these panels.

Figure 5 shows the grouping of these switches on the switch panel by function and by position into the following switching groups:

1) **ENGINES**;

2) **BILGE PUMP**;

3) **LIGHTS**;

4) **DOCKING LIGHTS**.

The other two switches, "**ENGINE SYNCH**" (synchronization) and "**FUEL PRIMING**", are mounted singly in this panel.

2. Engine Switches

Figure 5 depicts the following five engine switches in the "**ENGINE**" switch group.

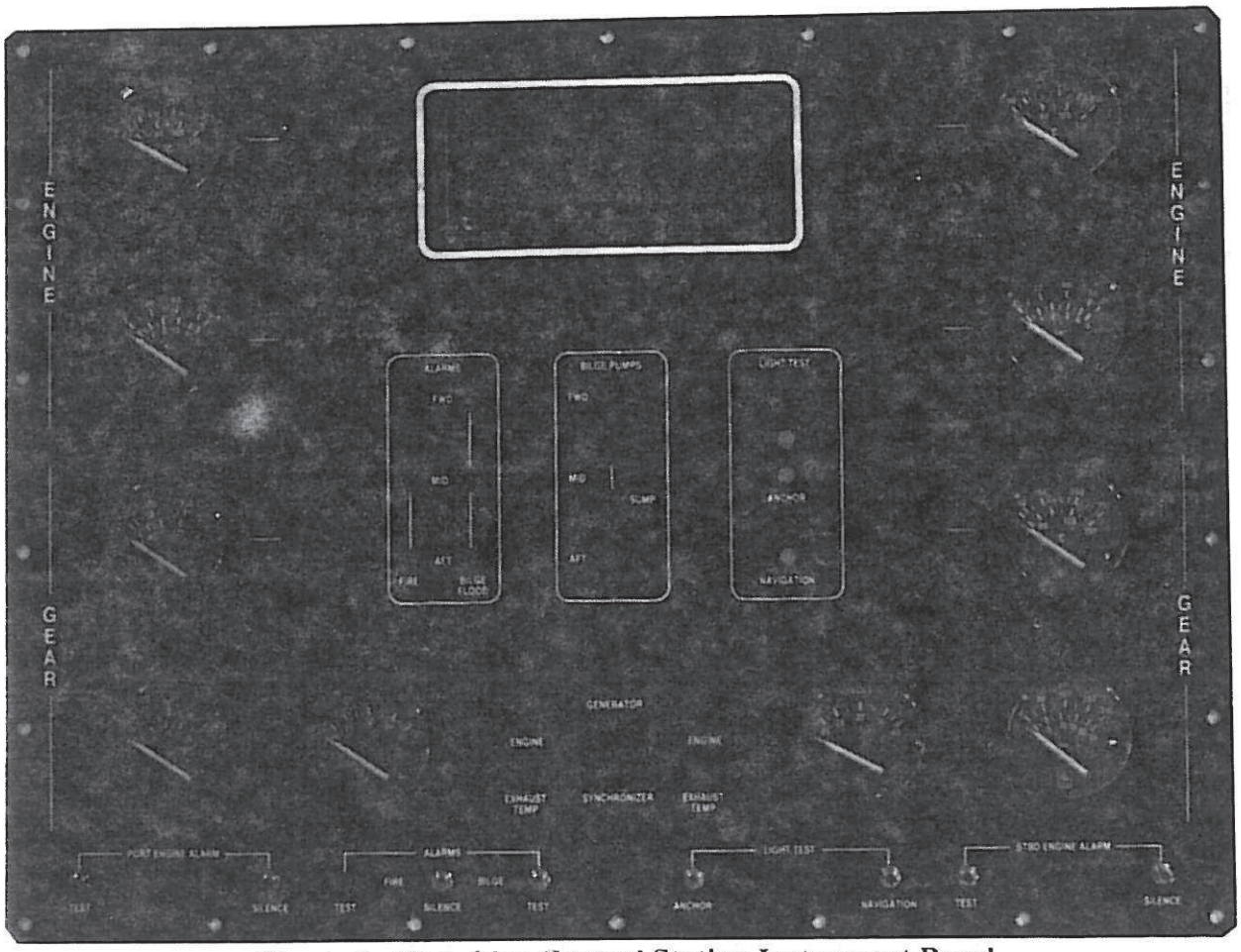


Figure 6 - Flybridge Control Station Instrument Panel

Each engine has one 3-position, "**ON/OFF/STOP**", toggle switch. The procedure for starting and stopping your engines is discussed in Part II, Section V.

Each engine also has one red, 3-position, momentary contact "**START/OFF/COLD START**" switch.

A single "**BATTERY PARALLEL**" switch is used to parallel both 32 Vdc battery banks when starting the engines.

3. BILGE PUMP Switches

Figure 5 shows a group of three, two-position, rocker-type Mode-selector switches over the caption "**BILGE PUMPS**".

The forward bilge pump (**FWD**) mode selector switch selects the operating mode, **AUTO** (automatic) or **MAN** (manual) for the bilge pump located under the forward cabin sole.

The midships bilge pump (**MID**) switch controls the engine compartment bilge pump.

The aft bilge pump (**AFT**) switch controls the generator compartment bilge pump.

For your protection, these three switches have no **OFF** position. This prevents an inadvertent bilge pump shut down. The bilge pumps can be set on manual (**MAN** -- run continuously regardless of the bilge water level) or on automatic (**AUTO** -- controlled by the bilge water level sensed by the bilge pump floats). The engine compartment sump pump is always in the automatic mode.

In the "**AUTO**" position, the bilge pumps start to operate when the bilge water rises to about 1.5 inches above the base of the bilge pump switch in that bilge and shut down when the water is lowered below about 0.5 inch above the base of this switch. These switches are normally in "**AUTO**"mode.

4. DOCKING LTS (Lights) Switches (Optional)

Figure 5 shows a two-position switch provided to switch "**ON**" or "**OFF**" the optional forward (**FWD**) docking lights and another for the optional aft (**AFT**) docking lights.

NOTE:
These lights are to be only used for docking. When underway, only your navigation lights may be showing. The Rules state: That from sunset to sunrise no other lights shall be exhibited that might be mistaken for the lights specified in the Rules, impair the visibility or distinctive character of the navigation lights, or interfere with maintaining a proper lookout.

5. FUEL PRIMING Switch

Figure 5 also shows the momentary-contact switch provided to activate the fuel priming system. This switch is duplicated in the engine compartment.

Details of the fuel system and its controls are discussed in Part II, Section V.

6. INSTR, COMPASS, and NAV/ANCHOR Light Switches

A two-position switch (see Figure 5) controls the instrument panel lights. A second two-position switch controls the compass light. A three-position switch (center is **OFF**) illuminates either the navigation lights or the anchor light.

7. ENGINE SYNCH Switch (Optional)

Figure 5 shows a two-position switch controlling the optional engine electromechanical sychronizer. This device uses engine speed information supplied by a tachometer cable from each engine to continuously match the slave (starboard) engine speed to that of the master (port) engine.

8. Horn and Trim Tabs

Figure 1 shows the horn push-button switch located on the front of the Flybridge Control Station console, starboard of the system control switches. The two trim tab control rocker switches are mounted on a panel starboard of the horn button and just below the throttles.

E. ENGINE PERFORMANCE GAUGES

1. General

As shown in Figure 6 - The Flybridge Control Station Instrument Panel, your Bertram has two identical sets of performance gauges mounted on the instrument panel, one for the port engine and port transmission the other for the starboard engine and transmission. These gauges keep you aware of the status of each critical engine and transmission system parameter.

NOTE:

In addition to the gauges for each engine and each transmission, your Bertram is equipped with an audio/visual engine alarm system that sounds an alarm (horn) and illuminates a red warning light on the instrument panel. This warning function is fully described in Part II, Section III, Alarm Systems.

2. Engine Coolant Temperature Gauges

The two (2) engine coolant temperature gauges shown in Figure 6 each independently indicates the temperature of the coolant circulating through its respective engine in degrees Fahrenheit (100 to 250°F) and Celsius (40 to 120 °C).

3. Engine Lube Oil Pressure Gauges

As shown on Figure 6, there is one engine lubricating oil pressure gauge for each main engine. The two engine oil pressure gauges are calibrated in pounds per square inch gauge (0 to 80 psig) and millibars (0 to 5 mbar).

4. Gear Oil Temperature Gauge

Each transmission has a temperature gauge calibrated in degrees Fahrenheit (°F). These gauges indicate the transmission gear box lubricating oil temperature on a scale of 150 to 300°F (50 to 150°C). These gauges are outboard of the red transmission lubrication oil over temperature warning lights.

5. Gear Oil Pressure Gauge

Each transmission oil pressure gauge shows the operating pressure of the oil in that transmission. It is calibrated on a scale of 0 to 350 psig. A sudden drop in gear oil pressure reading could indicate a major problem and that engine should immediately be put into "IDLE" and then shut down until the cause of this change is determined.

6. Battery Condition Voltmeter

There are two 24 to 40 Vdc battery condition meters. These meters monitor the voltage levels in your 32 Vdc main battery banks.

7. Tachometer

a. General

The twin, digital, two-in-one tachometer mounted on the flybridge control console instrument panel displays a continuing digital readout of your main engines' revolutions per minute (rpm) which serves several purposes:

1) It gives a good indication of relative engine performance;

2) it permits engine speed settings for fuel efficiency;

3) it helps in estimating speed;

4) it serves as a visual synchronizer to balance engine speeds.

b. Operation

The engine tachometers shown in Figure 6 simultaneously display both engines' rpm. These tachometers give a readout in numerals in increments of 10 rpm. Diesel engines perform best when they are operated at relatively steady speeds. Therefore, any substantial change in either engine's rpm from a fixed power setting or a drop from your Bertram's maximum rpm may indicate a problem. You should stop and check your engines and running gear to limit any damage.

c. Speed Estimation

Using your tachometer to make a series of timed test runs back and forth over a measured course at different rpm readings provides a good tool for estimating speed, but that there is no direct correlation of rpm to the speed of the boat across the bottom due to:

1) Slippage of the propellers;

2) the effect of wind on the vessels superstructure;

3) the effect of tides or currents;

4) the condition of the vessels bottom; and,

5) variations in the load.

d. Visual Engine Synchronizer

The digital tachometer has a built in visual synchronizer. This feature should not be confused with the optional mechanical engine synchronizer described in the next subsection. The visual synchronizer on your digital tachometer shows you which engine is running faster (or slower) than the other by illuminating a small bar under one of the numbers arranged in a row across the bottom of the instrument. The illuminated numbers indicate the difference in rpm (20, 40, 60, or 90) between the engines. When the engines are synchronized, a "**SYNC**" indicator will be illuminated in the center of the tachometer between the digital read outs.

F. ENGINE SYNCHRONIZER (Optional)

CAUTION

Do not use your synchronizer when maneuvering or when in confined waters. A failure of this device could cause your vessel to make sudden, unplanned maneuvers.

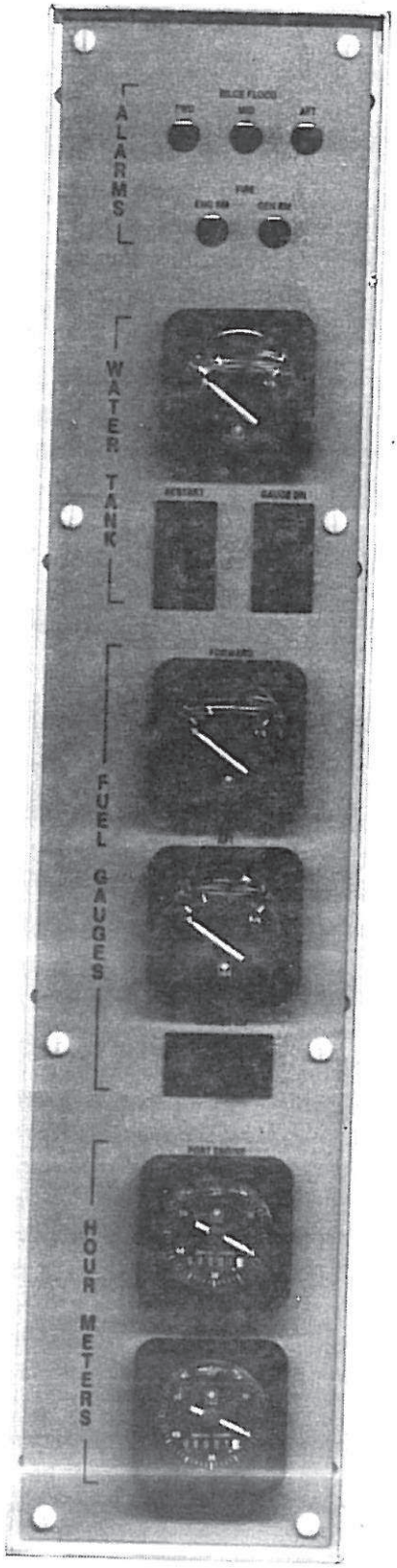


Figure 7 - Salon Gauge and Switch Panel

a. General

A rotating cable take-off connects the optional mechanical engine synchronizer device to each engine. Each engine's rpm are fed into the synchronizer which allows this device to tell when the "slave" engine's rpm do not match those of the "lead" engine. When this happens, the synchronizer mechanically makes the necessary correction to the slave engine throttle.

In your Bertram, the port engine is the "lead" or master engine and the starboard engine is the "slave".

The synchronizer should only be used when you are in open waters and not in confined areas nor when maneuvering.

b. To Engage the Synchronizer:

1) With both engines running, set the engine speeds slightly above the idle.

2) Switch the synchronizer to "**ON**".

3) The red "**SYNCHRONIZER**" pilot light will illuminate (see Figure 6).

4) Move the "slave" (starboard) engine throttle to the maximum speed position. (There should be no change in the starboard engine rpm.)

NOTE:
The synchronizer controls the "slave" (starboard) engine, the starboard throttle control is effectively disconnected from its engine. Therefore, moving the starboard throttle to its maximum speed position is not absolutely necessary to the synchronizer's operation; however, this step removes the unnecessary strain of moving this cable and its linkage from the synchronizer thus reducing wear on the synchronizer and prolonging its life.

5) Both engines are now under the control of the port "lead" engine throttle which may be advanced or retarded through its full range of speeds and both engines will respond.

c. To Disengage the Sychronizer:

1) Move the "slave" engine throttle back to idle.

2) Switch the synchronizer to "**OFF**".

NOTE:
At this point the starboard "slave" engine's throttle automatically re-engages the engine throttle linkage and the synchronizer pilot light extinguishes. A built in safety collar on the synchronizer ensures a positive return to idle speed when you move the throttle back to idle and switch the synchronizer "OFF".

G. OTHER GAUGES

1. Fresh Water Gauge

The fresh water tank gauge is on the salon gauge and switch panel and reads in quarters of a tank full (see Figure 7 - The Salon Gauge and Switch Panel). This gauge is normally **OFF**. To activate, depress the "**READ GAUGE**" momentary-contact, rocker switch next to the gauge. Also on this panel is the "**RESTART**" momentary-contact rocker switch that restarts the fresh water pump after filling if the tank has run dry.

The technical specifications and details of the fresh water system, including including instructions on filling the fresh water tank, are discussed in Part II, Section VI, Fresh Water System.

2. Fuel Gauges

The two (2) fuel gauges are also mounted on the salon gauge and switch panel. As shown in Figure 7, each fuel gauge is labeled with the name of the tank that it monitors. Fuel tank gallonage and selection are discussed in detail in Part II, Section V, Propulsion System Operation.

3. Bilge Pump Running Time Counters

There are three (3) bilge pump timers mounted on the bilge pump monitor panel (see Figure 8 - The Salon 32 Vdc Distribution Panel). These timers keep track of the accumulated running time of the FORWARD and LAZARETTE (aft) bilge pumps

and the ENG RM SUMP (engine compartment sump pump). The bilge pump monitor panel is in the salon mounted just below the 32 Vdc distribution panel.

Keeping a log of the pump operating times on a regular basis can alert you to a possible problem. The three bilges in your Bertram are sealed from each other. Therefore a periodic check on the amount of time that each of these three bilge pumps has accumulated in any given period (such as on a daily basis) could give you advance warning of a worsening leak before it gets too serious.

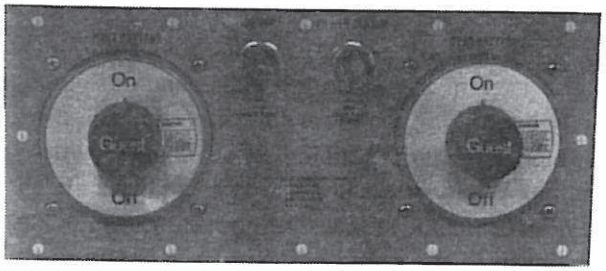


Figure 8A - 32Vdc Battery Main Switch Panel

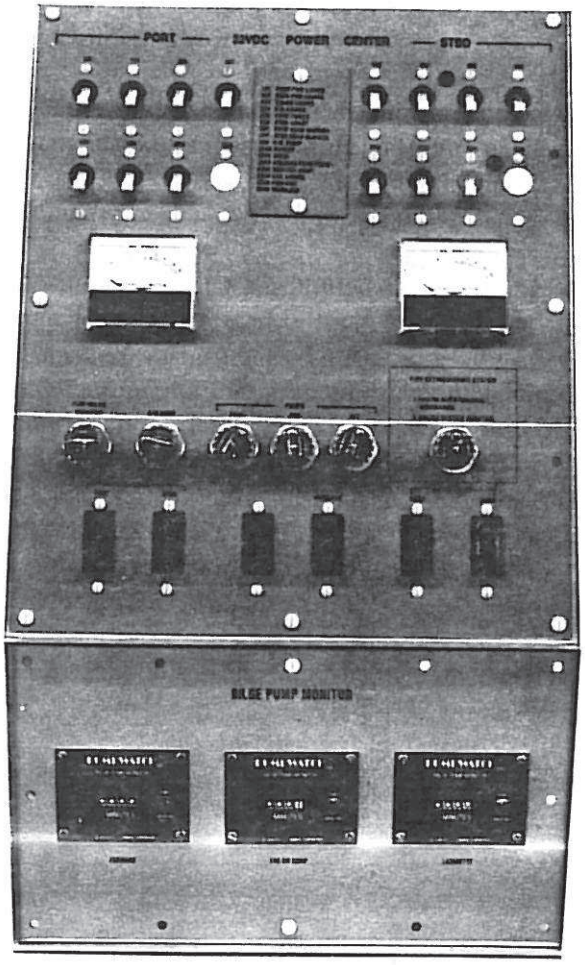


Figure 8 - Salon 32Vdc Distribution Center

H. THE METERS

1. General

Your Bertram is also factory-equipped with the indicators and meters that Bertram feels are needed to monitor the status of your vessel's electrical and non-electrical systems. Each indicator and meter has a purpose: to assist you in efficient and safe operation and in the proper maintenance of your Bertram.

Therefore, you should:

1) Become familiar with the function of each of your Bertram's gauges and meters;

2) make it a good habit to check your gauges and meters frequently when under way;

3) in particular, check your gauges and meters carefully when you first start your engines;

4) note what constitutes the "normal" readings or operational ranges of each of the gauges and meters (see Section II, Part I, Table II-I-1, Propulsion System Operating Specifications).

5) You should also be aware that:
   a) all the engine gauges are powered by your Bertram's electrical system through the ignition circuit;
   b) the gauges do not necessarily return to any particular position when the ignition is switched OFF.

6) During operation, there may be some slight fluctuations in the gauge readings. This is normal and due to the nature of lubricating oil and temperature variation.

7) When you first start your engines, especially in cool weather, oil pressure will read higher than normal and will return to normal as soon as the engines, transmissions, and the lubricating oils reach the normal operating temperature.

NOTE:

Paying attention to your gauges is important, but does not replace regular, visual engine compartment inspections.

2. Battery Condition (Voltmeter) Meters

Your Bertram has 13 electrical meters. Nine measure voltage; of these, five are for the 32 Vdc system. One 24 to 40 Vdc voltmeter is in the lower port and starboard corners of the flybridge control console instrument panel (see Figure 6). These meters monitor the 32 Vdc port and starboard battery banks respectively. There are two meters to monitor the 12 Vdc system, and two meters for the 120/240 Vac system.

The use of each meter is discussed in the section on the applicable voltage (that is, in Section X - The 12 Vdc System, or in Section XI - The 32 Vdc System), in the subsection on the applicable panel.

3. Current Draw Meters (Ammeters)

Your Bertram also has four ammeters. All of these ammeters are located on the salon main 120/240 Vac distribution panel (see Figure 9 - The Salon "120/240 VAC Power Center") and show the current draw through the two shore power lines and the two on-board ac generators.

4. Frequency Meter

On the 120/240 Vac Distribution Panel "**GENERATOR**" panel (see Figure 9) is a frequency meter with a two-position rocker switch mounted just below it. This meter reads the frequency of the "**PORT GEN**" or the "**STBD GEN**", depending on switch position, which allows you to check that the ac frequency being generated by the onboard Diesel ac generators is within limits (59 to 61 Hz).

5. Main Engine Hour Meters

Each of these twometers tracks the total hours its respective engine has been operating. Engine running time is accumulated regardless of engine speed (rpm). The engine hour meters are energized by the ignition switch. They are located on the salon gauge and switch panel as shown in Figure 7.

6. Generator Hour Meter

Mounted on each generator is a non-resettable hour meter. This meter accumulates the generator's running time and is intended to be used to schedule preventative maintenance.

I. THE INDICATORS

1. General

As shown on Figure 6 - The Flybridge Control Station Instrument Panel, your instrument panel has three rectangles. The rectangle to starboard is labeled "**LIGHT TEST**", and has the navigation light test indicators. The middle rectangle is labeled "**BILGE PUMPS**" and has the bilge pump operation indicators. The rectangle to port is labeled "**ALARMS**" and has fire and bilge flood alarm indicator lamps.

2. Navigation Lights

Unless you are dockside or at anchor in a marked anchorage your navigation or anchor lights must be illuminated between dusk and dawn. It is easy to check the operation of the anchor light and the forward facing white 225° masthead light operation from the flybridge. However, if you want to check your transom light or your port and starboard navigation lights you must leave the flybridge, which may not be desirable, especially at dusk.

Therefore, one of the flybridge instrument panel rectangles is captioned "**NAV/LTS**" (navigation lights). On this rectangle, the navigation and anchor lights are shown as green (starboard) and red (port) running lights, and three white indicator lamps representing the 135° white stern running, the 225° masthead light, and the 360° white anchor light are shown by two white indicator lamps in their correct positions. There are also two push-button switches (labeled "**NAV**" and "**ANCHOR**"), one on each side of the caption "**TEST**".

To test the navigation or anchor light circuits, including the light bulbs, switch "**ON**" the circuit and depress the appropriate test button. The indicator lamps will illuminate to confirm that the navigation or anchor lights circuits and bulbs are operating.

NOTE:
The navigation and/or anchor lights will go out when the TEST button is depressed.

3. Bilge Pump and Generator Operation Indicator Lamps

The center rectangle is labeled "**BILGE PUMPS**". In this rectangle are four (4) indicator lamps (three amber and one red). The four lamps are in the approximate onboard locations of the bilge pumps they represent. The amber lamps represent the forward "**FWD**", the engine compartment "**MID**" sump pump (so labeled), and aft "**AFT**" bilge pumps. The red lamp indicates the engine compartment bilge pump. Each lamp illuminates when the pump it represents is operating. When the red engine compartment bilge pump light illuminates, it indicates that the lower mounted, smaller capacity engine compartment sump pump is not able to control the level of water in the engine compartment bilge. The reason for this should be determined and the necessary correction(s) made.

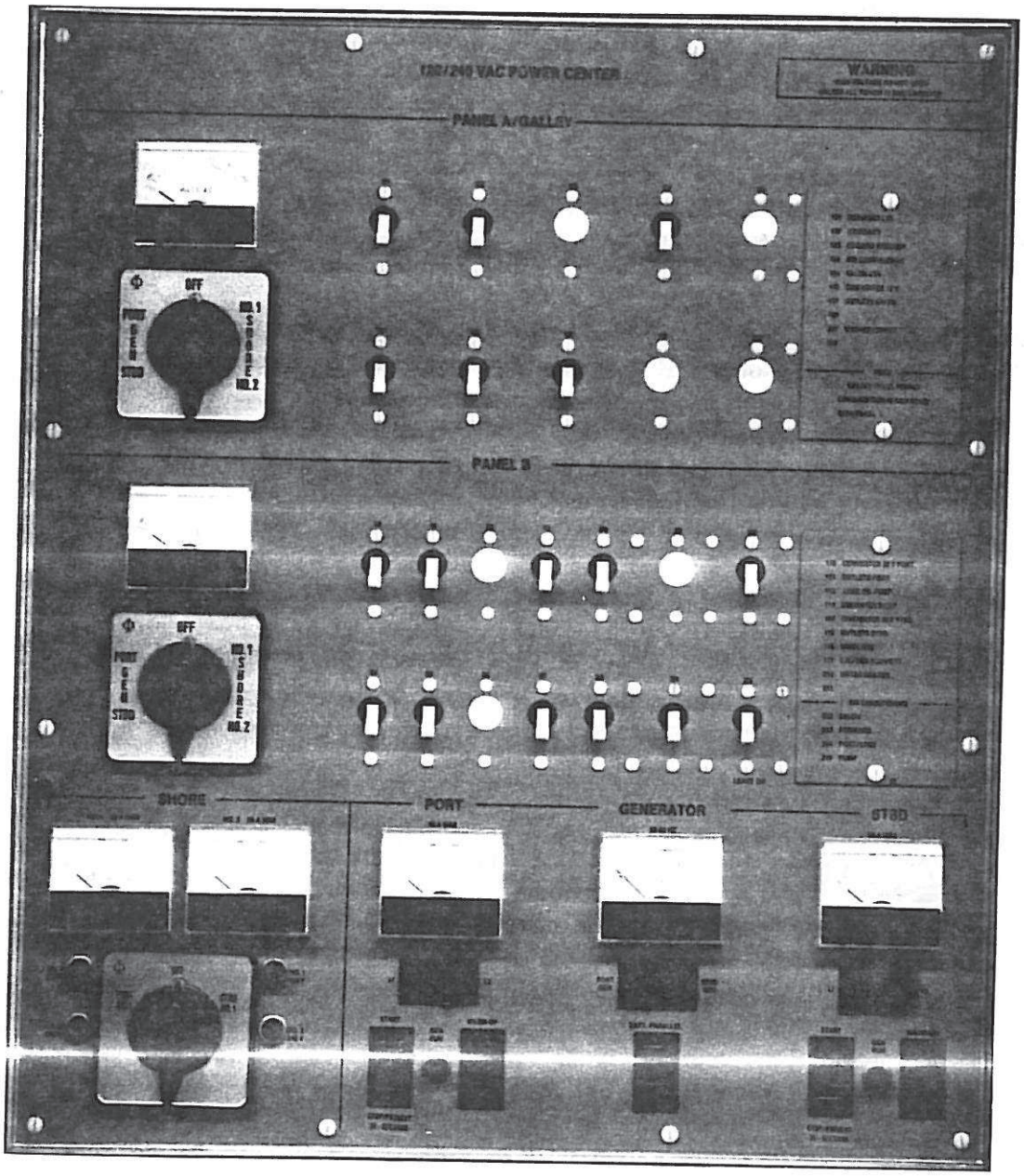


Figure 9 - Salon 120/240Vac Power Center

Below the "**BILGE PUMP**" rectangle are two other amber lamps, one on each side of the caption "**GENERATOR**". Each lamp represents one generator and each illuminates to indicate that its respective generator is running.

4. "Sychronizer On" Indicator Lamp

Below the "**GENERATOR**" run lamps and centered at the bottom edge of the flybridge control station instrument panel (see Figure 6) is a single red indicator lamp that illuminates to indicate that the engine synchronizer is engaged and is operating.

5. Alarm Test and Silence Push-button Switch

in each set is further captioned "**TEST**" and is depressed to check the operation of the alarm circuits and alarm horn for that engine and transmission. The other push-button switch is captioned "**SILENCE**" and is depressed to silence the engine/transmission alarm horn. Port of the instrument panel centerline is a group of three push-button switches below the caption "**ALARMS**".

There is a "**TEST**" push-button for "**FIRE**" and one for the "**BILGE FLOOD**" alarm circuits, plus a "**SILENCE**" push-button to stop the alarm bell. There are also two "**LIGHT TEST**" push-button switches captioned "**ANCHOR**" and "**NAVIGATION**".

6. Compass

a. General

Your Bertram comes with a compensating, lighted, marine compass mounted on top of the instrument panel (see Figure 1).

CAUTION

The compass aboard this boat is not compensated by Bertram Yacht. Compensation is the responsibility of the boat owner. It should be performed by a competent compass technician.

This is a magnetic card compass and, like all magnetic compasses, it is affected by:

1) Nearby ferrous metal (iron and steel) objects including tools, some beverage cans, etc.;

2) magnetic fields generated by nearby electrical or electronic equipment, including other compasses;

3) variations in the earth's magnetic field.

CAUTION

Any time any electronic equipment, gauge, or instrument is added, removed, or replaced on the instrument panel or in its immediate area, Compass Deviation should be checked by a competent compass technician.

The magnetic compass can be the most important navigation instrument on a vessel. A compass is basically a permanent magnet free to swing into alignment with the influence of existing magnetic fields. A typical marine magnetic compass consists of:

1) one or more magnets;

2) a calibrated card;

3) a jeweled pivot;

4) the compass bowl;

5) an illumination system for night use.

Except for the night navigation light, the marine magnetic compass installed on your vessel does not need electrical power to function, and therefore it is not disabled in case of shipboard electrical difficulties.

b. Compass Construction

The permanent magnet provides the magnetic field seeking element of the compass and is usually attached to the underside of the calibrated card. Additional magnets may be located inside the compass and are used for adjustments.

The card is a non-magnetic material marked with a scale calibrated from 000° at North, then clockwise through 090° (East), 180° (South), 270° (West) to 360° (which is also 000° and North). This card is centered on a jeweled pivot in the center of the compass bowl.

The bowl may be filled with a mixture of alcohol and water or light oil. The compass card is partially supported by the liquid, reducing the frictional resistance and damping out excessive motion.

The housing for your compass is called the binnacle. When mounted, the compass card magnet aligns with the strongest magnetic field, normally the earth's magnetic field (but the effect of this field can be modified by electrical and electronic equipment, machinery, other compasses, and other nearby magnetic materials). When a compass is properly adjusted (compensated), the compass card will align itself closely with the earth's magnetic field and point approximately toward magnetic north.

c. Compass Error

Compass error is the observed difference between an indicated compass bearing and the actual bearing relative to true north (based on the north star, Polaris).

All navigation at sea is plotted on charts which use true north as a reference. If you are doing any long distance cruising that could require you to work navigation plotting problems and plot compass courses, it is vital that you know two things:

1) local variation (the difference in degrees east or west between true north and what your compass indicates as north (magnetic north) as shown on the local chart;

2) your compass' deviation for a given heading.

In order to obtain your correct bearing from the vessel's compass, you must correct for these two compass errors.

d. Compass Variation

Local variation is the angular difference between magnetic north and true north. Variation is expressed in degrees east or west of true north and is not affected by your vessel's heading. It ranges from zero to about 20 degrees east or west error, depending on your global location.

This variation in the world's magnetic field is shifting continuously and irregularly, so magnetic north moves slightly each year. You will find local variation readings printed on current navigation charts.

e. Compass Deviation

Every compass is affected by objects in the immediate vicinity. Deviation is the angular difference between the reading your compass provides as installed and the reading it would provide if the objects were not there.

Deviation is caused by such shipboard magnetic influences such as your engines, electric motors, instruments with meter movements, electronic equipment, speakers, and other objects placed near the compass.

Deviation is expressed in degrees east or west of true north. It varies with the heading of your vessel, because, as your vessel turns, the position of the objects that affect the compass change relative to magnetic north.

You must know and record deviation on the compass card placed on or near each compass. You must record the deviation for each individual compass you use, because the position of each compass relative to the materials around it determines the deviation.

Your marine compass is fitted with a set of compensation or adjustment screws to minimize these errors. It is seldom possible to compensate for all compass deviation errors since this type of error varies as the heading of your vessel varies. However, the error should remain the same for any given heading as long as no changes are made to the instruments and electronics on or near the instrument panel.

There is a vertical mark on the compass bowl called the "lubber line". This line was oriented when your compass was installed so an imaginary line drawn from the compass pivot point to the lubber's line

will be parallel to the longitudinal axis of your vessel. Thus, your vessel's course (compass heading) is the compass card reading under the lubber's line.

J. CONTROLS AND INDICATORS NOT ON THE FLYBRIDGE

1. General

Your Bertram has six electrical distribution and control panels, two on the flybridge, two in the salon, one for the galley, and one in the engine compartment entrance companionway. The two fuel gauges, the hour meters, the fresh water tank gauge, the "**READ GAUGE**" switch, and the water pump "**RE-START**" switch are on the salon Gauge and Switch Panel.

2. Fuel Gallonage

The amount of fuel in gallons in your tanks as shown by your fuel gauges is shown on the table in part II, Section I - Technical Data.

3. Engine and Generator Fuel Tank Selection

Mounted on the stringer on the inboard side of each engine is a three position fuel tank selector valve for that main engine. The operation of these selector valves is discussed in Part II, Section V - Propulsion System Operation.

SECTION III - ALARM SYSTEMS

A. GENERAL

Your Bertram is delivered to you equipped with five (5) independent and separate alarm systems that make use of both visual indicators and audio signal generators. One of these alarm systems keeps watch over your main engine operating conditions. Another checks for excessive water in the bilges. Additionally, there are two independent systems that are designed to alert you if fire is detected in either the engine-compartment or the ac generator-compartment. The remaining system consists of a battery powered smoke detector installed in the salon.

B. THE ENGINE PERFORMANCE ALARM SYSTEMS (one per engine)

CAUTION

If the engine alarm horn sounds and ANY engine alarm light illuminates indicating an engine or transmission problem, immediately

1. **Throttle the engine back to idle speed;**
2. **shift the engine into neutral; and,**
3. **shut-down that engine.**

NOTE:

An illuminated alarm light indicates an open circuit condition in a normally closed loop alarm circuit. This open circuit can mean either a possible emergency or a problem with the alarm circuit.

1. General. Each engine and transmission has an alarm system consisting of a horn and alarm indicator lights mounted on the flybridge control console instrument panel. These lights will indicate to you which engine has the problem and what that problem may be.

2. Engine Alarm Operation. Each engine and transmission has an independent alarm system that consists of an alarm horn and a set of four (4) red alarm indicator lights mounted on the flybridge control console instrument panel (see Figure - 6, The Flybridge Control Station Instrument Panel) to warn you in case either of the following two possibly dangerous conditions exist:

a. the lubricating oil pressure (OIL PRES) in that engine has dropped below a preset level. If this occurs, an alarm horn will sound and the red port or starboard alarm condition indicator lamp will illuminate. The red indicator lamps are located just inboard of the two engine lube oil pressure gauges (see Figure - 6).

b. if any one or more of the following three engine operating temperatures are too high:

1) the engine coolant temperature (WATER TEMP); the alarm horn will sound and the port or starboard red alarm condition indicator lamp will illuminate if either engine coolant temperature exceeds its specified upper limit. These red indicator lamps are on the instrument panel just inboard of the two engine temperature gauges (see Figure - 6).

2) the engine exhaust temperature (EXHAUST TEMP); an alarm horn will sound and the red port or starboard alarm condition indicator lamp will illuminate if the exhaust system temperature of either engine exceeds a specified upper limit. The indicator lamps are located below the digital tachometer.

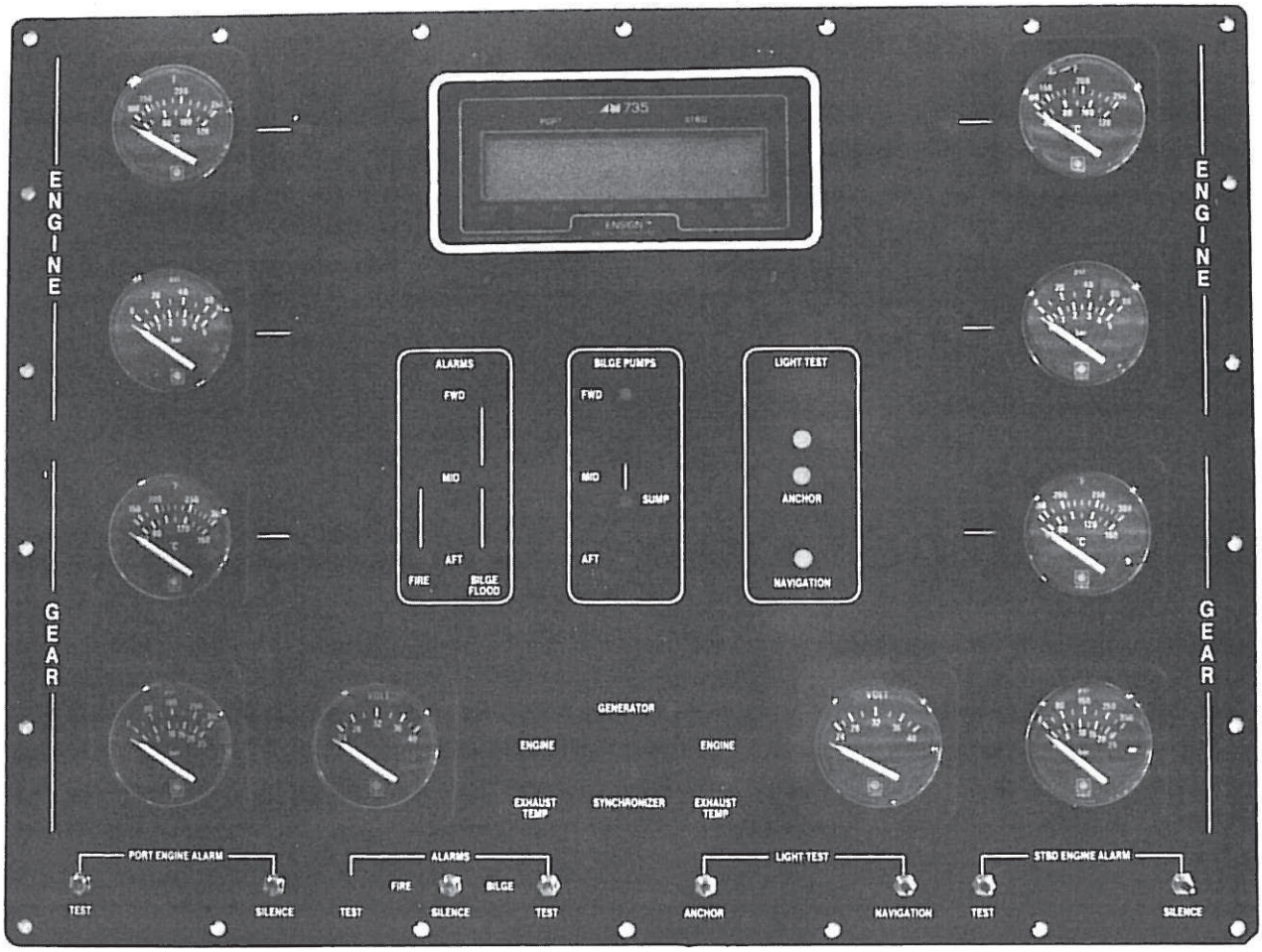


Figure 6 - The Flybridge Control Station Instrument Panel

3) transmission temperature (GEAR TEMP); an alarm horn will sound and the red port or starboard alarm condition indicator lamp will illuminate if the gear oil temperature in either transmission rises above a specified upper limit. These indicator lamps are located just inboard of the two engine oil pressure gauges (see Figure - 6).

As shown in Figure - 6, there are two sets of two push-button switches, one set at each lower corner of the instrument panel. One switch in each set is labeled "**TEST**" and allows you to check the operation of the alarm horn and the port and starboard engine performance alarm lights and the alarm light circuits. The other switch is labeled "**SILENCE**" and the switch sets are labeled "**PORT ENGINE ALARMS**" and "**STBD ENGINE ALARMS**".

The engine performance alarm horn and light have done their job once they have alerted you to a possible problem. Once alerted, you can temporarily silence the horn by depressing the button switch labeled "**SILENCE**". However, the illuminated red warning light remains illuminated until the problem is corrected. A silenced engine alarm horn will sound again if there is another problem.

3. Trouble Shooting. A trouble shooting procedure using the engine alarm lights is included in Part III, Subsection III of this manual.

C. THE FIRE AND BILGE FLOOD ALARM SYSTEMS

1. General. The fire and bilge flooding alarm systems monitors your vessel for fire in the engine- and/or the ac generator-compartments and for excess water in the bilges.

2. **The Fire Alarm System**. As shown in Figure - 6, the port side rectangle on the flybridge control station instrument panel is labeled "**ALARMS**". Within this rectangle are five red, alarm, indicator-lamps. Two of these alarm indicator lamps on the rectangle's port side are connected by a line and are above the label "**FIRE**". These lamps are connected to your two independent fire detection systems; one in your engine-compartment and one in the ac generator-compartment. A second set of two lamps is on the top of the Salon Gauge and Switch Panel (see Figure - 7, The Salon Gauge and Switch Panel) under the label "**FIRE**" and across from the label "**ALARMS**".

NOTE:

The fire detection system is completely separate from the onboard fixed fire extinguishing system's own audio/visual alarms.

The heat sensitive detector components of the fire detection system are located on the engine- and ac generator-compartment overheads. You should be aware that protection offered by this fire detection system is limited solely to the engine- and the ac generator-compartment spaces.

The engine- and ac generator-compartment system detectors consist of two (2) wires individually encased in a heat sensitive material. At the critical temperature (155°F.), the heat sensitive material shrinks and the two wires come into contact. At this point, the alarm system is activated.

IMPORTANT

a. The heat sensitive wire system cannot be reset. This wire must be replaced.

b. The fire/bilge alarm system can only be disabled by removing the panel fuse.

c. Do not test the engine compartment or generator compartment fire detection system by heating the wires.

d. Even if the alarm bell is silenced, the alarm horn may sound. This indicates that the automatic discharge machanisms have discharged Halon gas into the over heated compartment(s).

3. **The Bilge Flood Alarm System**. Three other red, alarm indicators on the port side instrument panel rectangle are connected by lines and are above the label "**BILGE FLOOD**". These lamps represent the three bilge flood detector sensors; one in the forward bilge, one in the engine-compartment bilge, and one in the ac generator-compartment bilge. The bilge alarm float switches are attached to the hull, about three inches above the bottom of the bilge. A second set of three lamps is on the top of the salon gauge and switch panel (see Figure - 7) under the label "**BILGE FLOOD**" and across from the label "**ALARMS**".

4. **The Fire and Bilge Flooded Alarm Lights (Test)**. The fire and bilge (flooding) alarm lights on the flybridge instrument panel and their respective circuits, can be tested by depressing first one than the other of the two test switches that are mounted just below the "**ALARMS**" vessel out-line drawing on the instrument panel.

D. THE FIXED FIRE EXTINGUISHER SYSTEM DISCHARGED ALARM

For added fire protection reliability, your vessel has a third and totally independent fire alarm system. Your vessel's fixed, Halon fire-extinguishing system has an alarm horn built into it that sounds when either Halon bottle discharges. See Part II, Section IV, for detals.

E. THE SMOKE ALARM

Should the smoke alarm sound, unless the smoke is from the galley and the fire easily extinguished as discussed in Part II, Section IV, Safety Afloat, the procedures discussed in the subsections on the Fire Fighting and Emergency Evacuation Plans in Section IV. should be followed.

SECTION IV - OPERATIONS AND SAFETY AFLOAT

A. BOAT SPEED

Your Bertram's deep "V" hull cushions pounding by slicing through the waves rather than slapping against them. However, even a Bertram will eventually encounter extreme conditions that a sensible seaman must not ignore. Your speed should be reduced as required by adverse sea conditions in the interest of your comfort, and to reduce any needless strain on the engines and boat structure.

B. HULL EFFICIENCY

Your Bertram is designed to carry comparatively heavy loads without appreciably reducing performance; however, for the best performance results you should maintain original trim. This is with a slight (about 5 degrees) bow up attitude. Therefore, Bertram suggests that you spend at least a few minutes to become familiar with how the vessel behaves at this trim and to just get the feel of your vessel, especially the visual relationship of the bow to the horizon when she is first launched, and before any extra equipment is put onboard.

Of course, all gear and equipment onboard should be properly stored while cruising and you should be aware that all of the personal equipment and accessories placed on board will tend to decrease her speed as will adding weight in the form of passengers. Remember to take the effect of this added weight into consideration when calculating the performance of your vessel.

A planing hull will perform slightly better in salt water than in fresh water due to the difference in the weight of water that it displaces.

C. ATMOSPHERIC CONDITIONS

There are some additional operational considerations for you to keep in mind while operating your Bertram; for instance, engine performance will be slightly affected by local atmospheric conditions. Among other things, you will find that the engines develop slightly less power in warm air temperatures. Similarly, dry air reduces power, as will high altitudes. If you are cruising regularly in waters well above sea level, you will want to have a certified mechanic make the necessary adjustments to your engines to get the correct air/fuel mixture.

D. MARINE GROWTH

To obtain maximum hull efficiency, which directly translates into speed, the bottom of your Bertram must be kept free of marine growth, including grass. Any growth will cause an increase in water resistance, thus decreasing speed and fuel efficiency.

E. WATER IN THE BILGE

The bilge should be pumped dry to minimize excess weight and sloshing. The added weight of bilge water causes the vessel to ride lower, increasing water resistance. This added drag in turn reduces your vessel's speed and lowers fuel efficiency. Your Bertram has cockpit scuppers that prevent water from accumulating in the cockpit by allowing it to flow overboard. The bilge is kept dry by a sump pump and three bilge pumps equipped with sensor switches (see Figure 10 - Drainage and Bilge Pump System). The galley and lavatory sinks have their own drains directly overboard and the showers have a sump equipped with a sump pump that discharges overboard.

F. DAMAGED UNDERWATER EQUIPMENT

CAUTION

Only under emergency conditions should your Bertram be operated at cruising speed with a vibration caused by damaged propellers or running gear. Seek a tow, or, if necessary, proceed with extreme caution at idle speed.

A significant loss of speed and excessive vibration can and usually does result from damaged propellers, shafts, struts, and/or missaligned rudders and engines. The rudders on your Bertram always should be kept parallel, neither "toed" in nor "toed" out. The propeller shaft alignment should be checked periodically.

G. DRAFT

To avoid going aground or damaging your underwater gear in shallow waters, it is absolutely vital you know how much water your vessel draws (her draft). Be aware that any vessel's draft varies depending on her load. Bertram suggests that you determine her draft fully equipped and at or near the maximum load you expect her to be carrying. Remember, any vessel will draw slightly less in saltwater than she will equally loaded in fresh water. To determine her draft:

1) Measure the freeboard (hull height above the water) from the covering board top to the waterline at the transom's center.

2) Subtract this measurement from the dimension given for the distance between the covering board top (at the transom's center) to the bottom of the propeller. See the docking plan supplied with this manual to find your vessel's maximum draft at the transom.

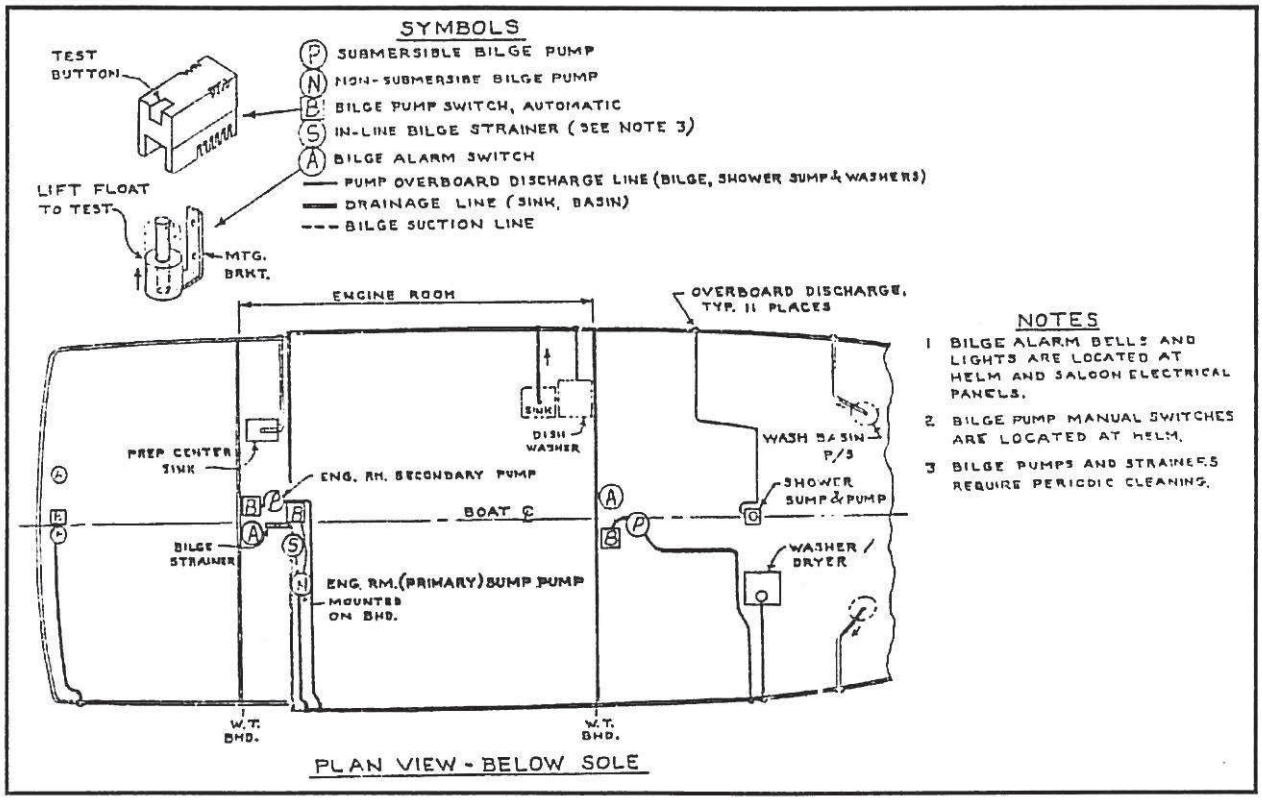


Figure 10 - Drainage and Bilge Pump System

3) Record this dimension where it will be readily available, for instance on your compass deviation card.

H. HEIGHT

Besides knowing your vessel's draft, it is also vital you know her height including any optional equipment such as fishing towers and/or antennae for your electronic equipment. Take this measurement when she has the lightest possible load of fuel, passengers, and equipment. This measurement should also be recorded on your compass deviation card.

I. TRIP PREPARATION CHECKLIST

To minimize problems and to get the maximum pleasure from your Bertram, we suggest that you go over a written checklist each time you prepare for a cruise. The items listed in Table II-IV-1 should be part of this list. There are blank spaces left so you may add other items to your personal list.

J. FISHING TOWER

WARNING

NO ONE SHOULD OCCUPY THE FISHING TOWER UNDER ADVERSE SEA AND/OR WIND CONDITIONS.

The height and weight of a fishing tower (also called a tuna or marlin tower), and that of any occupant(s) add significantly to your vessel's vertical center of gravity. This may result in excessive heeling and slower recovery to an upright condition and may make it difficult to leave the tower if sea conditions worsen. Therefore, under adverse sea and/or weather conditions do not occupy this tower.

K. PROPELLER HAZARD

WARNING

TO REDUCE THE RISK OF SERIOUS INJURY, DO NOT ENTER OR LEAVE THE WATER FROM YOUR VESSEL WHILE THE ENGINES ARE RUNNING.

When swimming or working in the water near your vessel, remember that propellers have sharp blades that can seriously hurt anyone who is pushed against them by a wave or the current, even if that propeller is not turning. To reduce the risk of death or serious injury from your props, SHUT DOWN both engines and ensure that both propellers have stopped turning before allowing anyone to:

1) go out on the swim platform;

2) enter or leave the water; or,

3) board or disembark from your vessel by climbing out of or down into a dinghy.

L. WHEN UNDERWAY

WARNING

WHEN UNDERWAY, TO REDUCE THE CHANCES OF SOMEONE FALLING OVERBOARD, DO NOT LET ANYONE:
1) MOVE TO OR FROM THE FOREDECK ALONG THE OUTSIDE OF THE CABIN;
2) LEAVE THE TRANSOM DOOR OPEN;
3) MOVE ABOUT TOPSIDE WITHOUT THE PROPER NONSLIP "BOATER" FOOTWARE.

Certain aspects of being on any moving vessel can be dangerous. However, these dangers can be reduced if you are the type of operator that exercises caution where required. For instance, moving for-

Table II-IV-1 - Trip Preparation Checklist

Check items off as you complete them:

___ 1) Daily Maintenance checklist performed (see **Part III: Maintenance, Section 1**)

___ 2) Fuel and fresh water tank levels checked

___ 3) One correct sized life jacket (PFD) for every person aboard

___ 4) Throwable Type IV PFD (life preserver) on board and in its mounting bracket

___ 5) Current visual distress signals are on board

___ 6) Portable fire extinguishers on board, usable, and in their mounting brackets

___ 7) First aid kit on board

___ 8) Necessary charts on board

___ 9) Communications and navigation equipment works

___ 10) Latest marine weather forecast obtained

___ 11) Fire/Bilge Flood alarm circuit tested

___ 12) Fire Extinguisher System Monitor Panel checked

___ 13) _____

___ 14) _____

___ 15) _____

___ 16) _____

___ 17) _____

___ 18) _____

___ 19) _____

___ 20) _____

___ 21) _____

___ 22) _____

___ 23) _____

___ 24) _____

ward on deck or moving about the foredeck when your vessel is under way should always be done cautiously. Always keeping the transom door shut when underway is another obvious precaution.

M. CARBON MONOXIDE GAS

WARNING

GASOLINE AND DIESEL INTERNAL COMBUSTION ENGINES USE PETROFUELS AND EMIT CARBON MONOXIDE GAS, WHICH IS COLORLESS, ODORLESS, AND LETHAL IF BREATHED IN SUFFICIENT QUANTITIES.

1) When at anchor, be sure to open sufficient windows, hatches, and vents to maintain adequate ventilation even with the air conditioner operating and when operating the ac generator.

2) When you are tied up to a dock and/or immediately alongside of other vessels or when rafted up against one or more other vessels, pay particular attention to the generator exhaust emissions from the nearby vessels; since a lethal concentration of carbon monoxide could be drawn into your vessel from the outside by your ventilation system.

Remember that carbon monoxide (CO) poisoning is one of recreational boatings most insidious hazards. CO poisoning first attacks the brain's judgment center and its early symptoms (headache and nausea), are easily confused with seasickness. CO is lethal and its effects are cumulative. As CO builds up in your body, your blood can carry less and less oxygen. This can take place over a long period of time and at relatively low concentrations.

Carbon Monoxide gas is colorless, tasteless, and odorless. Therefore, take NO chances with your life and health. If you even think that you smell excessive exhaust odor, or if you think that you or anyone on your vessel might be possibly have one or more of the following classic symptoms of carbon monoxide poisoning which can be easily masked by the symptoms of common sea sickness:

1) throbbing in the temples;

2) dizziness;

3) ringing in the ears;

4) watering and itching eyes;

5) headache;

6) nausea;

7) cherry pink or red skin color.

You should immediately:

a) Move everyone aboard out on deck into fresh air;

b) open all hatches, windows, and vents to air out your vessel;

c) shut down the engines and/or the ac generators until you have located the source of the CO, if it comes from your vessel;

d) make all the necessary corrections and/or repairs before getting underway again.

You should also be aware that it is quite possible for you to get the exhaust fumes of vessels tied up along side of your vessel or even docked in the next slip.

N. PREPARATIONS FOR ROUGH WEATHER

CAUTION

Keep deck hatches dogged and engine room entrance door and hatch secured while underway to prevent engine room and lazarette flooding.

One of the several compelling reasons you operate a Bertram may be its long tradition of exceptional strength and its seaworthiness. Even so, you should never forget that there is no vessel, regardless of its

Table II-IV-2, Heavy Weather Checkoff Sheet

Check items off as you complete them:

___ 1) Close and secure all hatches, doors, ports, and windows, and in particular, double check that the cockpit hatches are tightly shut and dogged down.

___ 2) Use the MAN (manual) bilge pump switch positions to ensure that all bilges are pumped dry. This should be repeated as often as may be necessary, since "free" water sloshing in your bilges degrades your vessel's performance.

___ 3) Secure all loose gear. Stow all the smaller items and securely lash down all the larger ones.

___ 4) Break out the Personal Flotation Devices (PFDs) (life jackets) and have everyone don and properly adjust one before the weather turns this chore into a real problem.

___ 5) Get the best fix possible on your current position and track and update the plot on your chart.

___ 6) Break out and keep handy whatever emergency gear you feel may be needed, such as flashlights, the first aid kit, a sea anchor, distress flares, etc.

___ 7) Plot course changes to the nearest protected harbor or sheltered waters in case the storm worsens.

___ 8) Stay current with local marine weather reports. If possible, have one person assigned to monitor the marine weather channel(s).

___ 9) Any time there is reduced visibility, post at least one lookout whose sole responsibility it is to watch for other vessels or possible dangers.

___ 10) If at all possible, keep all hands busy rather than sitting and worrying. Keep your crew and passengers informed:

a) what you are doing;

b) what you want each of them to do or not to do.

___ 11) _____

___ 12) _____

___ 13) _____

___ 14) _____

___ 15) _____

size and strength, that is completely immune to the dangers of heavy weather.

When you are preparing for heavy weather, or if you are running ahead of a heavy following sea, be sure the cockpit hatches are tightly shut and dogged to prevent flooding below decks.

Table II-IV-2 provides a checklist of things you should do to prepare for rain, fog, high winds, and/or rough seas that you will eventually encounter. There are blank lines in case you wish to add your own items to this list.

Fog or Limited Visibility

In case of fog or other limited visibility, you are required by the law (Rules of the Road) to:

1) Slow Down. If you are navigating in waters marked on your charts as falling under the Inland rules, you are required to slow to a "MODERATE SPEED" in accordance with the Inland Rules. Under the International Rules you must slow to a "SAFE SPEED".

   Admiralty courts have generally held that a "safe speed" is the maximum speed at which a vessel can come to a complete stop in a distance equal to one half the existing visibility.

2) Post at least one lookout (besides the helmsman) whose sole responsibility it is to watch for vessels and other hazards to navigation.

O. THE BEAUFORT SCALE OF WIND FORCE

To more accurately and quickly transmit wind and wave information over the radio, the British "Royal Meteorological Office" developed a table with comparison photographs of each of the thirteen wind forces of the Beaufort scale (see Table II-IV-3 - The Beaufort Scale of Wind Force). Some of these photographs are in Chapman's text "Piloting", the basic text book for boaters.

P. RUNNING AGROUND

CAUTION

If aground, do not attempt to drive this vessel off. Trying to refloat this vessel under its own power could result in damage to the propellers; propeller shafts; struts; and/or, the transmissions (clutch and reverse gears).

CAUTION

Do not run engines while aground; sand, dirt, and other foreign matter could be drawn into the cooling system and damage your engines.

If you are an active boater for an extended period of time, the odds are that sooner or later you will either run aground and/ or hit a piece of floating debris (flotsam). If you do have either of these accidents, you must immediately take the following steps to protect your vessel and to minimize the damage and take them in the order given below.

1) Resist the natural impulse to "throw" the transmission into reverse and instead, pull both throttles back to reduce the engine speed to idle or less than 1000 rpm.

2) Then shift both clutches into neutral.

3) If aground, stop both engines.

4) If you have struck a piece of flotsam:

5) Scan the waters ahead and behind for additional flotsam to try to determine if it is safer to proceed or to try to back out of the danger area.

6) Then leave the area at the slowest possible speed.

Table II-IV-3, The Beaufort Scale of Wind Force

Beaufort Scale	Wind Description	Sea Conditions	Wave Speed (Knots)	Wave Height (Feet)
0	Calm	Glass smooth	0 - 1	0
1	Light air	Ripples without crests	1 - 3	0.25
2	Light breeze	Small wavelets, crests do not break	4 - 6	0.50
3	Gentle breeze	Large wavelets, occasional white foam crests	7 - 10	2.0
4	Moderate breeze	Small waves, growing, frequent foam crests	11 - 16	4.0
5	Fresh breeze	Moderate waves, white foam crests and spray	17 - 21	6.0
6	Strong breeze	Large waves, white foam crests and more spray	22 - 27	10.0
7	Near gale	Very large waves, foam streaks blown, spindrift	28 - 33	14.0
8	Gale	High, long waves, blown foam and spindrift	34 - 40	18.0
9	Strong gale	Higher waves, much foam, crests start to topple	41 - 47	23.0
10	Storm	Very high waves, white tumbling seas, reduced visibility	48 - 55	29.0
11	Violent storm	Exceptionally high waves, white sea, wave crests blown to froth, visibility further reduced	56 - 63	37.0
12	Hurricane	Air filled with foam & spray, white sea, almost no visibility	64 & up	45.0

Q. RECOMMENDATIONS FOR REFLOATING VESSEL

Most vessels run aground at the bow. Unless your vessel has received hull damage that requires repair before refloating, the most important thing is for you to avoid damaging your propulsion system, being holed, or being driven further ashore and for you to prevent possible damage from pounding or broaching.

Pounding is when each wave raises a grounded vessel's hull and then drops against the sea bed. Bottom damage from pounding can range from cracking the fiberglass to opening serious holes in the hull. As each wave strikes against the vessel, the continuing wave action tends to drive the vessel harder aground.

Broaching is the most serious problem a grounded vessel may face and occurs when the vessel is thrown or turned broadside to the shore or the shoal by the waves. Broaching is dangerous for two reasons. First, broaching continually drives a grounded vessel harder aground. Second, currents are set up around a grounded vessel's bow and stern. These currents tend to scour sand away from under the vessel's hull, piling this sand up amidships and to leeward of the vessel, eventually leaving the hull supported only amidships. This can break a vessel's back.

1) Step one is to determine the location and extent of any hull damage. Bertram hulls are among the strongest made, but running any vessel up onto a sharp coral reef or a pointed rock can damage it. If necessary, make a patch using one or more of the two part, emergency, fast setting epoxy, hull patch kits, readily available at marine hardware stores. These can be applied to almost any hole from either inside or outside your Bertram as the situation requires. At least one of these kits should be a part of your emergency supplies. Otherwise, cram anything available into the hole to stop or at least cut down the water coming in.

2) Once your water tight integrity has been established or restored, and you have determined that you are better off afloat than grounded, break out your "ground tackle" which should include a heavy duty service anchor and a light duty "lunch hook", and prepare to set them as "kedges" off of your stern as quickly as possible to prevent being driven further aground.

3) Ideally, kedge anchor(s) are carried into place by your vessel's dinghy or by an inflatable raft, if available. For maximum effectiveness, set the kedge as far behind your vessel as available line permits with an offset to the port or starboard to compensate for the wind or current, which ever is stronger.

4) Make the bitter end of your anchor line fast to your stern cleats and make the rower's job easier by coiling the anchor line in the dinghy rather than having the rower fight to drag the line off your vessel and through the water. If no other way is available, the kedge can be temporarily secured to several PFDs and swum into place. This technique should be regarded as an emergency procedure and each swimmer should wear a PFD and should be attached to your vessel with a light life line.

5) If two anchors are available, depending on the sea conditions it is usually worthwhile to take the time and effort to put two kedges out, one off the port quarter and one off of the star board quarter. By using your vessel's winch and/or all hands and by pulling first on one line and then on the other, this arrangement may make it possible to "walk" your vessel off.

6) In any case, always keep tension on the kedge line. If you cannot "kedge" yourself afloat and a tow is not immediately available, you may have to wait for the next high tide. A lead, a weighted hand line marked in feet, can be very useful to check around a grounded vessel to determine where the deeper water is.

R. FLOTSAM (Floating Debris)

If you observe flotsam while at cruising speed, immediately throttle back to idle speed. Once at idle, shift into reverse or forward depending on the situation and proceed cautiously until out of the danger area.

S. VIBRATIONS

If you run aground or strike a piece of flotsam, proceed first at low speed and check that there is no noticeable vibration which might indicate damage to your vessel's underwater gear. If a vibration is noticed, proceed to dockside at the reduced speed. Depending on the damage done, it might be necessary to shut down one engine.

T. TOWING

WARNING

DO NOT SECURE TOW LINES TO DECK CLEATS, WHICH ARE ONLY FOR MOORING. CLEATS ARE NOT FASTENED TO YOUR VESSEL FOR TOWING. RATHER, USE A LONG LINE TO FORM A TOWING BRIDLE AROUND HER HULL.

CAUTION

Take added care if towing or being towed with "Nylon" lines. These lines stretch and if a fitting fails or the line parts, the ends can snap back with sufficient force to injure.

1. General

Though it is a common courtesy between pleasure vessel skippers, towing is not recommended since it can be dangerous to the occupants of the towing and towed vessels. Towing is best left to professional salvors or those trained to minimize the risks. The U.S. Coast Guard Auxiliary manual CG 484 "Auxiliary Towing Guide" (1977) states that most marine accidents occurring during towing fall into one of the following three categories:

1) Most recreational type boats do not have suitable deck fittings for towing and many do not have suitable deck fittings to be towed;

2) the boating public in general has both a limited knowledge and practice of good seamanship;

3) boaters sometimes failed to conform to good seamanship practices through inexperience and/or expediency.

2. Personnel Safety

In all towing operations the primary objective is to ensure the personnel safety on both vessels. The first goal always is to save lives and to avoid inflicting injury. Saving property is only secondary and must never take precedence over personnel safety.

3. Towing MAN Engine-equipped Vessels

If your vessel is equipped with MAN Diesel engines, there are special instructions you must follow when being towed. See the ZF Gear Operator's Manual supplied with your documentation.

U. FIRE WARNING AND FIRE EXTINGUISHING SYSTEMS

1. General

Boating safety studies show that the best way to fight shipboard fires is to prevent them. Most shipboard fires CAN be prevented by:

1) not allowing fuel spillage to accumulate in the bilge;

2) properly storing paint and other combustibles;

3) taking appropriate care when cooking, especially frying;

4) taking appropriate care with smoking materials;

5) not exceeding the safety factor built into electric wiring.

Unfortunately, all vessel fires cannot be prevented. Boating safety statistics (DOT U.S.C.G. COMDTINST M16754.1G *Boating Statistics*, June 1986) show that more than 80% of the fires on pleasure craft start in the engine compartment, and

that unless the fire is put out in the first 5 to 10 minutes, 80% of all pleasure craft that catch on fire are destroyed.

To give you fire warning and fire fighting capabilities, the following equipment is furnished as a part of your Bertram:

1) Fire Alarm

2) Fire Extinguisher Discharge Monitor

3) Fixed Fire Extinguisher System

4) Portable Fire Extinguishers

5) Smoke Detector

2. Fire and Bilge Flood Alarm Systems

See Part II, Section III (Alarm Systems).

3. Fixed Fire Extinguisher Discharged Monitor System

This system is an integral part of the Halon fixed fire extinguisher system. It sounds the alarm horn and illuminates one or both red warning lights on the fire extinguishing system monitor panel (see Figure - 4, Emergency Engine Stop andFire Extinguishing System) when the system is discharged.

4. Fixed Fire Extinguisher System Operation

WARNING

1) YOUR FIXED FIRE EXTINGUISHERS FIGHT ENGINE COMPARTMENT AND AC GENERATOR COMPARTMENT FIRES. FIRES OUTSIDE THESE COMPARTMENTS ARE FOUGHT WITH HAND HELD EXTINGUISHERS.
2) BURNED HALON CAN BE TOXIC DO NOT BREATH THE FUMES, SMOKE FROM FIRE, OR ENGINE EXHAUST.

CAUTION

Most fire fighting agents stop engines by oxygen depletion, Halon 1301 may not. If you do not quickly stop your Diesels, the Halon gas concentration will be rapidly lowered and maybe eliminated as an effective fire fighter.

NOTE:
To give the Halon the chance to put out a fire, the concentration must be kept as high as possible. This means keeping the door to the engine compartment and all hatches to the engine and generator compartments closed unless they are being used.

Your Bertram has two Halon 1301 fixed fire extinguisher systems. You should know that both systems protect both the engine compartment and the ac generator compartments.

Halon 1301 was selected for several reasons. It is safe and clean (it leaves no water, foam, powder, or other residue behind). Halon 1301 works chemically to stop a fire, by breaking the chain of reactions by which the fire propagates itself from one fuel molecule to another. With a minimum Halon 1301 concentration of at least five percent, it will prevent reignition and flashback.

a. System Description

Each independent, fixed, fire extinguisher system consists of a Halon gas bottle with its associated controls and indicators. One bottle is the **AUTO/MANUAL** system and the other is the **MANUAL** only (back up) system. Both bottles are in the engine compartment and both discharge into the engine compartment and the ac generator compartments. Each bottle has sufficient Halon for more than the necessary five percent (5%) concentration needed to extinguish fires.

1. Systems Redundancy

The reasons for having two fixed fire extinguisher systems are:

a) to provide a second effort or backup if reignition occurs or if the first Halon discharge fails to completely put out the fire;

b) to provide a second effort or backup if, in addition to a fire you were faced with a coincidental second danger that required you to have maneuvering power and you felt that it was necessary either to not shutdown the engines or that you must restart one engine immediately after the system automatically discharged.

2. Auto/Manual System

On the Flybridge Control console is a Fire Extinguisher System Monitor panel (see Figure 4) with: red **MANUAL** and **AUTO/MANUAL** systems "DISCHARGED BOTTLE" indicator lights; push button switches for "**TEST**" and **OVERRIDE**; and a manual (covered) discharge switch. The system has automatic (heat sensing) and manual (electrically powered) discharge capabilities. It is electrically operated and requires 32 Vdc electric power from a 5 Amp fused circuit on the salon 32 Vdc main distribution panel for either automatic or manual discharge mechanism to work.

3. Manual System

The **MANUAL** fire extinguisher system is intended as a backup for the **AUTO/MANUAL** system and has only a manual mechanical discharge mode. This system is discharged by pulling out the safety pin and pressing down on the lever that releases the CO_2 from the bottle in the cockpit. The CO_2 in turn powers the mechanism that releases the Halon.

b. System Function

Regardless of which system was discharged and/or how that system was discharged, the systems automatic responses are the same. That is:

1) the forced ventilation systems in both compartments are automatically shut down;

2) the ac generators are both automatically shut down;

3) the system's **DISCHARGED** indicators (horn and lamp) are activated.

An overtemperature condition (a fire) in either the engine compartment or the ac generator compartments will be sensed by that compartment's heat detector. Normally, the Fire Warning System detects the overtemperature situation first and sounds the alarm bell first since the fire detection wires are set for a lower temperature than are the sensors on the Halon automatic discharge mechanisms. A fire detected in either compartment causes several events to happen almost simultaneously:

1) The Fire Warning System alarm bell sounds and an alarm light illuminates on the instrument panel. From this you can:
   a) determine where the fire is located by checking which instrument panel alarm light(s) are illuminated;
   b) silence the alarm bell by depressing the **SILENCE** push button switch on the instrument panel.

2) The automatic mechanism releases the Halon.

3) The alarm horn sounds.

4) One or more red fire alarm light(s) on the Fire Extinguishing Monitor Panel illuminates.

5) The ac generator(s) and the blowers are automatically shut down.

NOTES:

a) Depending on the rate of temperature rise, the time between the fire warning system alarm and the Halon discharged alarm may be too short to be acted upon as separate events.

b) The blowers operate on 120 Vac which is available from the ac generators at sea or from the shore power at dockside.

c) The Halon fire extinguisher systems information is summarized on the "Fire Extinguishing System" Panel (see Figure 4), on the flybridge control console above the emergency engine stop system panel.

d) To prevent the Halon bottles from exploding due to pressures created by over heating, they have relief devices to release the Halon if the compartment temperature reaches a preset level.

c. After the Discharge of Either Fixed Fire Extinguisher System

WARNING

DO NOT OPEN THE ENGINE COMPARTMENT OR THE AC GENERATOR COMPARTMENT HATCH OR TRY TO ENTER EITHER COMPARTMENT FOR AT LEAST 15 MINUTES AFTER A HALON DISCHARGE.
IF YOU ALLOW OXYGEN TO ENTER A COMPARTMENT BEFORE HOT METALS AND/OR FUELS ARE COOL, YOU MAY CAUSE REIGNITION OR FLASHBACK.

Except in the rare case of a coincidental emergency requiring immediate power to maneuver your vessel out of danger from another source, you must give the Halon sufficient time to completely extinguish the fire. Therefore, once the Halon is discharged, to minimize the risk of reignition or flashback, you should wait a minimum of 15 minutes for any heated metal or fuel to cool off before either opening the engine compartment or the ac generator compartment hatches.

If you hear the "extinguisher discharged" horn, the auto/manual Halon system has discharged and you should immediately take the following steps:

1) Unless other dangers make it imperative that you have maneuvering power, immediately shut down the engines. The Diesel engine **STOP** switches are on the flybridge control console switch panel (see Figure - 5, The Systems Control Switches). There is one **ON/STOP** switch for each engine. The standard method for stopping a Diesel engine is for you to move its associated **ON/STOP** switch down into the **STOP** position. It must be stressed, that for Halon to be fully effective as a fire extinguisher in your engine and ac generator compartments, the Diesel engines must be shut down just as soon as possible after the **AUTO/MANUAL** system automatically discharges or before you manually discharge either system. Both ac generators and the blowers for both compartments are automatically shutdown when either Halon bottle discharges.

   If an immediate Diesel engine shutdown is necessary and placing and holding the **ON/STOP** switch in the **STOP** position fails to shutdown the engines; your Bertram has an emergency shutdown system. This system consists of two (2) Emergency Stop "T" handles on the "Emergency Engine Stop System" panel (see Figure 4) on the flybridge control console just below the fire extinguishing system monitor panel. To use this system; you pull each emergency stop T handle out as far as it will go. The emergency stop system is discussed in detail in Part II, Section V - Propulsion System.

   NOTE:
   Bertram suggests that if you deem it necessary to manually discharge this system, that you always attempt to manually discharge the AUTO/MANUAL bottle first.

2) except for the bilge pumps, navigation lights (if after dark), and the emergency radio, shut down all electrical power;

3) do **not** open either the engine or the ac generator compartment hatches for at least 15 minutes or until they are cool to the touch unless you have reason to believe the fire is not out, then discharge the manual system.

4) stand by with portable fire extinguishers in case the fire spreads past the engine- or the ac generator-compartment bulkheads.

5. Inspecting and Restarting Boat Systems

WARNING

HALON 1301 IS SAFE TO BREATH, BUT ITS COMBUSTION PRODUCTS ARE TOXIC. WAIT FOR BLOWER/VENTILATION TO COMPLETELY CHANGE ENGINE COMPARTMENT AND AC GENERATOR COMPARTMENT AIR BEFORE ENTERING.

Wait a minimum of 15 minutes. Then carefully check to be sure that the fire is totally out. Verify by feeling all around the hatchs and bulkheads to ensure that these surfaces are cool to the touch before either cautiously opening the engine or the ac generator compartment hatches or before switching **ON** the engine compartment or the ac generator compartment blowers or before restarting your ac generators.

1) The fire extinguishing system monitor panel (see Figure 4) shows which fire extinguisher systems was discharged.

2) Depress the **OVERRIDE** push button switch, on the same panel, to permit restarting the ac generators and then the engine compartment and the ac generator compartment forced air blowers.

NOTE:
Depressing the "SILENCE" pushbutton does not extinguish the fire alarm or monitor lights. These light(s) remain illuminated as long as there is electrical power on the circuits or until the alarm sensor wire is replaced or the Halon bottle(s) is refilled and discharge switch reset.

3) Have the proper type of United States Coast Guard approved hand held fire extinguishers ready.

4) Ventilate the engine compartment and ac generator compartment.

5) Carefully examine the engine compartment and ac generator compartment for damage and to determine the cause of the fire.

6) Make the necessary emergency repairs.

7) Depress the **FAULT** push button switch on the control panel of each generator to allow the generator to restart.

8) Restart the ac generator.

9) Switch **ON** the engine compartment and the ac generator compartment forced air ventilation blowers.

10) Reset the Emergency Stops, if activated.

11) Restart the engines.

NOTE:
The engines or the ac generators may be hard to start due to residual Halon in the engine- or ac generator-compartments.

12) Activate only those electrical circuits necessary to safely maneuver your vessel.

13) Return to dockside.

14) Have the Halon fixed fire extinguisher system(s) and any hand held fire extinguishers that were used checked and serviced as soon as possible.

15) Repair the Fire Warning System by having the heat detecting elements replaced.

6. Using the Portable Fire Extinguishers

Do not use water based extinguishing agents on electrical fires due to the potential danger of electric shock to the fire fighter and the possibility of short circuiting the electrical circuits and causing more fires.

For fires other than engine compartment and/or ac generator compartment fires, Bertram supplies four mounted dry chemical portable (hand held) fire extinguishers, U.S.C.G. approved Type BC 1.

NOTE:
You must keep in mind that if you hold the trigger and do not release it, these hand held fire extinguishers will be empty in 8 to 20 seconds and that some fires can reignite.

To help select the correct fire fighting tool, fires are divided into the following three classes:

a. Class "A" Fires

Class "A" fires are fueled by paper, wood, fabric, rubber, and some plastics. Water is the best means of extinguishing a Class "A" fire and should be used as soon as possible. Drench the fire, open the material to expose all burning embers and redrench, or throw the smoldering material overboard.

b. Class "B" Fires

Class "B" fires are fueled by flammable liquids (i.e., gasoline, oils, paint, and cooking fats). Carbon dioxide, dry chemical, and Halon fire extinguishers are suitable against Class "B" fires. A firefighter should aim his extinguisher at the base of the fire, not at the smoke, working in a horizontal sweeping motion from the front to the back of the fire.

c. Class "C" Fires

Class "C" fires are caused by energized electrical equipment. Carbon dioxide, dry chemical, and Halon fire extinguishers will extinguish Class "C" fires. Class "C" fires should never, repeat never be fought with water which could cause short circuits and more fires and/or endanger the life of the fire fighter by electrocution.

Galley grease fires may be fought with the dry chemical extinguishers, by smothering the fire (covering with a pot lid), or with baking soda; but never, repeat never with water which splatters hot grease, possibly spreading the fire and causing injuries.

V. FIRE FIGHTING PLAN

After an active fire prevention program, a well thought out and well rehearsed vessel fire fighting plan is probably the next single most important step toward organizing the fire fighting efforts of the vessel operator, the crew members, and guests. Such organization can literally be vital since studies of fires at sea show that a quick reaction time is absolutely essential to extinguishing a shipboard fire.

Therefore, the vessel operator as well as other designated persons on board should be thoroughly familiar with:

1) location of the controls for and the operation of both fixed Halon fire extinguishing systems;

2) location of the switches to shut down:
   a) the engines;
   b) the ac generators;
   c) the 12 Volt and 32 Volt power supplies;
   d) the forced air ventilation blower system;

3) location of, and instructions on the operation of, every hand held portable fire extinguisher on board as well as what type of fire(s) it should or should not be used on.

Bertram suggests that you have at least one dry run each time you go to sea and assign specific duties to ensure operator and crew efficiency levels. Dry runs should stop short of actually discharging fire extinguishers.

W. FIRE OR EMERGENCY EVACUATION PLAN

One problem that can and should be prepared for is an uncontrollable fire or other emergency at sea requiring that all hands leave your vessel. As an important part of your fire emergency preparedness plan, the operator, along with the crew and regular guests should develop and practice an emergency evacuation plan (Abandon Ship Drill).

As a minimum, this plan should include:

1) location of the PFDs (life vests) and how to don them;

2) location and operation of any other emergency flotation equipment such as a life raft;

3) speedy operation of the forward hatch;

4) how to quickly summon help by:
   a) using the hailing/emergency channel for the on board VHF (in inland or coastal waters)

or the single side band radio (past the continental limits);
b) when and how to use flares and/or daylight visual distress signals;
c) the use of the orange and black distress flag;
d) the Emergency Position Indicating Radio Beacon (EPIRB).

X. USE OF PERSONAL FLOTATION DEVICES

By federal regulation and the laws in most states, this, or any other vessel, powered or not, is required to have one U.S. Coast Guard approved Personal Flotation Device (PFD) of suitable size and readily available for each adult and each child on board (this device is commonly referred to as a life preserver or life jacket). If this vessel is not used commercially, PFDs may be Type I, II, or III. If this vessel is to be used commercially and will be carrying 6 or fewer passengers for hire (charter boat operation), the PFDs must be Type I.

For this vessel, Bertram furnishes eight (8), Type II buoyant vests, adult size (90 pounds or more). This type of Personal Flotation Device (PFD) is capable of turning its wearer to a vertical or slightly backward position in the water. The Bertram-supplied vests are high visibility orange and comply with all the U.S. Coast Guard requirements for a Type II device and carry the U.S. Coast Guard's approval label. Type II PFDs come in three sizes, adult (90 pounds plus); child medium (50 to 90 pounds); child small (less than 50 pounds).

This type of PFD is donned by placing it over the head with the collar behind the neck. The waist strap should then be connected and adjusted to prevent this device from riding up on the wearer. The technique for donning PFDs should be practiced by everyone so that they know where to find them and how to properly don one even in the dark, try donning your PFD while wearing a blindfold. If time and conditions permit, for instance during a swim, all hands should also practice water entry and swimming while wearing a PFD.

The recommended technique for water entry while wearing a PFD is to wrap both arms as tightly as possible around the wearers chest, under the chin. This protects the face and keeps the PFD from riding up. Always jump into the water feet first, with both the feet and knees together and the knees slightly bent. The head should be tucked down into the pocket made by the folded arms. As soon as a wearer is in the water he should join others for mutual assistance and warmth.

Please keep in mind that Bertram furnishes only adult sized PFDs and that the U.S. Coast Guard requires that every one on board have the correct size PFD. Please keep in mind also that being put away wet and/or stored in a damp locker promotes mildew and hastens the deterioration of the PFDs. Rather they should be first thoroughly rinsed off in fresh water, then dried, and then they should be stored in a cool dry place out of direct sunlight. Storage should include being kept away from oil, paint, and greasy substances. In this connection, you should know that for purposes of satisfying the legal requirements, the U.S. Coast Guard does not consider as "Readily available" any PFDs found left in their original plastic wrappers since persons under stress may be unable to get them out quickly.

Y. RING BUOY

In addition to the life jackets (PFDs) mentioned in the previous paragraphs, and also required to be on board by federal regulations is at least one (1) U.S. Coast Guard approved throwable Type IV (life ring or buoyant cushion. This device must be carried where it is immediately available to those on deck.

Bertram supplies one Coast Guard approved 20 inch diameter ring buoy with 3 mounting brackets. You should mount this bouy in a suitable location. Bertram recommends that about 60 feet of light line be attached to the ring buoy. You may add to the one onboard "throwable" and/or replace the ring bouy with any other approved Type IV device if you so choose.

Z. RADIOS AS EMERGENCY EQUIPMENT

The use of a marine radio as a method of obtaining help in an on board emergency cannot be over estimated. The possibilities of how reliable radio communications could add to the safety of the vessel and its crew are almost unlimited.

AA. NAVIGATION and RUNNING LIGHTS

Your Bertram is delivered to you with a complete set of navigation/running lights installed. These lights fully comply with the requirements of the International Regulations for Preventing Collisions At Sea, 1972 (72 COLREGS). All vessels may use the 72 COLREGS as the controlling document when in international waters. For U.S. navigable waters, reference must be made to the Great Lakes and Western Rivers Rules.

The 72 COLREGS require that the navigation (running) lights shall be switched **ON** if your vessel is being operated between sunset and sunrise. For a vessel of this size, the required navigation lights consists of a red (for port) and a green (for star board) sidelights, a white masthead light, and a white stern light, or if you are not docked nor anchored in a recognized anchorage, a white anchor light.

NOTE:
Keep the transom door closed while underway at night to avoid obscuring the stern light. (This door should be kept shut when underway to minimize the possibility for someone to fall overboard.)

NOTE:
All the navigation lights furnished on your Bertram meet the current 72 COLREGS requirements. However, it is the legal responsibility of the vessel's owner to:
a) be sure that if there are modification(s) to the the vessel superstructure (i.e., the addition of a fishing tower, radar, and/or other electronic equipment), the required areas of visibility for each of these lights is not obstructed.
b) be sure this vessel complies with any future changes to the existing 72 COLREGS.

BB. VISUAL DISTRESS SIGNALS

WARNING

DO NOT USE AUTOMOTIVE ROAD FLARES AS YOUR REQUIRED NIGHT SIGNALS. THE "SLAG" FROM ROAD FLARES CAN CAUSE INJURY AND/OR START A FIRE.

A Federal regulation became effective January 1, 1981, requiring that all vessels, 16 feet or larger, must carry a minimum of three (3) U.S. Coast Guard approved visual day and three (3) visual night distress signals, or three (3) approved day/night signals. These signals may be flares and/or smoke generating devices or battery powered automatic emergency signaling devices, and they must ALWAYS be carried on board when ever you are operating in U.S. waters and on the high seas.

If you choose to carry pyrotechnic signaling devices, it is your responsibility to ensure that they have not exceeded their expiration date (42 months from date of manufacture). This expiration date is clearly marked on the approval label.

Bertram does not supply such equipment. You, the operator, should study the latest issue of the Coast Guard pamphlet "Visual Distress Signals for Recreational Boats", copy of which are available from the Department of Transportation, U. S. Coast Guard.

CC. SOUND SIGNALS

The length of this vessel falls within the Coast Guard category that requires that it carry both a bell and a whistle or a horn. Bertram has equipped this vessel with a suitable bell (unmounted) that satisfies the Federal Requirement for a bell for use in fog and a dual air horn powered by an air compressor that is suitable for the sound signals required by the Rules

of the Road, fog, and other signaling. The horn push button switch is on the flybridge control console between the helm and the throttles (see Figure 1).

DD. CALLING AT PORTS AWAY FROM HOME

You are not likely to have trouble with shore current in the United States. However, you should be careful when cruising abroad, check shore power for single phase ac, 50 or 60 Hz.

Also, when cruising abroad, try to purchase fuel equal to American standards. (See Fuel Systems section for requirements in your engines.) Carry extra fuel filters with you, since replacements may be necessary.

In some areas, it is advisable to use water purifying tablets of the iodine type. Be sure to take these with you when cruising to places where the water supply is suspect.

EE. LEAVING YOUR BERTRAM

The following are procedures to follow when leaving your boat overnight or for a short period of time.

1) Switch **OFF** all ignition or engine circuits.

2) Lock all doors, windows, and hatches.

3) Make sure mooring lines are well secured with adequate allowance for the tide.

4) Fenders and spring lines should be set.

5) The Automatic bilge pump should be left on the **AUTO** position. If for any reason your vessel is taking on water, the batteries should be checked frequently.

SECTION V - THE PROPULSION SYSTEM

A. GENERAL

WARNING

COMING INTO CONTACT WITH MOVING MACHINERY CAN RESULT IN SERIOUS INJURY.

B. PROPULSION SYSTEM CARE

NOTE:
It is important that you:
1) Check the engine lubricating oil level and the coolant level before you start the engines;
2) check the transmission lubricating oil level with the engine idling and the transmission in neutral; and ,
3) monitor the propulsion system performance gauges especially the first several minutes after engine start up.

Your propulsion system is manufactured from high quality materials in a design of proven ruggedness. Nonetheless, your system's performance and life expectancy very much depend on the care you give it.

To maintain its rugged reliability and ensure long life for all components, your system demands your care ful attention, gentle treatment and a consistent program of preventive maintenance.

Part III of this manual contains information on maintaining your vessel; Part III, Section I covers Periodic Maintenance. You should also follow the instructions in the engine and transmission operator's manuals provided by the manufacturers for:

1) selecting fuel and lubricants;

2) scheduling preventive maintenance;

3) monitoring performance instruments carefully.

You can find these manuals in the supplementary information packet delivered with your Bertram. Part III, Section II of this manual covers propulsion system troubleshooting procedures.

C. DIESEL ENGINES

CAUTION

To avoid possible serious engine damage, do not attempt to start or operate your engines until you have read and understand the manufacturer's Operator's Manual.

In Section I, Table II-I-1 - Propulsion System Operating Specifications gives engine and transmission operating specifications.

All the information (including technical data) you need to start, operate, and to perform routine maintenance on your Diesel engines is contained within the manufacturer's Engine Manuals. These manuals are supplied as a part of this vessel's documentation package. You should carefully readthe sections on engine operation, lubrication requirements, and preventive maintenance before you try to start or operate your Diesel engines.

For those who wish to become knowledgeable about the Diesel engines in their vessel, Key Power Incorporated gives three-day seminars for vessel owners and captains. The seminars on marine Diesel engines include theory of operation, preventive maintenance, and troubleshooting.

For more information and/or registration, send in the registration form in this manual (Part III, Maintenance), or contact the Director of Training, Key Power Incorporated, 2295 N.W. 14th Street, Miami, Florida, 33125, U.S.A.; telephone (305) 633-5028.

1. MAN Engines

The engine serial and model numbers are located on the port side of each engine just forward of the starter. The engine lubricating oil fills and dipsticks are on the inboard side of each engine.

Part ordering information is included in the Service Documentation provided as part of your vessel's documentation package.

2. Detroit Diesel Engines

The engine serial and model numbers are stamped on the upper right front corner of the cylinder block. The engine lubricating oil fills and dip sticks are on the inboard side of each engine.

Part ordering information is furnished on one of the engine rocker valve covers.

D. DIESEL ENGINE OPERATIONS

1. Preparing To Start the Main Diesel Engines

WARNING

BEFORE STARTING THE ENGINES, ENSURE THAT THE CLUTCH CONTROLS ARE SET IN THE NEUTRAL POSITION TO PREVENT ACCIDENTAL BOAT MOVEMENT.

CAUTION

If engine fails to start within 7 seconds; release the START switch, wait 2 to 3 minutes, and try again. Excessive cranking results in unnecessary starter wear and battery drain.

2. Diesel Engine Starting Procedure:

NOTE:
When starting your engines, it is very important to be sure that:

1) Engine cooling seawater intake seacocks are fully open;
2) engine cooling seawater strainers are not clogged;
3) you have set the fuel tank selector valves in the engine compartment to draw from either the forward or aft tanks .

On the 32 Vdc battery disconnect panel (see Figure 8A - 32 Vdc Battery Main Switch Panel):

Set both 32 Vdc battery disconnect switches to **ON.** These two battery disconnect switches feed the 32 Vdc battery power to the salon 32 Vdc distribution panel.

On the salon 32 Vdc distribution panel (see Figure 8 - Salon 32 Vdc Power Center Distribution Panel):

Set the port **3FP** and the starboard **3FS** "F/B MAINS" circuit breaker switches to **ON.** These breakers feed the 32 Vdc battery power to the flybridge 32 Vdc distribution panel.

On the flybridge 32 Vdc Distribution Panel (see Figure 12 - Flybridge 32 Vdc Distribution Panel):

1) Set the "PORT ENG" **3F1** and the "STBD ENG" **3F2** circuit breakers to "**ON**".

2) Position the "HORN" **3D11** and the "TRIM TAB" **3F6** circuit breakers and others necessary for vessel operation to "**ON**".

On the flybridge control console:

1) Position the clutch controls in the "NEUTRAL" position.

2) Advance the throttle levers to slightly forward of "IDLE".

On the flybridge system control switch panel (see Figure 5 - System Control Switches):

1) Set either "**ON/STOP**" switch to "**ON**". (The engine alarm horn should sound and the (lube) "OIL PRES" alarm light should illuminate.) If the "GEAR OIL TEMP","EXHAUST TEMP", and/or the "COOLANT TEMP" alarm lights are illuminated (with the

or both alarm circuits. It is important to find and correct this problem before starting the engine.

2) Set and hold the "**BATTERY PARALLEL**" switch in "**PARALLEL**". (Bertram recommends that you use the "**PARALLEL**" mode whenever you start an engine). Release this switch as soon as the engine starts.

NOTE:

The use of the "COLD START" position allows the engine to be turned over for several seconds without fuel being injected into the cylinders. This allows:

a) the cylinder wall temperatures to be raised;

b) lube oil to be pumped through out the engine especially the cylinder walls: and,

c) any condensed water vapor or collected fuel to be ejected on the exhaust cycle.

No harm can be done by using the COLD START feature whether the engine is cold, warm, or even hot. Bertram recommends that COLD START be used each time you start an engine.

3) Set either "**START/OFF/COLD START**" rocker switch into the "**COLD START**" position, and hold for seven seconds.

4) Reposition that same "**START/OFF/COLD START**" switch to "**OFF**" for about two seconds to be sure that the engine has completely stopped turning before you reengage the starter.

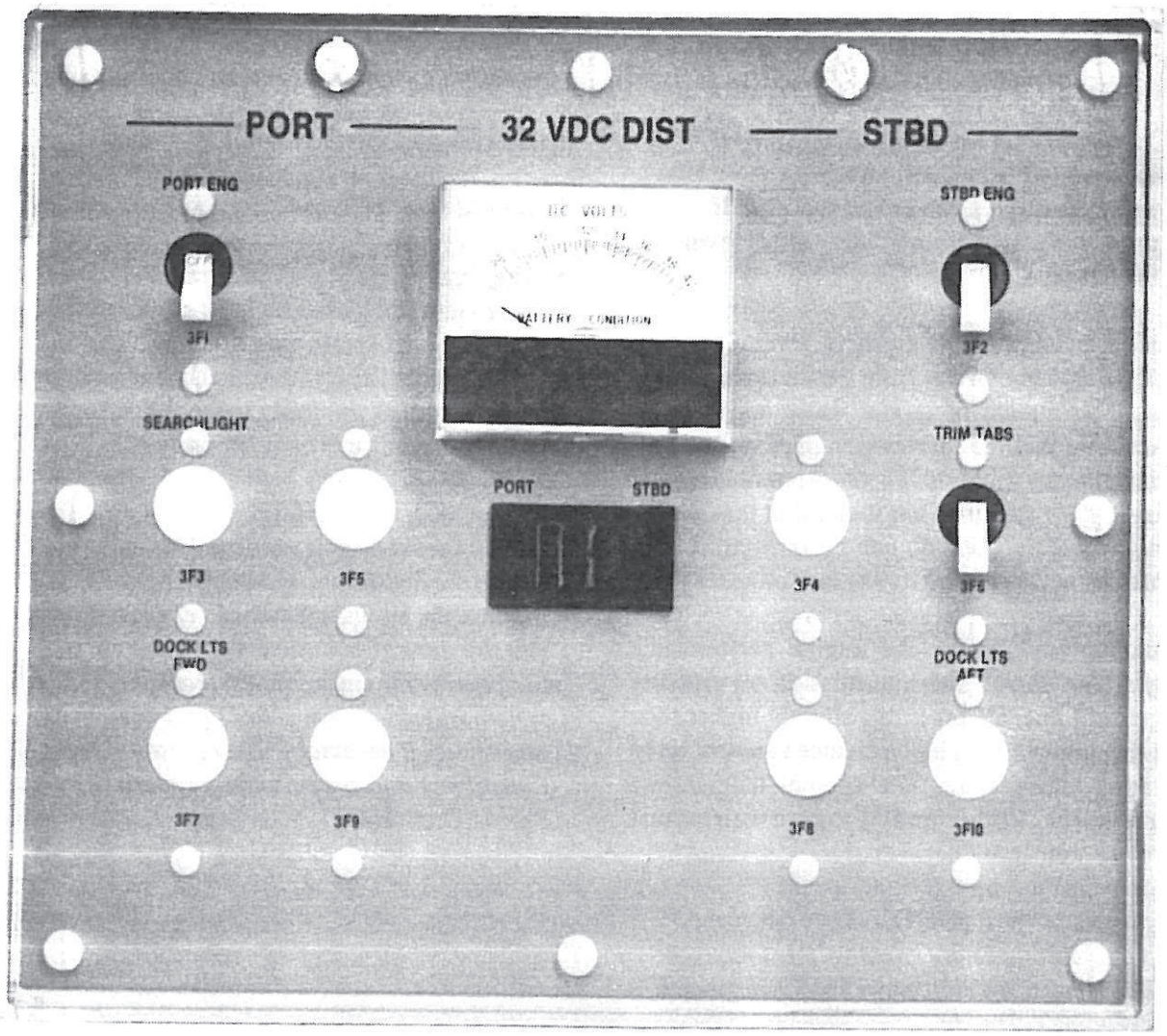


Figure 12 - Flybridge 32Vdc Distribution Panel

NOTE:
It is possible that your engine(s) will catch as you reset the "START/OFF/COLD START" switch into the "OFF" position. This is acceptable performance and is not a malfunction.

5) If the engine does not start, reposition the "**START/OFF/COLD START**" switch to its "**START**" position and hold for a maximum of seven seconds or until the engine starts, whichever comes first.

6) Release the "**START**" switch. (The engine alarm horn should stop and all engine alarm lights should now be extinguished).

3. After the Engine Starts

CAUTION

To avoid severe engine damage, once each engine is started, check for adequate water flow from the exhaust outlet. If there is no flow, immediately shut down that engine.

A few seconds after each engine is running, visually check the stream of water from the transom exhaust outlet. This stream of mixed water and exhaust gases shows that the seawater engine cooling system is operating properly. To avoid possible engine damage, if the stream is not there, shut that engine down immediately and do not try to restart it until you determine the reason for the lack of water flow.

Check the readings on the engine performance gauges. The engine and transmission oil pressure gauges will indicate pressures slightly higher then after the engines have had a chance to warm up to operating temperature. The coolant temperature gauges will be slowly climbing toward their normal operating temperature.

NOTE:
Once your engines are running, it is important to be sure that the engine performance gauges are reading correctly .

NOTE:
Detroit Diesel Engine-equipped Vessels:
The engine manufacturer recommends that you not idle your Diesel engines under no-load conditions for any extended period (more than five minutes), either when starting or during the day's operation.

4. Stopping the Main Diesel Engines

a. The Normal Stop. The Diesel engine "**ON/OFF/STOP**" switches in your Bertram have three operating positions.

1) Move the "**ON/OFF/STOP**" switch for either the port or starboard engine to the "**STOP**" position.

2) Hold the "**ON/STOP/OFF**" switch in the "**STOP**" position until the engine is fully stopped.

3) Release the "**ON/STOP/OFF**" switch.

4) Repeat steps 1, 2, and 3 for the other engine.

b. The Emergency Stop. Once started, Diesels will run as-long-as they have fuel and air. To shut down your Diesel engines (in case a "**STOP**" circuit fails or is disabled by fire), your vessel has an emergency shutdown system primarily meant to be used with the Halon fixed fire extinguishing system.

NOTE:
Detroit Diesel Engine-equipped Vessels:
Due to the possibility of damaging your engines, the engine manufacturer recommends that this emergency shutdown system not be used except for emergencies. However, the system will shut down your Diesel engines at other times if necessary. The operation of the Emergency stop system is fully explained in Part II, Section II.

E. THE FUEL SYSTEM

1. General

The aft fuel tank is made of molded fiber glass with a fire retardant resin. It is aft of the battery compartment and forward of the ac generators. Fuel is drawn from the top of the aft tank by a suction tube with a strainer at the bottom.

The forward fuel tank is made of welded aluminum and is up against the forward engine compartment bulkhead. Fuel is drawn from the bottom of the forward tank.

Both tanks meet Bertram and accepted industry standards.

The fuel gauges are on a panel in the salon, next to the electrical distribution panels, as described in Part II, Section II, Controls, Instruments, and Indicators.

2. System Description

Your fuel system (see Figure 13 - Fuel System), consists of:

1) two fuel tanks;

2) fuel lines;

3) fuel selection valves;

4) fuel filters.

A small cockpit hatch provides access to the aft tank fuel supply fittings and fuel gauge sender. The tank fill and vent plate assembly can be inspected from the engine compartment.

The forward fuel tank fittings and gauge sender can be inspected from the engine compartment.

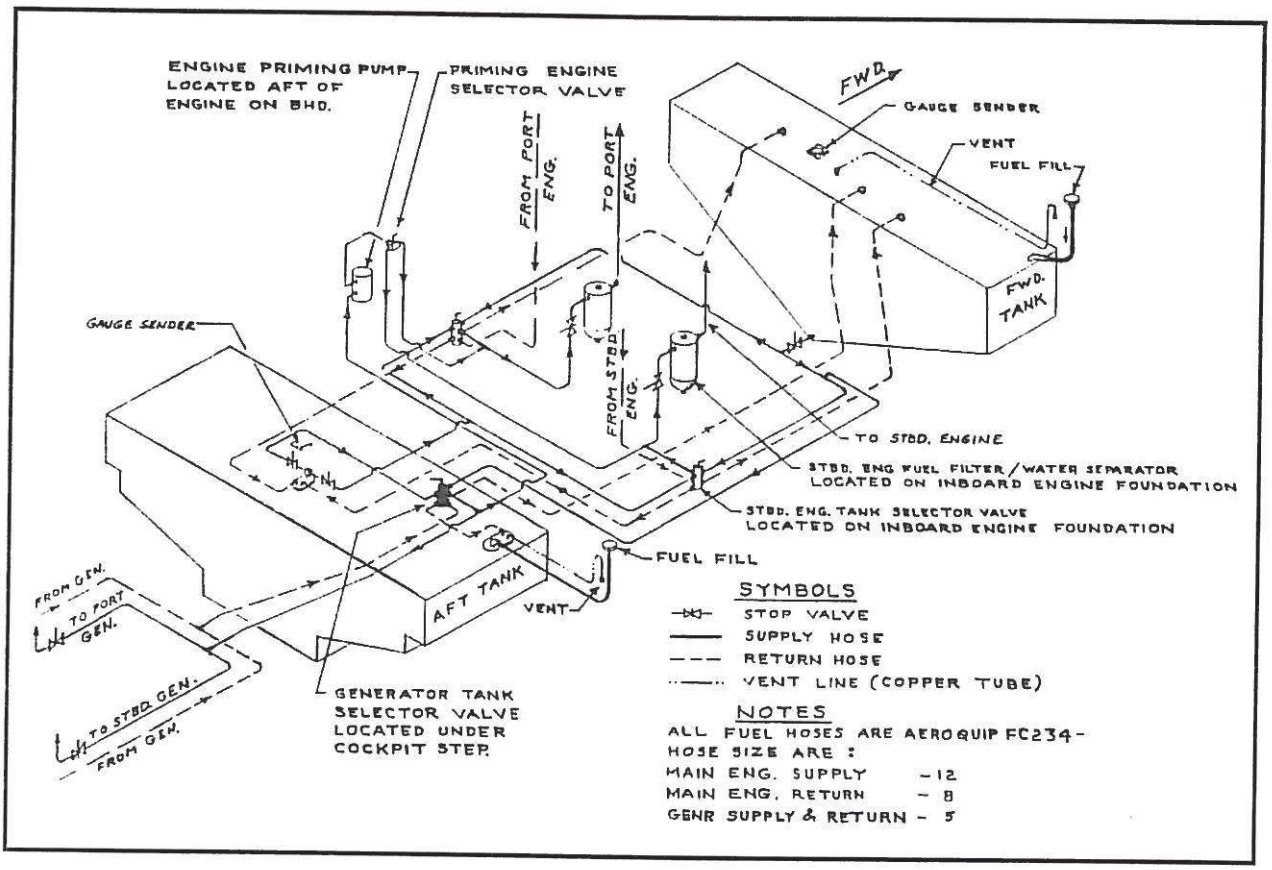


Figure 13 - Fuel System

3. Fuel Priming System

If the fuel lines for either engine are drained accidentally or on purpose, there is a fuel priming system that enables you to pump the Diesel fuel from the selected tank through the drained fuel lines to the engine fuel pump.This makes restarting your engines easier after you change or clean a fuel filter or if a fuel tank and its associated fuel lines became totally drained.

1) Turn the generator tank selector valve to a tank with fuel in it (the priming pump fuel supply is controlled by the generator tank selector valve).

2) Turn the priming pump selector valve to the engine to be primed.

3) Prime the system for three or four minutes using the engine room fuel priming pump switch.

4) Check the fuel system for leaks at the fittings and filters.

MAN Engines

5) Go to the engine compartment and locate the manual priming pump just above the rear lifting eye on either engine. Unlock the knob by turning counter-clockwise. Pull the knob out and pump seven to 10 full strokes. Lock the pump closed by turning the knob clockwise when the pump knob is pushed completely in.

6) Advance the throttle slightly. Try to start the engine for a maximum of seven seconds.

7) If the engine does not start, repeat steps 5 and 6, but increase the number of manual priming pump strokes. Continue to run the electric priming pump (using the flybridge priming switch) while starting. If starting fails, increase the number of pump strokes and repeat again.

8) Repeat steps 2 through 7 for the other engine.

Detroit Diesel Engines

5) Try to start the engine for a maximum of seven seconds. If the engine does not start, prime the system three or four minutes using the flybridge priming switch. Continue to run the priming pump while starting.

6) Repeat steps 2 through 5 for the other engine.

5. Fuel Gallonage

Both fuel tanks fit athwartships inside your Bertram's hull. The shapes of these fuel tanks follows your hull's deep "V" interior shape. Therefore, to make the best use of the space available, your vessel's fuel tanks are necessarily larger at the top portion than they are at the bottom.

The result of this design is that there is actually space for more fuel in the top half of the tanks than there is in the lower half. Therefore, the fuel gauges mounted on the Salon Gauge and Switch Panel (Figure 7) cannot register accurate gallonage. The fuel gauge level indications only show the approximate level of fuel remaining in the tanks.

Keep this in mind when planning for or during long trips to avoid running too low on fuel and to reduce the chance of running out of fuel at sea. Table II-I-3, Fuel Gauge Readings vs Tank Gallonage (in Part II, Section 1 - Technical Data) shows an approximate relationship between the fuel gauge readings and the actual fuel remaining.

6. Engine Fuel Tank Selection

Mounted on the stringer on the inboard side of each engine is a three-position fuel tank selector valve for that main engine which permit you to select which engine (port or starboard) shall draw fuel from which tank (forward or aft). The valves are connected to the fuel tank suction heads and the fuel return lines. Diesel engines do not use all the fuel drawn into them so the fuel return lines automatically return unused fuel to the tank from which it was drawn. The return lines have no shut-off valve.

The 3-position fuel selector valve for each main engine has a manual shut-off feature. A filter service valve is located on the fuel line at each engine allowing you to replace the fuel filter without having the fuel lines either drain and thus require priming or leak fuel into your bilge.

NOTE:

If Diesel fuel does get into your bilge, it is a violation to pump it overboard in U. S. territorial waters.

The fuel supply hose goes from each tank to a selector valve and then to a fuel filter which is also a fuel/water separator. A manual fuel shut-off valve is on the top of the aft fuel tank and at the bottom of the forward fuel tank.

7. Generator Fuel Tank Selection

Fuel for both generators is normally drawn from and returned to the aft tank. However, you can draw fuel for the generators or to prime the fuel system from the forward tank using a generator fuel selector valve in a compartment under the step from the cockpit to the salon.

Some Bertram 50s have a single three-position, six-port selector valve which allows you the choice of fuel tanks from which to both draw and return the unused fuel. Others have two three- position, three-port selector valves; one valve selects the tank from which the generators draw fuel and the other selects the tank to which the unused fuel is returned.

NOTE:

If your Bertram has the two three-position, three-port generator fuel selector valves, it is important that the fuel return line valve be set to return the unused Diesel fuel to the same tank from which it was drawn. If it is not, as much as six gallons of Diesel fuel per hour could be returned to a full tank and would be vented overboard. This is a violation of federal law.

Each main Diesel engine and the Diesel generator supply line has a fuel/water Separator. This separator assembly has a drain plug at the bottom that allows removal of water. Visual inspection should be made periodically and the water removed if required. The make and element numbers for main engines and generator filters are listed on the the Technical Data pages in Part II, Section I, of this manual as well as in the manufacturer's manuals.

8. The Fuel Fill Ports

NOTE:

The first time you fill any fuel tank, check carefully to ensure that fuel does overflow through the vent when full, if not, do not start engines and immediately notify the dealer and the Bertram Service Department .

Your Bertram has two fuel fill ports, they are flush mounted deckplates with captive, screw on covers. The forward fuel fill port is amidships on the starboard side. The aft fuel fill port is just aft of the salon superstructure on the starboard side.

9. Fuel Quality

WARNING

NEVER ADD COMMERCIALLY MARKETED DIESOHOL OR GASOHOL TO DIESEL FUEL. MIXING THESE BLENDS WITH DIESEL FUEL CREATES BOTH AN EXPLOSION AND A FIRE HAZARD.

CAUTION

Never use galvanized steel fittings in any Diesel fuel system. Diesel oil reacts chemically with the zinc coating to form a powder that clogs filters and damages engines.

CAUTION

Do not store fuel for long periods in your vessel's fuel tanks. Stored fuel will spoil and spoiled fuel can damage your engines.

Only use the types of clean, high-quality Diesel fuel oil that are specified in your engine manual. Diesel fuel must be clean and free from contamination. Fuel tanks and stored fuel must be inspected regularly for dirt, water, bacteria, and/or water-emulsion sludge.

Very small amounts of isopropyl alcohol (isopropanol) may be used to prevent fuel line freeze-up in winter months. No more than one (1) pint of isopropyl alcohol should or need be added to each 125 gallons of Diesel fuel for adequate protection.

10. Spoiled Fuel

Diesel fuel kept in your vessel's tanks for long periods deteriorates and spoiled fuel can damage your engines. Therefore, on shorter trips alternate tanks. On longer trips, use the forward tank first.This reduces the weight forward as fuel is drawn making it easier for you to trim your boat. We recommend that you refill your fuel tanks at the end of each days running to prevent condensation from contaminating the fuel.

11. Fuel System Operation

To avoid engine stoppage, fuel system contamination, and the need to reprime your engines, do not let your fuel tanks run dry in use.

Fuel is drawn from the selected fuel tank through the fuel strainer by a positive-displacement, high-pressure, engine-driven fuel pump. The fuel is then forced at high pressure through a fuel filter. The two-stage combination of a strainer and afilter cleans the fuel of impurities. The strainer removes larger foreign particles and the filter removes the smaller particles.

Fuel is pumped from the filter to the engine. All unused fuel is returned to the tank it was drawn from through the fuel outlet manifolds and the connecting return lines. Fuel is constantly circulating through the injectors which cools the injectors and removes air from the fuel system.

F. AIR SYSTEM (DETROIT DIESEL ENGINES ONLY)

In two-cycle Diesels, a charge of blower compressed intake air pushes exhaust gases out through the exhaust valve ports, and the cylinders are filled with fresh air ready to ignite at the end of each upward piston stroke. Input air also helps cool internal engine parts, particularly the exhaust valves.

A blower on each engine cylinder block supplies the compressed input air for scavenging and combustion. This blower consists of a housing with two each closely-fitted, three-lobe rotors. The revolving motion of the two rotors pulls fresh air in through the air cleaner and silencer and provides a steady, pressurized flow of air for each combustion chamber. The blower runs when the engine is running and builds up air pressure in the engine air box.

To keep dust and grit out of your Diesel engines, they are each equipped with replaceable air cleaners on the air intake silencer attached to the input end of each turbocharger. There is an air filter indicator on the end of each filter. This should be checked periodically and the intake filter replaced as indicated. See Part III, Maintenance, in Section I, Periodic Maintenance, under "As Required".

G. ENGINE LUBRICATION SYSTEM

As with any internal combustion engine, proper lubrication is critical to engine life and performance. All engine lubricating oil goes through a full-flow oil filter, which removes larger foreign particles without restricting oil flow. The full- flow filter has a bypass valve which opens if the filter becomes completely clogged.

As the oil circulates, all oil is eventually filtered by the full-flow filter. This filter element should be replaced each time the oil is changed. See Part III, Maintenance, for the replacement procedure.

H. ENGINE COOLING

1. General

Your Bertram 50-footer is fresh-water cooled. This means that cooling seawater is taken in through the hull via slotted strainers, drawn through the seacocks and the seawater strainers into the pump. The pump moves the cooling seawater through the heat exchanger and from there into the engine exhaust outlet (riser), where it mixes with exhaust gases and cools them.

To keep the seawater from getting back into the exhaust manifold, the cooling seawater is injected into the exhaust flow beyond the highest point of the riser and at a point several inches below it. The mixture is expelled overboard after passing through the exhaust silencers (mufflers).

2. Fresh Water and AntiFreeze Mixture

Your engine coolant provides the medium for heat transfer to control the engine internal temperature during operation. In an engine having the proper coolant flow, combustion heat moves through the cylinder walls and the cylinder head into the coolant. Without adequate coolant, normal heat transfer cannot occur within the engine and its temperature will rise rapidly. The coolant solution in your engines must provide the following functions:

1) adequate heat transfer;

2) a corrosion-resistance in the cooling system;

3) protection against the formation of sludge or scale in the system;

4) compatibility with the system's hoses and seals;

5) adequate freeze protection during cold weather operation and boil-over protection during hot weather.

Cooling system requirements vary according to the engines installed in your Bertram.

a) MAN Engines

CAUTION

Use only antifreeze or corrosion inhibitor that has been approved by the engine manufacturer. Refer to your MAN Service Documentation for a list of acceptable cooling system additives. Do not use more than 50% antifreeze.

The engine blocks, cylinder heads, exhaust manifolds, and turbochargers are cooled with a sealed and pressurized mixture of fresh water and an approved antifreeze or a mixture of fresh water and an approved corrosion inhibitor. This coolant mixture is in turn cooled by passing it through the seawater-cooled heat exchanger.

b) Detroit Diesel Engines

The engine blocks, cylinder heads, exhaust manifolds, and turbochargers are cooled with a sealed and pressurized mixture of fresh water and a suitable corrosion inhibitor such as NALCOOL 2000. This coolant mixture is in turn cooled by passing it through the seawater-cooled heat exchanger.

CAUTION

To prevent engine damage caused by silicate dropout from an automotive grade antifreeze, use only antifreeze that meets the requirements of GM 6038M or GM 1899M. Do not use more than 67% antifreeze.

In waters above 70°F, do not use antifreeze in the coolant mixture of your Detroit Diesel engines. Antifreeze does not transfer heat through the heat exchanger as efficiently as a 1:32 mixture of fresh water and NALCOOL 2000 (one pint of NALCOOL 2000 to four gallons of water).

The use of antifreeze in your Detroit Diesel engine coolant presents another problem. Over the years, as the use of aluminum parts increased in automobile engine cooling systems, antifreeze

manufacturers changed their products to include increased amounts of silicates to protect these aluminum components from corrosion. Today, most automobile antifreezes have three to eight times as much silicate as they did several years ago. This includes antifreezes to be used in heavy-duty Diesel coolants.

If a high silicate Diesel antifreeze is overconcentrated by evaporation and/or unnecessarily large amounts of corrosion inhibitor supplements are used, excess silicate "drops out" of the coolant and a silica gel builds up in the cooling system's cool, low-flow zones, especially the oil cooler core, the heat exchanger, and the aftercooler. This build up of silica gel restricts coolant flow and causes engine overheating which can result in serious engine damage. In its wet state, the silica gel looks like the antifreeze. When dried, the silicate appears as a white powdery deposit. The gel is non-abrasive, but it can pick up particles in the coolant and become a gritty, abrasive deposit and cause excessive wear in the water pump seals.

3. Seawater Inlet System

As shown in Figure - 14, Engine and Generator Cooling, the water inlet system consists of:

1) below the waterline intake ports;

2) seacocks;

3) seawater strainers.

Your Bertram has two seawater heat exchanger systems. The larger system has one heat exchanger mounted on each engine and the smaller system has one heat exchanger for each Diesel powered ac generator. First, the incoming seawater cools the heat exchangers. On the engine side of the heat exchangers is the fresh water engine coolant mixture. Once through the heat exchangers, the

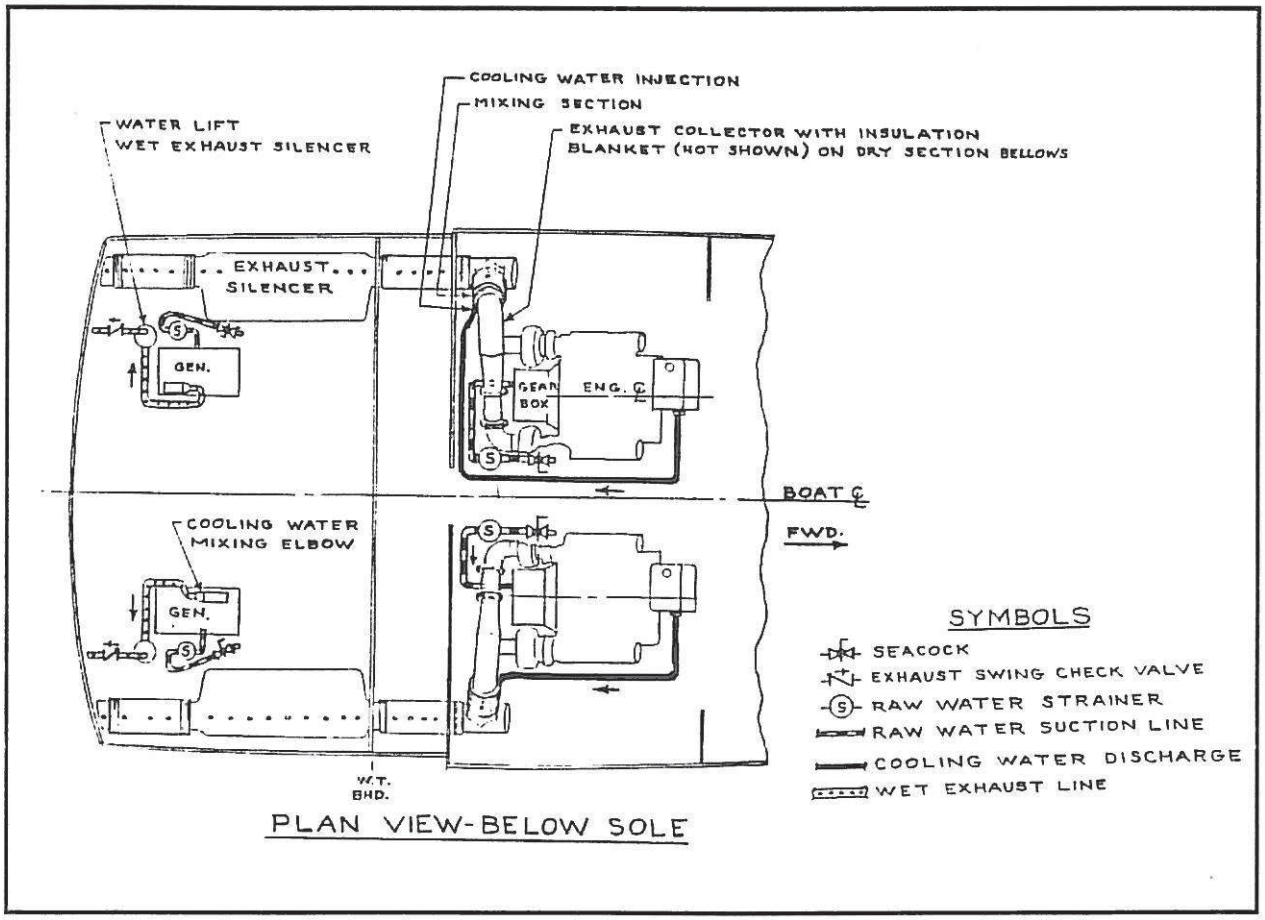


Figure 14 - Engine and Generator Cooling , Intake & Exhaust

seawater is piped directly to the engine exhaust riser mixing sections (on Diesels these are called the mixing elbows).

NOTE:
To avoid engine and/or ac generator overheating, it is most important that the seacocks be completely open and that the seawater strainers be kept clean .

I. MARINE GEARS

1. General

As shown in manufacturer's manual, the heavy-duty marine hydraulic transmissions attached to your engines each consists of the forward and reverse gears and two clutches. The transmissions are controlled by the position of the twin transmission control levers mounted on the flybridge control station console.

2. Operation

Operational information and maintenance procedures for your marine gears are in the manufacturer's Operator's Manual.

J. PROPELLER SHAFTS

1. General

Information as to diameter, length, and material of the propeller shafts is shown on the "Technical Data" pages at the front of this manual.

2. Propeller Shaft Alignment

See Part III, Section IV, Maintenance Procedures.

K. PROPELLERS

1. General

Bertram's Engineers calculate a specific combination of propeller diameter and pitch to give your vessel maximum efficiency based on engine power (at its rated rpm), hull design, vessel weight, and finally extensive testing for proper size.

Therefore, any changes in size or pitch could reduce engine performance and/or propulsion system life by placing undue stress on the running gear components. If propeller replacement is necessary,it is vital to use the original propeller size, diameter, and pitch.

2. Changing Propellers

If in the future, for any reason (such as adding a fishing tower or a similar modification, or if there is a significant change in your vessel's primary use) you feel that a different size or style of propeller could improve your vessel's performance, please send Bertram's Service Department a complete written report on your boat's past performance, including measured speeds at 1900, 2100, and at maximum rpm recorded with an accurate handheld tachometer. The Service Department will then check with Bertram's Design and Test Engineers to see if a change in propellers is indicated.

L. PROPELLER INSTALLATION

See Part III, Section IV, Maintenance Procedures.

M. SHAFT LOGS and STUFFING BOXES

1. Shaft Log Boxes

See Part III, Section IV, Maintenance Procedures.

2. Stuffing Boxes

See Part III, Section IV, Maintenance Procedures.

3. Stuffing Box Sprayshield

A rubber hose sprayshield is installed over each stuffing box to prevent any dripping water from being sprayed around the engine compartment.

4. Rudder Stuffing Boxes

The rudder stuffing boxes are packed in the same manner and with the same packing material as are the propeller stuffing boxes, except that it is not necessary to have the rudder stuffing boxes drip. Just check to be sure the rudders can turn freely.

N. WET EXHAUST SYSTEM

CAUTION

Where your vessel has removable covers over parts of the Diesel exhaust risers, check quarterly to ensure these insulating blankets cover all hot sections to prevent engine compartment fires and to protect anyone working near them when the exhaust risers are hot.

Wet exhaust systems are where the entire system or any portion of the system is cooled by water. As shown in Figure 14, in your Bertram, exhaust gases are collected in the exhaust manifold and then go into an exhaust riser. This area is dry (not cooled by the seawater), will get ***extremely hot*** and should be treated with great respect. The exhaust risers are covered by special heat resistant insulation to protect anyone working near them and to reduce the chance of an engine-compartment fire caused by a flammable material coming in contact with the risers. The seawater is injected into and mixed with the exhaust gases just below each exhaust riser and cools the remainder of the exhaust system.

SECTION VI - THE FRESH WATER SYSTEM

A. GENERAL

CAUTION

To avoid damage to your vessel, do not use lye based clog dissolvers on the fresh water, the toilet, and/or the bilge pump systems.

The fresh water system on your Bertram functions almost the same as the plumbing that you have at home. The system consists of: 1) a low noise, high-output, water-pump; 2) a water tank; and, 3) a pressure sensing device and gauge.

B. THE FRESH WATER TANK

Your Bertram has a stainless-steel, fresh-water tank amidships in the ac generator-compartment. As shown in Figure - 15, The Fresh Water System, this tank is filled through a deck fill plate aft, on the port side. The water tank gauge sender is in the tank and the gauge is on the salon gauge and switch panel (see Figure - 7, The Salon Gauge and Switch Panel).

C. THE WATER PUMP

CAUTION

The fresh water system circuit breaker must be turned OFF" when the tanks are empty.

For day-to-day operation, your vessel's water pump is automatic. The system holds an average static pressure of 30 pounds-per- square-inch gauge (psig) by being switched "**ON**" when the system pressure drops to 21 psig and switched "**OFF**" when the system pressure gets up to 32 psig. This pump is located in the engine- compartment aft of the lubrication oil tank and requires priming before its initial use or if the fresh water tank is allowed to be pumped dry.

TO PRIME YOUR WATER PUMP:

1) Ensure that the tank is at least partially full;

2) Remove the plug from the suction end of the pump;

3) fill the pump housing with fresh water;

4) replace the plug;

5) open one faucet to release the trapped air;

6) Depress the "**RESTART**" side of the pushbutton switch on the salon 32VDC POWER CENTER Panel below the fresh water gauge; or

7) start the pump by lifting the "**ON/OFF**" switch lightly until the pump starts;

8) then hold either the "**ON/OFF**" switch in "**ON**" or the "**RESTART**" switch in until the system pressure reaches 15 psig at which time the pump should run on its own; and,

9) release the "**ON/OFF**" switch;

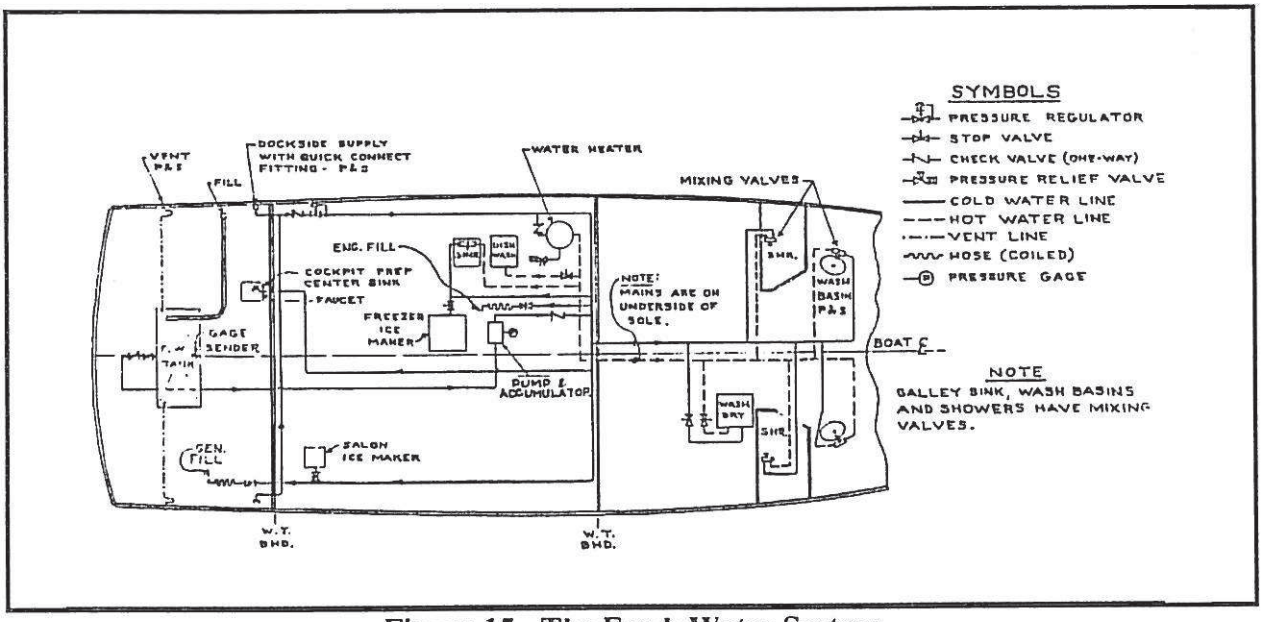


Figure 15 - The Fresh Water System

D. THE WATER HEATER

CAUTION

Turn ac power OFF before removing heater access panels. Do not remove thermostat protective covers.

CAUTION

To avoid burning out the heater element, do not turn "ON" water heater if water level is below the heater element. Open a hot water tap until water stops spurting to bleed air from hot water system, then turn heater "ON".

The automatic water heater is located below decks just aft of the forward fuel tank on the port side and outboard of the salt water wash down pump. The thermostat on this heater is preset by the manufacturer at 140° to 145° F, which Bertram recommends as maximum.

NOTE:

This type of water heater can be damaged (the heating elements burned out) if it is operated without water or if the water level gets below the height of the heating elements. The water heater operates on 240 Vac which is supplied either by the ac generators or by shore power.

E. THE SHOWERS

Your Bertram is equipped with two showers. Both showers have the customary mixing controls for adjusting the water temperature and hand held shower heads equipped with a push-button cut-off that retains the water temperature setting. Shipboard showers can either conserve or waste fresh water depending on how they are used. Unless your vessel is equipped with a desalinator, to conserve fresh water on a long trip, Bertram suggests that you take a "sailor's shower".

A sailor's shower means that after adjusting the water temperature, you wet yourself thoroughly. Then you turn the shower off by using the push-button on shower head, soap up, and then turn the shower back on to rinse off.

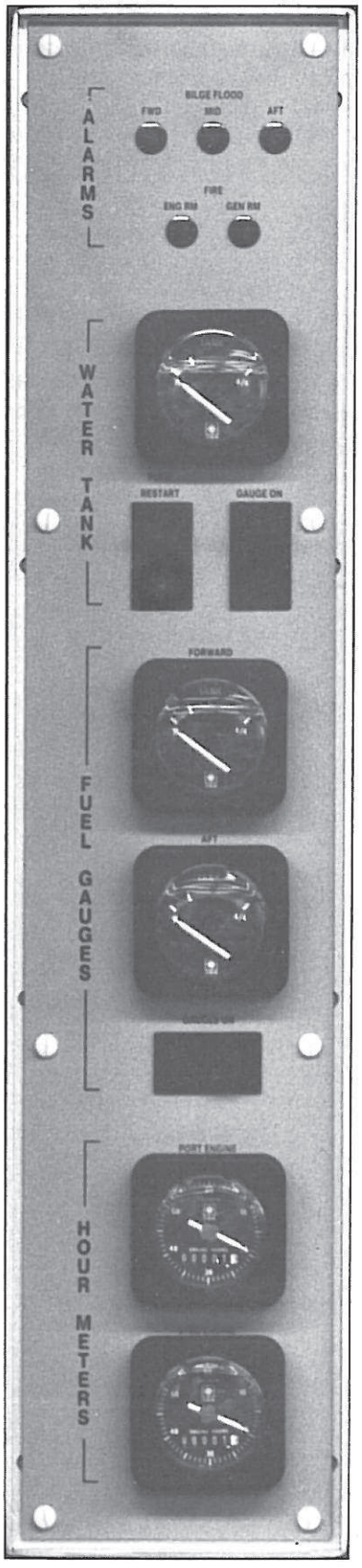


Figure 7 - Salon Gauge and Switch Panel

F. THE SHOWER SUMP PUMP

The shower sump is located in the bilge below the cabin sole. This sump has its own submersible pump which is equipped with an automatic float switch. The sump pump discharges the shower water overboard and is connected to the 32 Vdc through the SHOWER PUMP circuit breaker, circuit breaker number **3D13** on the salon 32 Vdc distribution center panel (see Figure - 8, The Salon 32 Vdc Distribution Center). This circuit breaker must be in the "ON" position if the showers and/or the air conditioning is being used since the air conditioning condensate drains into the shower sump and will cause the sump pump to operate even if the showers are not in use. The filter screen between the shower sump pump and the float switch should be inspected on a routine basis and cleaned as necessary.

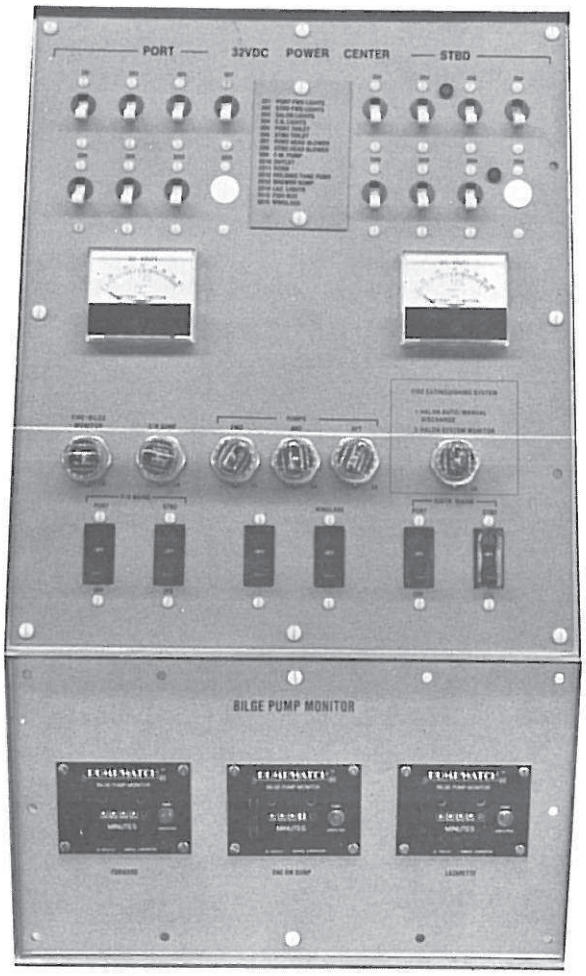


Figure 8 - Salon 32 Vdc Distribution center

G. THE GALLEY SINK and THE TWO LAVATORY SINKS

The galley and lavatory sinks get cold water from the fresh water tank and hot water from the water heater. The galley sink has a garbage disposal that drains overboard. The garbage disposal 120 Vac circuit is protected by circuit breaker number **125** on the Galley 120/240 Vac distribution panel (see Figure - 16, The Galley "120/240 VAC GALLEY" Distribution Panel). This circuit breaker must be in the "**ON**" position and the cold water running for the garbage disposal to operate. All three sinks drain over-board through hull-side fittings.

H. ENGINE/GENERATOR COOLING WATER

The engine- and ac generator-compartments are each equipped with fresh water outlets fitted with cutoff valves and hoses to simplify the task of adding water to the closed fresh water cooling system on each main engine and each generator.

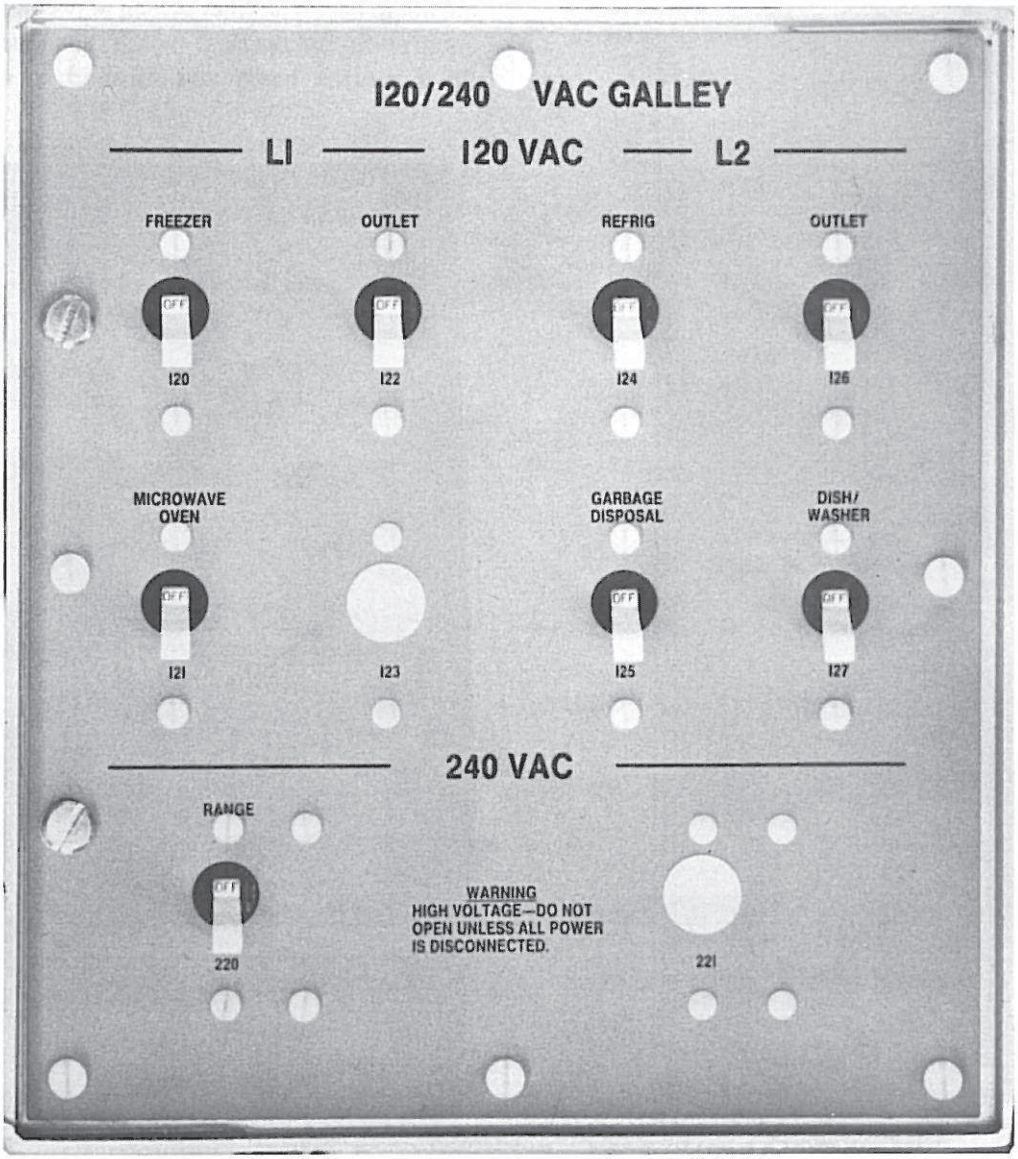


Figure 16 - The Galley "120/240 VAC Galley" Dist. Panel

I. THE DOCKSIDE WATER SUPPLY

CAUTION

When leaving vessel unattended, the dockside fresh water hose should be disconnected.

There are two dockside quick-disconnect fresh water hose connections. These fittings are under a panel on the port and starboard pilasters with the shoreside 120/240 Vac and CATV/telephone connections. This is a convenience feature which allows you to use available fresh water at dockside. A pressure regulator in the supply line reduces the normal city water pressure to within the limits of the on-board system.

SECTION VII - THE BILGE PUMP SYSTEM

A. GENERAL

CAUTION

To avoid damage to your vessel, do not use lye based clog dissolvers on the fresh water, the toilet, and/or the bilge pump systems.

OIL DISCHARGE WARNING

The "Federal Water Pollution Control Act" prohibits the discharge of any oil or oily waste into or upon the navigable waters and contiguous zone of the United States, if such a discharge causes a film, or sheen upon, or a discoloration of the surface of the water. or causes a sludge or emulsion beneath the surface of the water, it is considered a violation of the regulation.

This applies to any overflow of fuel oil as well as any bilge pump discharge

Violators are subject to a penalty of $5,000.00

As shown on Figure - 10, The Drainage and Bilge Pump System, your Bertram has three (3) independent and separate bilge pump systems and one (1) sump pump system. Each pump system consists of a pump and an associated automatic bilge pump switch. To avoid accidental bilge pump shutdown, the bilge pump switches have no "**OFF**" position and each pump is connected directly to your vessel's 32 Vdc system through a fuse. The "**MAN-AUTO**" switch operation for the three bilge pumps is covered in Part II, Section II., "The Bilge Pump Switch Group". The forth pump system, the "engine-room Sump Pump"; is always "**ON**", has no switch, and is always in the AUTOMATIC mode.

B. BILGE PUMP LOCATIONS

The submersible Forward bilge pump with its associated water level sensing switch are in the bilge under the master cabin sole just forward of the engine-room bulkhead. The submersible Midships bilge pump and associated water level sensing switch are in the keel sump between the two main engines. The submersible Aft bilge pump and associated water level sensing switch are near the transom in the aft bilge area. The "Engine-Room Sump Pump" is not submersible and with its associated water level sensing switch is in the battery compartment.

The forward and aft bilge pumps are in the bottom of these bilges just below their bilge pump switches. This arrangement ensures that there will be a positive shutdown signal to the pump when the bilge is nearly dry. However, if the water in either bilge rises to about 1/2-inch and if that bilge pump's switch is in the "**AUTO**" mode, that bilge pump will be activated.

C. BILGE PUMP SYSTEM OPERATION

Bertram intended that none of the three electric bilge pumps could be switched "OFF" from either the flybridge control station instrument console or from the 32VDC POWER CENTER distribution panel. The bilge pump control is wired so that the instrument panel switches (see Figure - 5, The System Control Switches) can select between the manual (**MAN**, running constantly) mode or the automatic (**AUTO**, controlled by the bilge pump switch) mode.

Engine-room bilge water from the propeller shaft stuffing boxes is pumped overboard by the engine-room sump pump. The sump pump and its switch are in the engine-compartment sump with the sump pump intake about level with the engine-compartment bilge and always in "**AUTOMATIC**". The

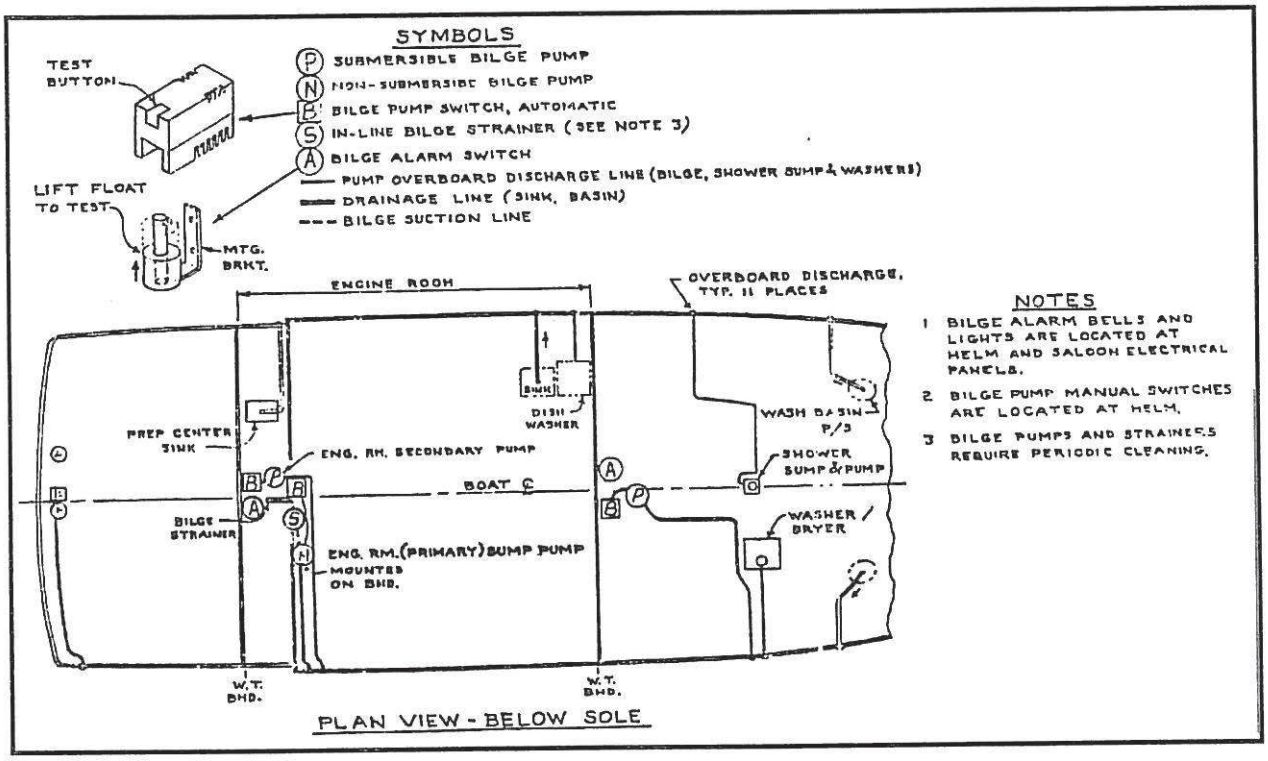


Figure 10 - Drainage and Bilge Pump System

are in the engine-compartment sump with the sump pump intake about level with the engine-compartment bilge and always in "AUTOMATIC". The Engine-compartment bilge pump will operate if the water level rises over the sump about 1/2-inch.

D. THE ENGINE DRIVEN AUXILIARY BILGE PUMP (Optional)

You have the option of having a back-up bilge pump installed in your Bertram. This pump is belt driven directly from the starboard engine. The pump is mounted on the aft side of the forward engine-compartment webframe just forward of the starboard engine as shown in Figure - 17, The Engine Driven Aux. Bilge Pump System. Pump intakes are hoses into each bilge compartment. The manifold for the pump intake valves in below the webframe step in the engine-compartment. To use this pump it is necessary to:

1) open the valve to the bilge compartment to be pumped;(Ensure that the valves to the other compartments are closed to avoid the loss of suction.)

2) Engage the clutch by pulling it toward you as shown in Figure - 17.

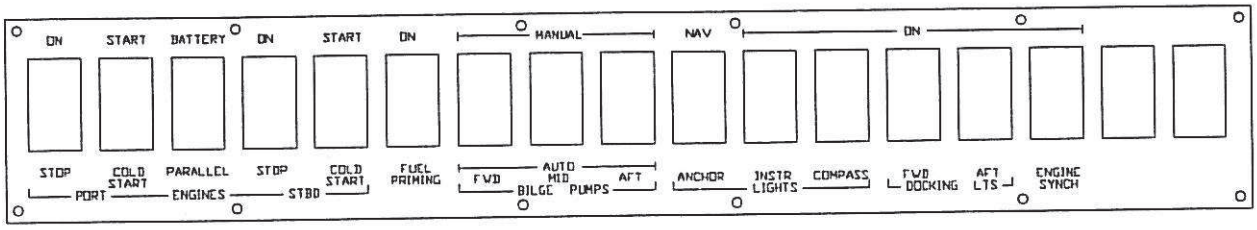


Figure 5 - System Control Switches

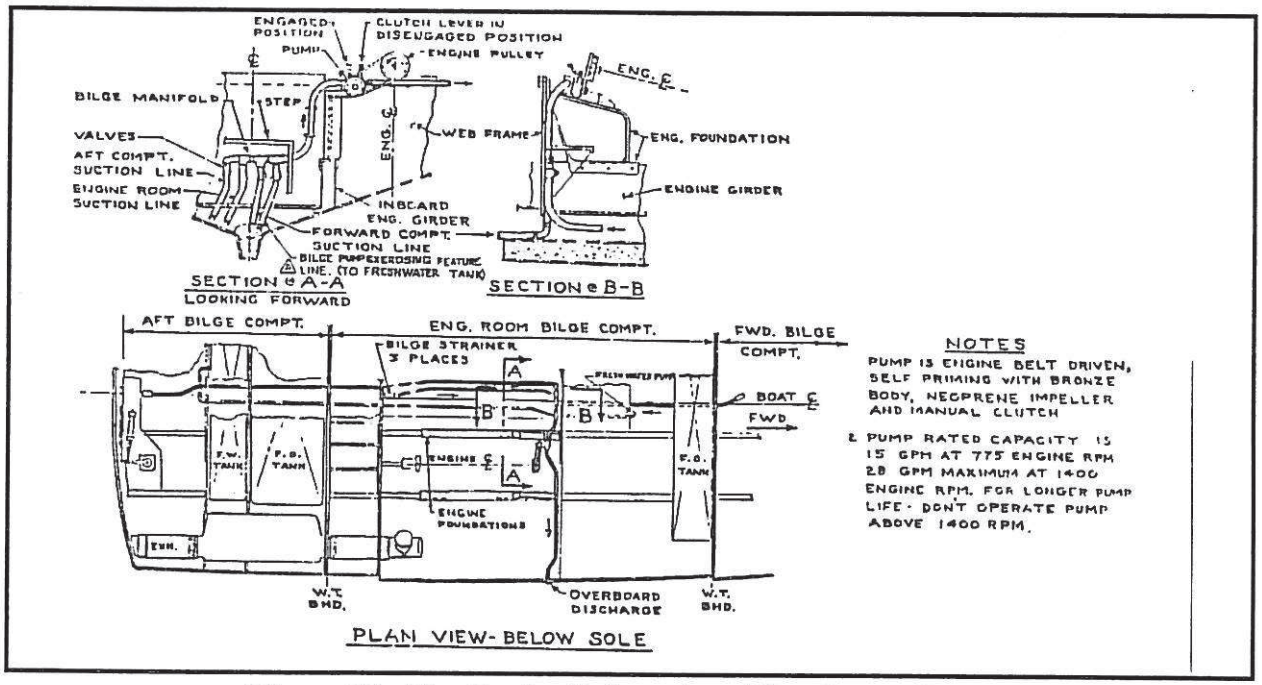


Figure 17 - The Engine Driven Aux. Bilge Pump System

NOTE:

For maximum pump life:
1) Do not operate dry;

2) do not operate at engine speed exceeding 1,400 RPMs; and,

3) operate pump periodically to check operation.

The pump is connected to the fresh water tank and should be operated once-a-month to ensure proper function. It is not necessary to pump more than a few gallons of fresh water over board to be sure that this pump is operational.

NOTES:

*a) The four (4) auxiliary bilge pump manifolds should be "**CLOSED**" unless this pump is in use or being excercised. When this pump is operating only one (1) manifold valve should be open at any one time.*

b) With the starboard engine at idle, the auxiliary bilge pump can be used to quickly empty the fresh water tank if desired.

c) Excercising this pump will normally by done at dockside during routine maintenance. Refill the fresh water tank after disengaging this pump and closing the manifold valve from the fresh water tank.

SECTION VIII - THE VENTILATION and AIR CONDITIONING SYSTEMS

A. THE VENTILATION SYSTEMS

1. General. Your Bertram has both natural air and forced air ventilation systems. Natural air ventilation for the state rooms uses the foredeck hatch to bring in fresh air. As shown on Figure - 18, The Ventilation System, natural air is delivered to and heated air removed from the engine-compartment via the hullside engine-compartment vents on both sides of the hull. These vents are equipped with built-in water traps.

2. Engine- And AC Generator-Compartment Ventilation.

The natural ventilation system for your Bertram is designed so that when your vessel moves, fresh air is taken in through the hullside vents and is ducted down to the engine-compartment. The ac generator-compartment draws its fresh air in from vents under the cockpit coaming pads on the port and starboard sides of the cockpit. Exhaust air ducting leads from the ac generator-compartment to the aft end of the engine-compartment. From there, the heated air is vented to the hullside exhaust vents.

To supplement the engine-compartment and the ac generator- compartment natural air ventilation there is also a thermostatically controlled forced air ventilation system for both compartments. With this system, the ac generator-compartment blowers discharge the heated air from the ac generator-compartment to the engine-compartment. The engine-compartment blowers discharge their heated air through the hullside exhaust vents.

The 120 Vac electric power for these blowers is connected to the blower circuit through circuit breaker number **117** ENG./GEN BLOWERS which is located on the salon 120/240 Vac distribution panel (see Figure - 9, The Salon "120/240 VAC Power Center"). When the blowers are in their normal operating mode and when circuit breaker number **117** is in the "**ON**" position, the blowers are automatically switched **ON** by a thermostatically controlled switch when the engine-compartment temperature reaches 110°F and they are automatically switched **OFF** when that temperature drops below 90°F. The blowers have a manual override switch position which allows you to run them regardless of the engine-compartment temperature.

NOTE:

To operate the engine-compartment and the ac generator- compartment blowers, you must have 120 Vac power either from the on-board ac generators or from dock side shore power.

3. Stateroom Ventilation. If the air conditioning is not being used, the foredeck hatch can be opened either partially or completely to bring fresh air into the master stateroom area. This hatch is hinged at its rear and has two pairs of locking dogs, one set at the foreward edge of the hatch and the other set midway from the foreward edge to the hinge. Both sets of locking dogs are operated from inside the master stateroom and both sets can be locked shut to secure this hatch. The second pair of dogs is for added security and to ensure a water tight seal when this hatch is secured. In addition to being a source of fresh air, this hatch also serves as a means of exiting the stateroom area if necessary.

4. Toilet (Head) and Shower Ventilation. Each of the two heads on your Bertram has a toilet, a lavatory sink, and a separate enclosed shower. To keep a comfortable climate in the head and shower areas, you have two separate ventilation systems.

Each head has a 32 Vdc exhaust blower which is activated by a bulkhead mounted "**ON-OFF**" switch in each head. These two blowers are on the same 32 Vdc circuit as the lights in the heads. The exhaust blowers keeps down the humidity level in this area by drawing off the moist air from the showers out of the head area and exhausting it over-

board. Each exhaust blower has its own circuit breaker on the salon 32 VDC DISTRIBUTION PANEL (see Figure - 8). Breaker number **3D7** is for the PORT HEAD BLOWER and breaker number **3D8** is for the STBD HEAD BLOWER.

The other ventilation system consists of a circulation fan for each head that is powered by 120 Vac and activated by an "**ON-OFF**" switch in the head bulkhead. This circulation fan draws some of the interior conditioned air into the head and shower area. Bertram suggests that you leave this fan on when your vessel is in use.

B. THE AIR CONDITIONING SYSTEM

1. General. The components in your on-board air conditioning system were designed and built as a reverse cycle system for saltwater marine use. Your system operates off of three, seawater-cooled, reverse-cycle, condensers and either heats or cools as required for your comfort. The condensate from the two forward air conditioning units drain into the shower sump and is pumped over-board. The salon unit condensate is piped down to the engine-compartment sump and pumped overboard by the engine-room sump pump.

NOTE:

The starboard stateroom air conditioner is the galley air conditioner in the "Galley Down" version.

2. Condensing Units. As shown in Figure - 19, The Air Conditioning System, there are three compressor/condensers, on board your Bertram. This part of your air conditioning system is located below decks just aft of the forward fuel tank on the star-

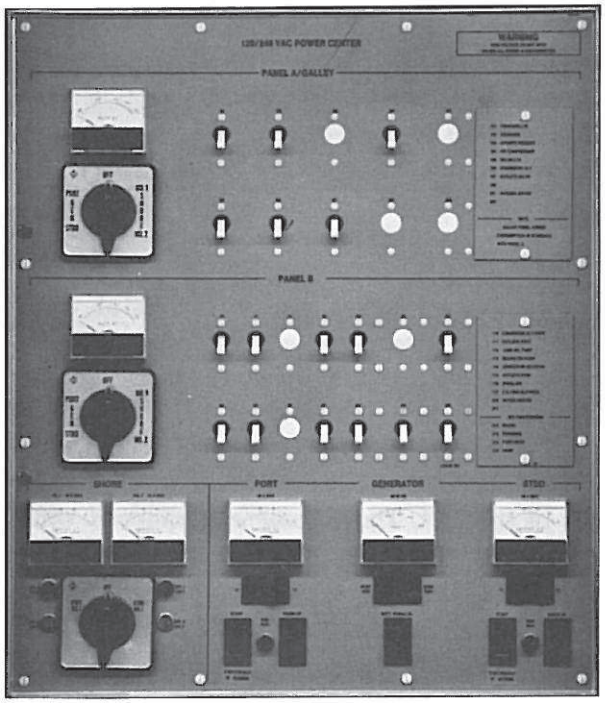


Figure 9 - The Salon "120/240 VAC Power Center"

board side. The 16,000 BTU unit cools or heats the deck house (salon) and the galley. The 7,000 BTU unit cools or heats the master stateroom, and the 10,000 BTU unit cools or heats the port and starboard guest staterooms.

3. The Air Conditioning Cooling Units. There are 5,000 BTU cooling units in the port and in the starboard staterooms. These two cooling units work with the 10,000 BTU compressor/condenser unit. The 7,000 BTU cooling unit in the master stateroom works with the 7,000 BTU compressor/condenser unit and the 16,000 BTU cooling unit in the salon works with the 16,000 BTU compressor/ condenser unit.

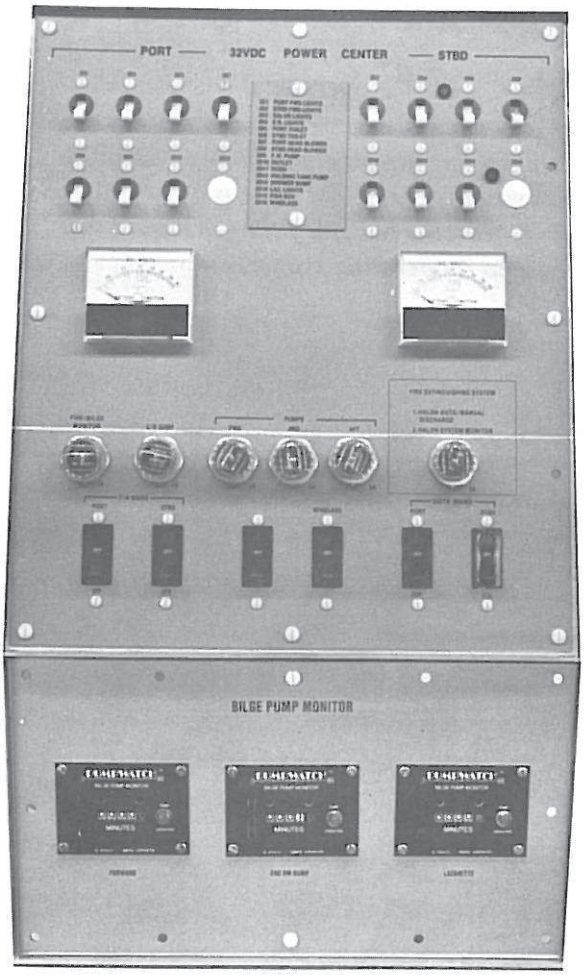


Figure 8-The Salon 32Vdc Distribution Center

4. The Air Conditioning SMX Control.

NOTE:

It is most important that you read and understand the "Cruisair SMX Microprocessor Air Conditioning Control Owner's Operation Manual" before you attempt to start or operate your vessel's air conditioning system.

Your vessel's air conditioning system has one SMX microprocessor based control for each of its three units. These state-of-the-art controls monitor the operation and interaction of all system components so effectively that component life is substantionally extended; however, their primary purpose is to give you the maximum benefit from you vessel's air conditioning system.

Among it other features, each SMX control has a memory that stores all settings during any ac power interruption to return to those settings when power is restored (one second or one year later).

Another feature is compressor restart sequencing. If shutdown,the three on-board compressors are restarted one-at-a- time with a programmed ten (10) second delay between each restart. This delay removes the heavy load of three compressors starting simultaneously.

In addition to the settings memory and restart sequencing features, the SMX controllers also have a compressor restart pressure equalization feature. Air conditioning compressors may be damaged if they are restarted before systems pressures are allowed to equalize since this can result in a "stalled" condition which is harmful to the wiring, the circuit breakers, and to the switchgear. It may also mean inconvenient trips ashore to find and reset the dockside circuit breaker. The SMX controllers have 2-second subroutine built into their programming that equalizes system pressure every time a compressor is started to prevent compressor stall and thus avoid possible system damage.

To fully understand and to get the most from the many added features available on the SMX controllers, you should first read and thoroughly understand the "Cruisair SMX Microprocessor Air Conditioning Control Owner's Operation Manual" which is provided as part of your vessel's documentation package before you attempt to start or operate this system. Most of the operating parameters for your air conditioning system have been factory preset and should not require changing. However, if it is necessary and/or desirable to change the preset system parameters, this manual takes you through each of the step-by- step processes.

5. The Seawater Cooling System.

NOTE:

The air conditioning cooling water seacock must be set to "OPEN" before any air-conditioning system is switched "ON". Failure to do this or failure to keep the seawater strainer and filter clean will cause a thermal overload and a system shut-down.

The cooling seawater supply system (see Figure - 19) consists of a seacock, a strainer, and a pump. Cooling seawater is drawn up through a through-hull fitting and drawn through a strainer. From the strainer, the seawater goes directly to the pump, then through the air conditioning compressor and back overboard as shown. The seawater pump cycles with the compressor.

NOTE:

When starting the air conditioning system, always visually check that there is a sea-water discharge from the hullside fitting to ensure that the pump is operating properly.

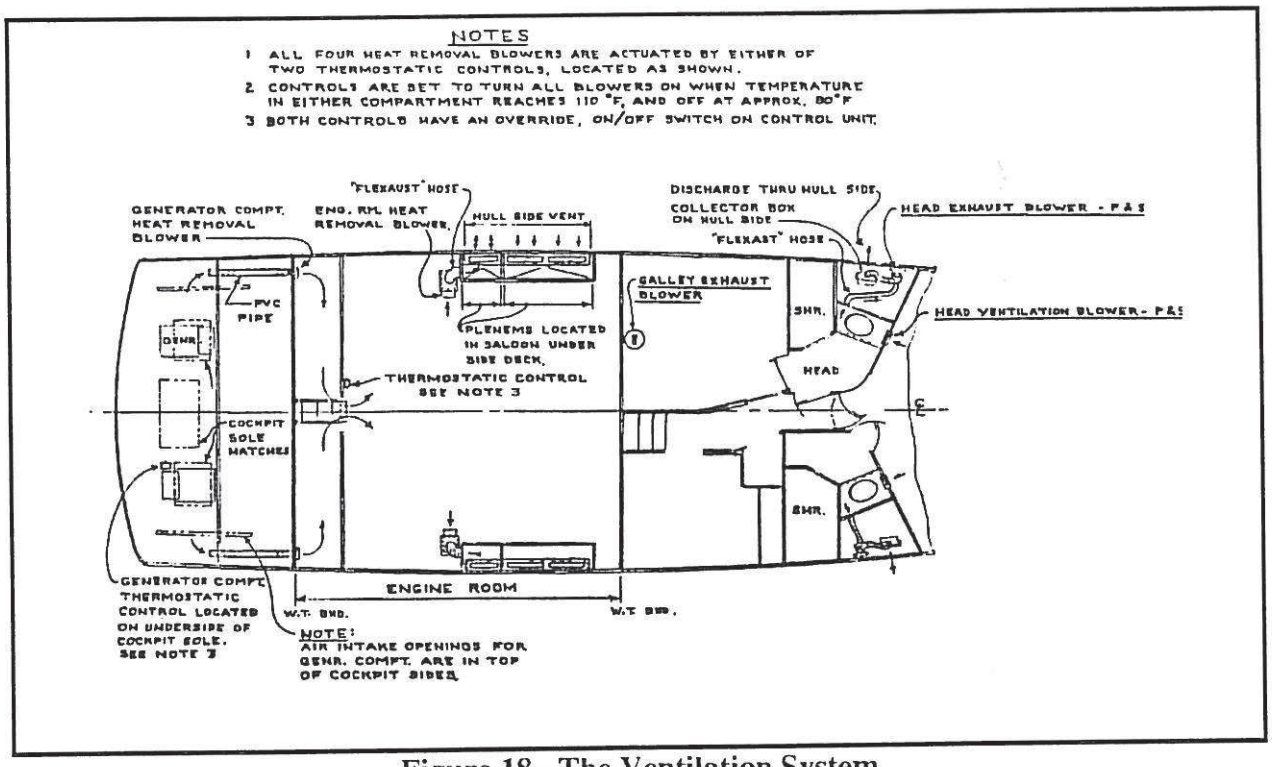


Figure 18 - The Ventilation System

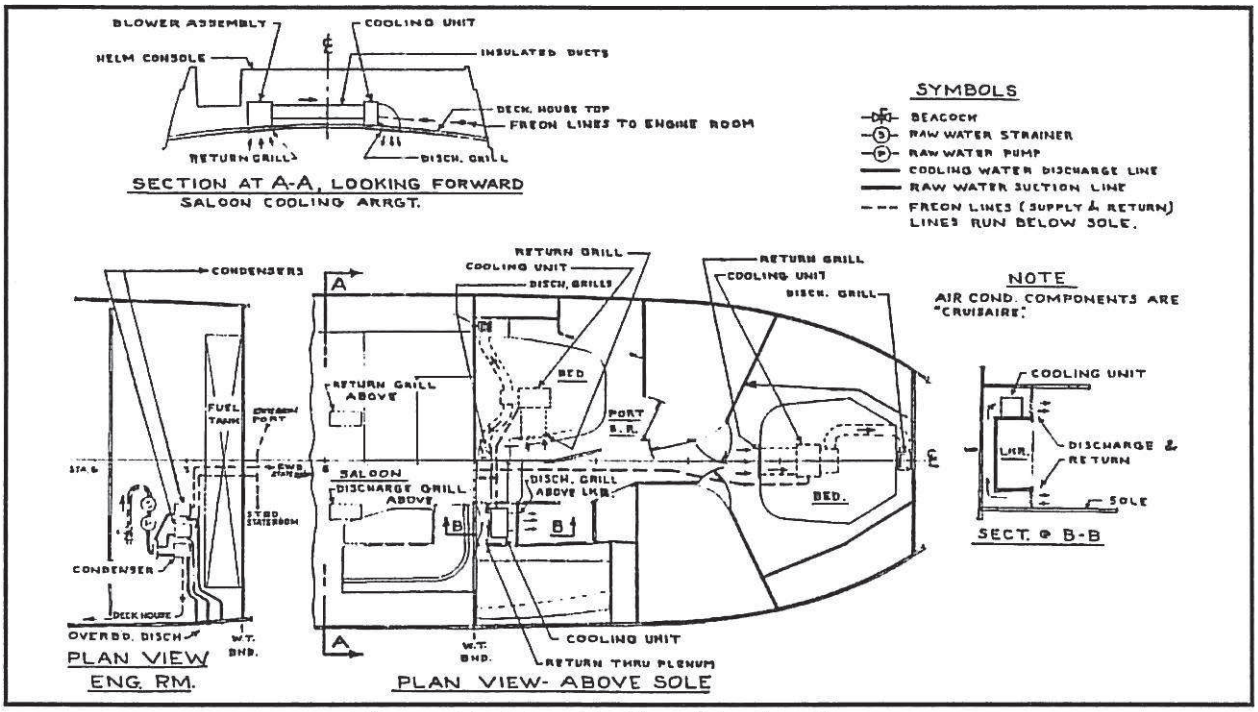


Figure 19 - The Air Conditioning System

SECTION IX - THE TOILET (Head) SYSTEM

A. GENERAL

CAUTION

To avoid damage to your vessel, do not use lye based clog dissolvers on the fresh water, toilet, and/or the bilge pump systems.

CAUTION

Do not flush the toilets when the holding tank is full, as shown by the illuminated red "CAUTION: DO NOT FLUSH TOILET SYSTEM. DAMAGE MAY RESULT" lamp on the "HOLDING TANK MONITOR" panel in each head. Continued flushing could severely damage the toilet system.

TOILET DISCHARGE WARNING

IT IS UNLAWFUL TO DISCHARGE UNTREATED SEWAGE WITHIN THE TERRITORIAL WATERS OF THE UNITED STATES. VIOLATIONS ARE SUBJECT TO A FINE OF $5,000.oo PER INCIDENT.

NOTES:

a) Federal law prohibits the discharge of improperly treated sewage into the territorial waters of the United States.

b) Additionally,some areas may be declared NO-DISCHARGE areas.

c) State and local laws make it important to check with the local authorities about using a treated waste disposal system.

d) Marine toilets on vessels operating within U.S. territorial waters shall discharge directly into a holding tank which is to be emptied by a dockside pump-out facility or at sea beyond the U.S. territorial limits. To satisfy U.S. regulations, all outlet seacocks on vessels operating within U.S. territorial waters must be locked shut with a padlock, a nonreleasable wire- tie, or have the valve handle removed.

e) For vessels operating outside U.S. territorial waters, it is acceptable to have a toilet system where the waste is either discharged into a holding tank and then pumped overboard or where the toilet discharges directly overboard through a discharge seacock.

Each toilet (head) in your Bertram is a complete Marine Sanitation Device (M.S.D.) and complies in all respects with the U.S. Coast Guard regulations and standards. The term M.S.D. means that this is a complete marine disposal system and includes the following hardware as shown in Figure - 20, The Toilet System Schematic:

1. the toilet and its associated plumbing;

2. the flush timers;

3. the pumps;

4. the holding tank equipped with a manual pump;

5. the seawater supply seacocks and discharge seacocks;

6. the deck mounted dockside pump-out fitting;

7. a holding tank "ALMOST FULL" and "DO NOT FLUSH" alarm; and,

8. an optional electric holding tank overboard discharge pump.

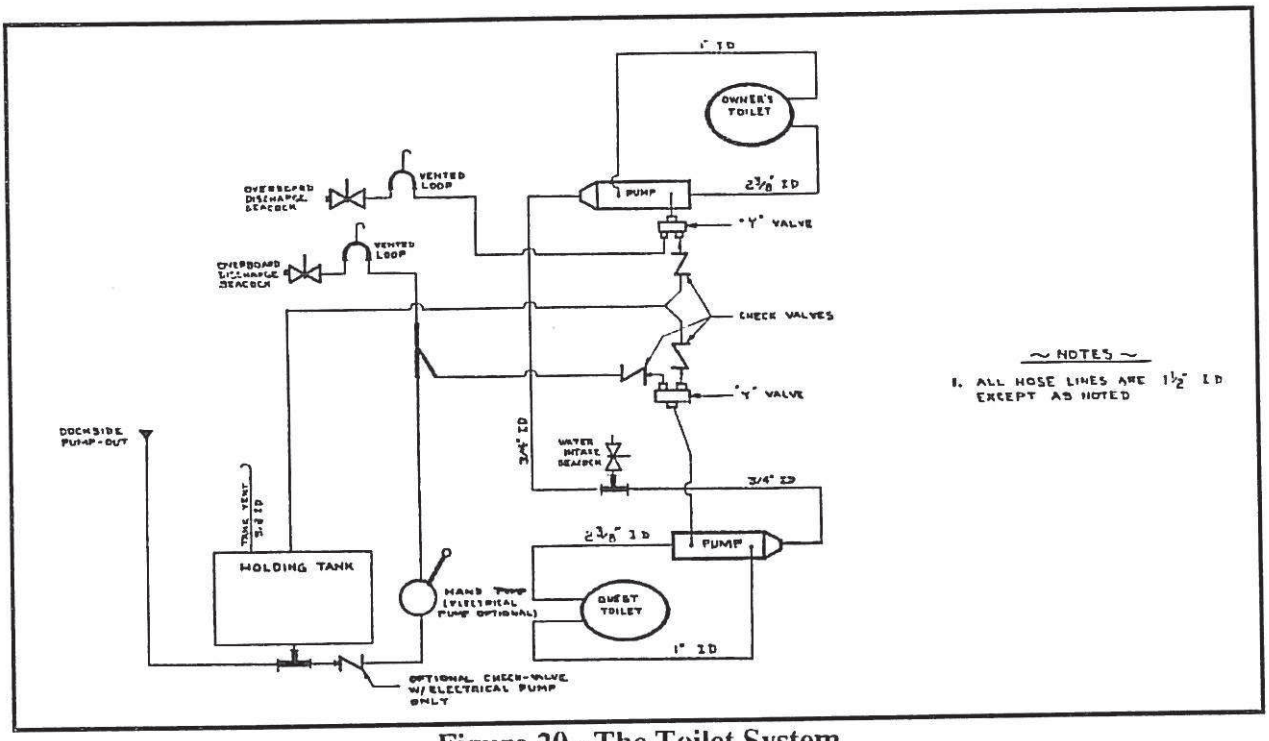


Figure 20 - The Toilet System

In this marine toilet system, a timer in each head controls a dual-operation, electric, toilet-pump. This pump simultaneously pumps up the raw seawater for flushing and removes the waste from the toilet and either pumps it into the holding tank or overboard, as selected by the position of the discharge "**Y**" valve.

B. TOILET SYSTEM OPERATION

CAUTION

Do not flush non-soluble items or materials such as cigarette butts, sanitary napkins, or paper towels. They will clog the system.

CAUTION

To avoid damaging the toilet pump impeller, do not flush a toilet unless there is water in the toilet bowl.

The position of the discharge "**Y**" mode control valve determines if the waste will be pumped into the holding tank or directly overboard. This valve is under the cabin passageway aft access hatch in front of the washer-dryer convenience center between the port and starboard guest staterooms.

1. **Inside U.S. Territorial Waters**. For your marine toilet system to operate in U.S. Territorial waters in compliance with U.S. regulations, the following conditions must be met:

1. The starboard number **3D6** TOILET STBD and/or the port number **3D5** TOILET PORT circuit breakers on the salon 32 Vdc distribution panel (see Figure - 8, The Salon 32 Vdc Dist. Center) must be "**ON**".

2. the seawater inlet seacock supplies seawater to the toilet system manifold, is located below the cabin sole, and is accessible through a hatch in the companionway from the salon to the master's stateroom. This seacock must be "**OPEN**".

3. The discharge seacock must be "**CLOSED**" and its handle secured or removed.

4. The Discharge seacock control "**Y**" valve must be set to direct the flow of waste materials into the holding tank.

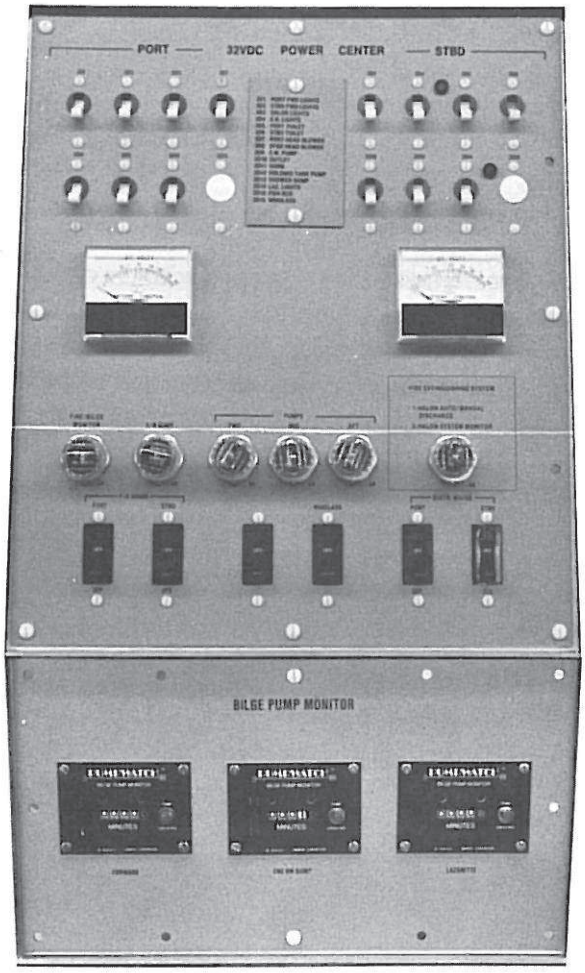


Figure 8 - Salon 32 Vdc Dist. Center

2. **Outside U.S. Territorial Waters**. For your marine toilet system to function without using the holding tank, legal only for operation outside U.S. territorial waters:

1. the "**Y**" valve (discharge seacock control valve) may be set to direct the flow of waste materials directly overboard.

2. The discharge seacock must be "**OPEN**".

C. FLUSHING

Inside each toilet room (head) is a control panel for flushing the toilet. This control panel has one "**ON/OFF**" toggle type switch and one pushbutton type switch. The "**ON/OFF**" switch must be in the "**ON**" position for your marine toilet to operate.

TO FLUSH YOUR MARINE TOILET:

1) Position the "**ON/OFF**" switch in the "**ON**" position;

2) then you simply depress the push-button switch.

The toilet functions automatically. A timer runs the flushing pump for a preset time (between 10 and 15 seconds). Your marine toilet uses a gallon of water for each ten seconds of operation and you can stop flushing at any time by placing the "**ON/OFF**" switch in "**OFF**". However, Bertram recommends this not be done unless the toilet is backing up or something in the toilet bowl is clogging the system and could damage the pump motor.

D. HOLDING TANK PUMP-OUT

Each head has a "**HOLDING TANK MONITOR**" panel near the Flush push-button with an amber and a red indicator light, to warn you when your holding tank is nearly full and when it is completely full. The amber warning light is above the caption "**TANK ALMOST FULL, NOTIFY SKIPPER**". The red warning light is above the caption "**CAUTION: DO NOT FLUSH TOILET SYSTEM. DAMAGE WILL RESULT**".

When the amber warning light illuminates in either head, this indicates that the holding tank is more than 3/4 full and that you will have to make arrangements to empty it.

When the red warning light illuminates in either head this indicates that further flushing could damage your toilet system.

There are three ways to empty your Bertram's holding tank:

1. Use dockside facilities (suction pump) to pump out the tank through the portside deck-plate. Removing the cover of this deck-plate allows direct access to the holding tank.

2. The optional electric overboard pump:

a) On the salon 32 Vdc Distribution Center (see Figure - 8), set the HOLDING TANK PUMP circuit breaker, number **3D12** to "**ON**".

b) Open the discharge seacock by reaching through the hatch in the companionway to the master stateroom. This hatch is nearest the stairs down from the salon.

c) Under the forward cabin sole, forward of the forward fuel tank, and adjacent to the holding tank is the HOLDING TANK DISCHARGE PUMP pushbutton switch. Depress this switch and hold it to activate the HOLDING TANK DISCHARGE PUMP motor.

d) When the holding tank is empty, the sound made by the HOLDING TANK DISCHARGE PUMP running free will change in tone and you should release the switch.

3. If your Bertram is not equipped with the optional electric overboard pump, you can empty the holding tank overboard using the standard manual pump. This pump is reached through the hatch in the companionway to the master stateroom, this is the hatch nearest the stairs down from the salon.

SECTION X - THE 12 VDC SYSTEM

A. GENERAL

The 12 Vdc system as shown on drawing D 9229, sheets 2 and 3 (see the drawing package included with this manual), is powered by two banks of one each 12-Vdc, lead-acid, wet-cell, marine, batteries. The primary use of each 12 Vdc battery bank is to start one ac generator. When you set the selector switch on the main 12 Vdc distribution panel (see Figure - 21, The Companionway "12 VDC Supply" Distribution Panel) you choose either bank to supply power to the fly-bridge 12 Vdc distribution panel (see Figure - 22, The Flybridge "12 VDC F/B" Distribution Panel). The main 12 Vdc distribution panel is on the engine-compartment companionway port bulkhead.

The 12 Vdc battery banks are charged by the ac shore power or the on-board ac generators via the 12 Vdc converter. Additionally, the ac generators have a battery charging circuit to maintain the battery charge when the batteries are used only to start the generators; however, this circuit will not keep up with battery power used by shipboard systems. Except for momentary paralleling both battery banks for starting the ac generators, the battery banks are completely independent of each other and also provide the electrical power for the on-board 12 Vdc systems.

B. THE 12 VDC SYSTEM

1. General. The battery disconnect switches (see Figure - 21) allow you to connect and disconnect the 12 Vdc battery banks from the on-board 12 Vdc circuits and equipment.

2. The Companionway 12 Vdc Main Supply Panel. Both main battery disconnect switches and the flybridge main circuit breaker are on this panel which also has the selector switch that allows you to choose which 12 Vdc battery bank (port or star-

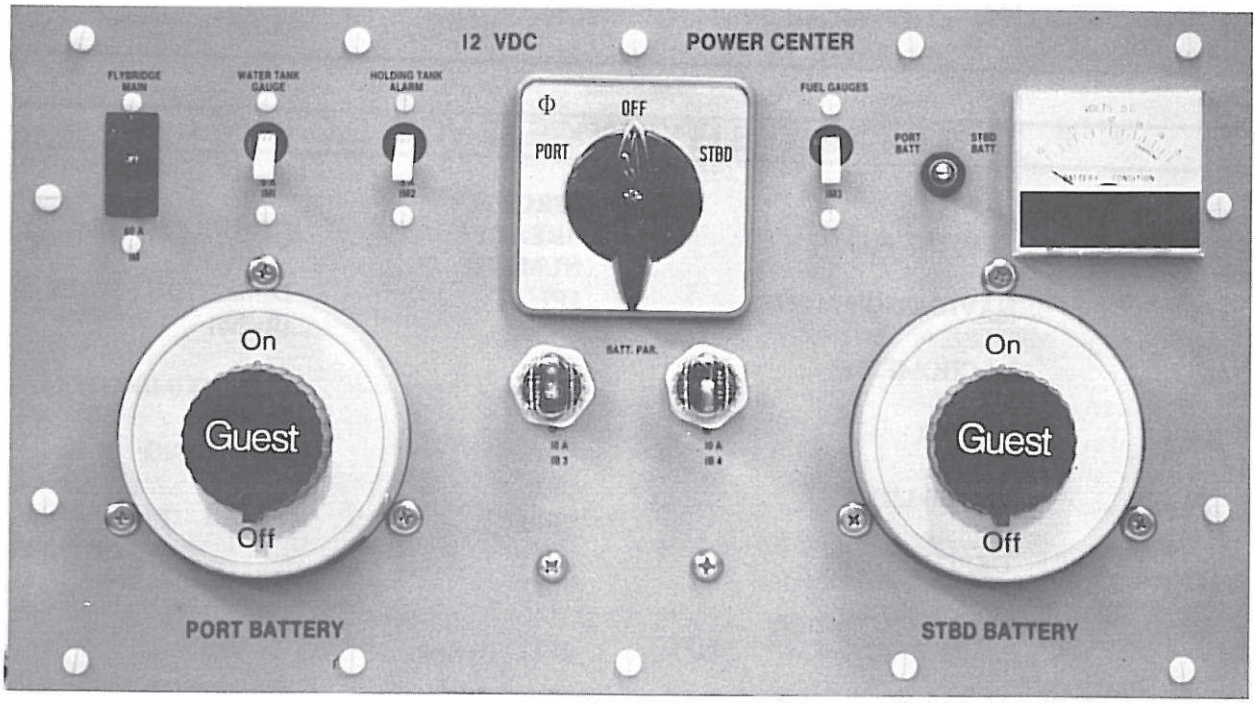


Figure 21 - The Companionway "12 Vdc Supply" Dist. Panel

board) will supply the power to the flybridge. The companionway 12 Vdc panel is also equipped with the circuit breakers for the water tank gauge and the holding tank alarm circuit (see Table II-X-1, The Companionway 12 Vdc Distribution Panel Circuit Breakers) and a dc voltmeter and its selector switch which enables you to read the voltage level on either battery bank with the one meter. The battery paralleling circuits used when starting the ac generators are protected by 10-Ampere fuses mounted on this panel.

3. The Flybridge 12 Vdc Distribution Panel. On this panel are the circuit breakers listed in Table II-X-2, The Flybridge 12 Vdc Distribution Panel Circuit Breakers and a dc voltmeter which reads the voltage level on the battery bank selected to power the flybridge.

C. DC EQUIPMENT PROTECTION

Do not replace existing circuit breakers or fuses with circuit breakers or fuses having a higher trip value than the originals. Such modification could cause equipment and/or circuit failure and/or fires.

A tripped circuit breaker may indicate either that you have a problem in that circuit or in the equipment that is being protected by that circuit breaker. If the same circuit breaker trips repeatedly, the cause of the problem must be found and corrected to avoid possible equipment damage and further complications. As stated in the above caution, under no circumstance should any circuit breaker be replaced with one having a higher trip value than

TABLE II-X-1, THE COMPANIONWAY 12-VOLT D.C. PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
1M1	WATER TANK GAUGE	1M3	FUEL GAUGES
1M2	HOLDING TANK ALARM		

TABLE II-X-2, THE FLYBRIDGE 12-VOLT D.C. PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
1F1	NAVIGATION LIGHTS	1F7	DIRECTION FINDER (Radio)
1F2	TACHOMETER	1F8	FUEL PRIMING PUMP
1F3	HAILER	1F9	VHF RADIO
1F4	FLOOD LIGHTS	1F10	SPARE
1F5	DEPTH FINDER	1F11	SPARE
1F6	DEPTH RECORDER	1F12	SPARE

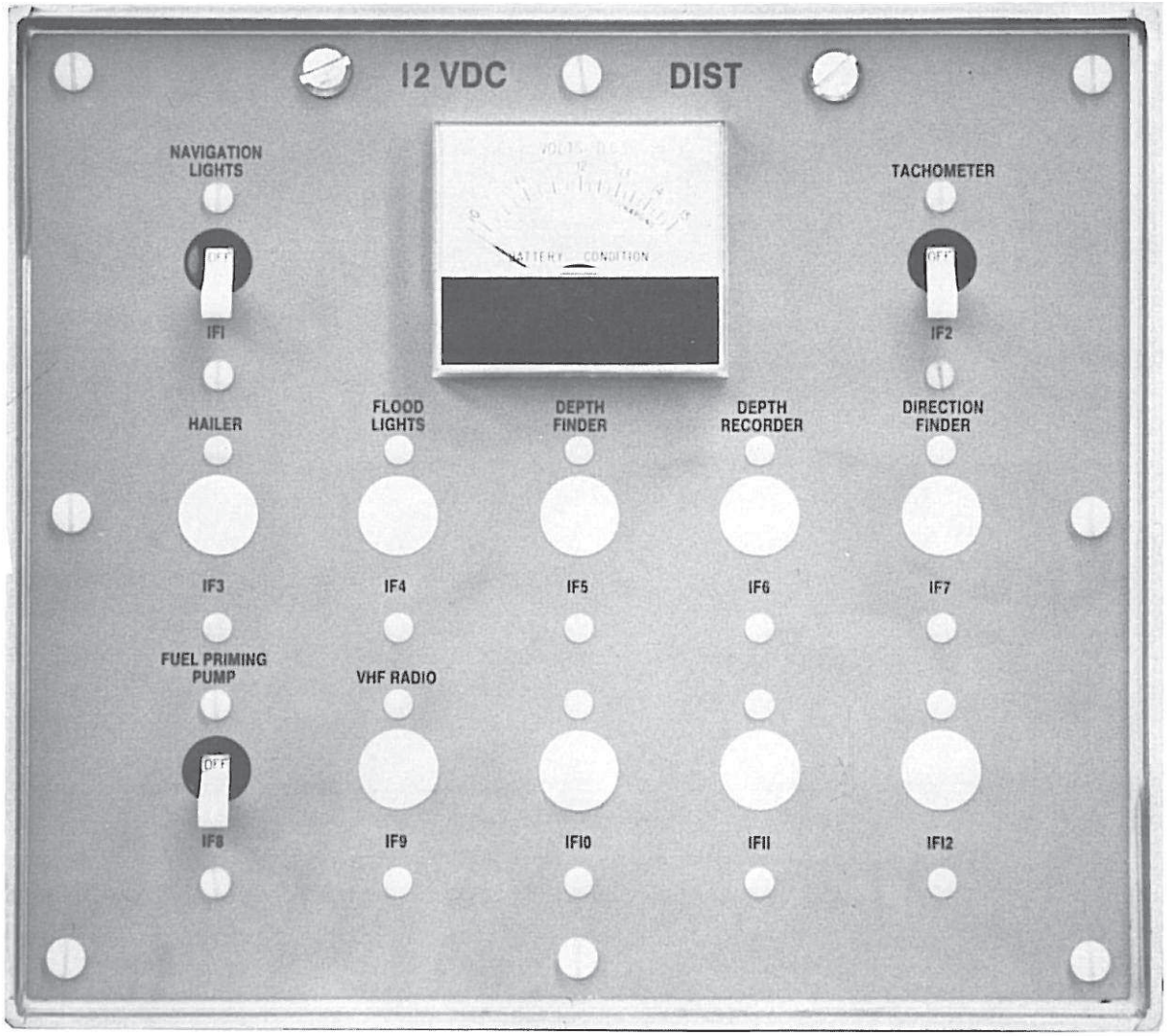


Figure 22 - The Flybridge "12 Vdc F/B" Dist. Panel

those that are all ready in any of your vessel's standard circuits.

D. THE BATTERY DISCONNECT SWITCHES

To activate your vessel's 12 Vdc system, the main battery disconnect switches must be in "**ON**". However, Bertram suggests that these switches should be left in the "**OFF**" position whenever your vessel is unattended for long periods.

The battery disconnect switches do not control the output from the 120/240 Vac to 12 Vdc converter. Provided that the appropriate shore power circuit breaker is "**ON**", the converter will normally keep the batteries charged during those periods when your vessel's ac generators are not operating.

The 12 Vdc battery disconnect switches are rated at 175 Amperes continuous and 800 Amperes momentary. In case of fire, these switches should be set to "**OFF**".

Each item that requires dc power is protected by its own circuit breaker. Provision is made on the dc power distribution panels for protection for additional dc equipment that you may wish to add to your Bertram.

SECTION XI - THE 32 VDC SYSTEM

A. GENERAL

As shown in drawing D 9230, sheets 4 through 11, the 32 Vdc system is your vessel's primary dc system. This system is powered by two (2) banks of four (4) each, 8-Volt, marine, lead-acid, wet-cell, batteries. The following main components make up your 32 Vdc system:

1. the two 32 Vdc battery banks;

2. the main 32 Vdc distribution panel (see Figure - 8, The Salon "32 VDC POWER CENTER" Distribution Panel) located on the salon aft starboard bulkhead;

3. the 32 Vdc battery disconnect panel (see Figure - 8A, The 32 Vdc Battery Main Switch Panel) located on the port side of the companionway from the cockpit to the engine-compartment (commonly known as the "doghouse"); and,

Figure 8A-The 32 Vdc Battery Main Switch Panel

4. a secondary distribution panel on the flybridge (see Figure - 12, The Flybridge "32 VDC F/B" Distribution Panel).

The battery compartment is below decks between the engine- compartment and the aft fuel tanks. When you are under way, the 32 Vdc battery banks are continually charged by the engine alternators. If you are running one or both generators the battery banks are also charged through one of the two 32 Vdc ac- to-dc converters. When you are dockside and if you have 120 Vac or 120/240 Vac shore power available, the batteries are charged by the converters using the shore power.

Except for the momentary paralleling of both battery banks for main engine starting, the two main battery banks are always independent of each other. However, Bertram suggests that you parallel the battery banks each time you start a main engine.

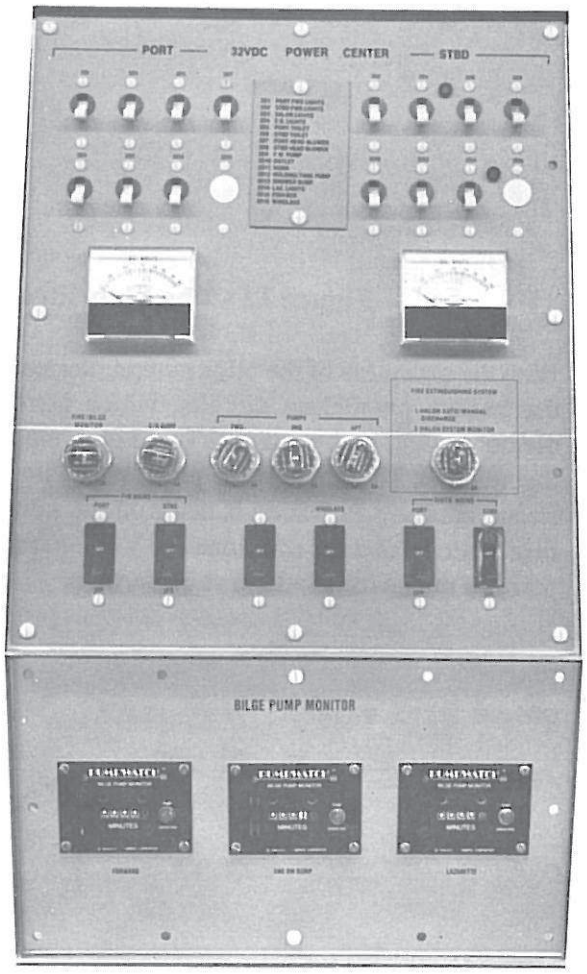


Figure 8 - Salon 32 Vdc Dist. Center

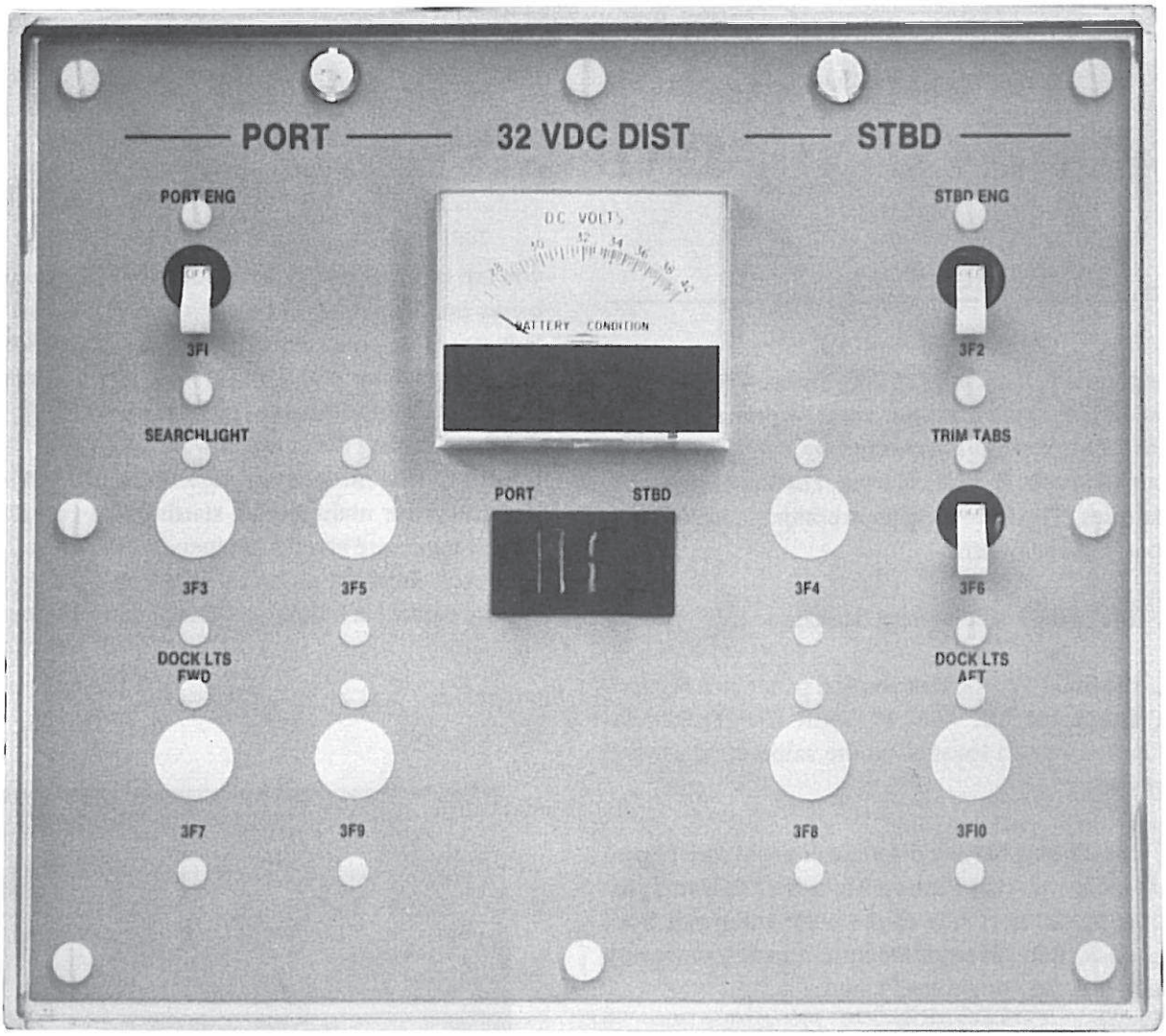


Figure 12 - The Flybridge "32 VDC F/B" Distribution Panel

With the exception of the bilge pumps, alarms, and the battery paralleling circuits, which have individual fuses, each system or piece of equipment that requires 32 Vdc power is protected by its own circuit breaker. Provision is made on the salon dc distribution panel for additional 32 Vdc equipment that you may wish to add to your Bertram.

B. CIRCUIT BREAKERS

CAUTION

Do not replace existing circuit breakers with circuit breakers having a higher trip value. This modification is dangerous and can cause equipment or circuit failures or fires.

A tripped circuit breaker is one indication that you either have a problem in that circuit or a problem in the equipment that is protected by that circuit breaker. If the same circuit breaker trips repeatedly, the cause of the problem must be found and corrected as-soon-as-possible to avoid possible fires or equipment damage.

TABLE II-XI-1, THE SALON 32-VOLT D.C. DISTRIBUTION PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
3D1	PORT FWD LIGHTS	3D12	HOLDING TANK PUMP
3D2	STBD FWD LIGHTS	3D13	SHOWER SUMP
3D3	SALON LIGHTS	3D14	LAZ. LIGHTS
3D4	E.R. LIGHTS	3D15	SPARE
3D5	PORT TOILET	3D16	SPARE
3D6	STBD TOILET	3FP	PORT - F/B MAIN
3D7	PORT HEAD BLOWER	3FS	STBD - F/B MAIN
3D8	STBD HEAD BLOWER	3DP	PORT - DKHS MAIN
3D9	F.W. PUMP	3DS	STBD - DKHS MAIN
3D10	OUTLET	SPARE	
3D11	HORN	SPARE	

TABLE II-XI-2, THE SALON 32-VOLT D.C. PANEL FUSES

FUSE VALUE	CIRCUIT NAME	FUSE VALUE	CIRCUIT NAME
5 AMPS	FWD PUMP	5 AMPS	E/R SUMP (Pump)
5 AMPS	MID PUMP	5 AMPS	FIRE /BILGE MONITOR
5 AMPS	AFT PUMP	5 AMPS	HALON SYS. & ALARM

TABLE II-XI-3, THE FLYBRIDGE 32-VOLT D.C. DISTRIBUTION PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
3F1	PORT MAIN ENGINE	3F6	TRIM TABS
3F2	STBD MAIN ENGINE	3F7	DOCK LTS FWD
3F3	THE SEARCH LIGHT	3F8	SPARE
3F4	SPARE	3F9	SPARE
3F5	SPARE	3F10	DOCK LTS AFT

C. THE BATTERY DISCONNECT SWITCHES

CAUTION

Battery switches are designed for use under normal operating conditions. If this switch opens the dc circuit while the engine is being cranked, the switch should be replaced as-soon-as you can to avoid future failure.

The 32 Vdc battery disconnect switches are extra heavy duty and are rated at 600 Amperes continuous and 1,000 Amperes momentary. To activate your vessel's 32 Vdc systems, which includes starting and operating your main engines, one or both 32 Vdc main battery disconnect switches must be in the "**ON**" position. However, Bertram suggests that whenever your vessel is left unattended, these switches should be left in the "**OFF**" position.

For your safety's sake and that of your vessel, the battery disconnect switches do not control power to the alarm system nor to the bilge pumps. These circuits are fuse protected and are normally continually energized. Nor do the battery disconnect switches cutoff the output of the 32 Vdc converters.

Provided that the 120/240 Vac shoreline is plugged in and has the proper voltage, the converters automatically charge your vessel's 32 Vdc battery banks during periods when she is unattended.

D. FUSES

Main 30A fuses protect the bilge pump and monitor circuits mounted on the main battery disconnect panel. The three bilge pump, the engine-room sump-pump power supply circuits, and the fire extinguisher, the Halon discharge, and the fire and bilge flood alarm circuits are protected by 5-Ampere fuses located on the salon 32 Vdc distribution panel rather than circuit breakers so they cannot be accidently switched "**OFF**".

E. THE BATTERY CONDITION METERS

Each of the two 32 Vdc distribution/control panels has one or two meter(s) that monitor the voltage level in either one or both battery bank(s).

A fully charged battery bank should read about 34.0 Vdc. When either the ac to dc converters or the engine-alternators are running, a reading of 37- to 37.8- Vdc indicates a normal charging rate. If either voltmeter reads below 32 Vdc, you have little chance to start that engine unless you hold the **BATTERY/PARALLEL** switch in its battery paralleling position.

F. THE SALON 32 VDC DISTRIBUTION CENTER

As shown on Figure - 8, this panel is equipped with the following:

1. a voltmeter for each battery bank;

2. the 16 branch circuit breakers (see Table II-XI-1, The Salon 32 Vdc Power Center Circuit Breakers);

3. the fuses for the bilge pumps and alarm circuits (see Table II-X1-2, The Salon 32 Vdc Power Center Distribution Panel Fuses);

4. the port and starboard flybridge main circuit breakers; and,

5. the port and starboard deckhouse main circuit breakers.

NOTE:

Bertram recommends that these main breakers be set in the "OFF" position when your vessel is left unattended.

G. THE FLYBRIDGE 32 VDC DISTRIBUTION PANEL

Mounted behind the hinged cover of the flybridge panel service access door on the flybridge, as shown on Figure - 12, is The Flybridge "32 VDC F/B" Distribution Panel. This panel has spaces for up to 12 branch circuit breakers as listed in Table II-XI-3, The Flybridge 32 Vdc Distribution Panel Circuit Breakers and a Voltmeter with its selector switch.

SECTION XII - THE 120/240 VAC SYSTEM

A. THE 120/240 VAC SYSTEM

As shown in drawing D 9231, sheets 2 through 8, the 120/240 Vac system is powered by either shore power or the onboard ac generators. The main 120/240 Vac distribution panel is in the salon (see Figure - 9, The Salon "120/240 VAC Power Center"), and the galley distribution panel (see Figure - 16, The Galley "120/240 VAC GALLEY" Distribution Panel) is in the engine-compartment.

On the salon 120/240 Vac power center, both "A" and "B" 120/240 Vac distribution panels have a four position plus "**OFF**" rotary selector switch. One position for each of the four possible ac power sources. Two of the switch positions (SHORE 120 and SHORE 240) select the dockside power and the other two positions (GEN PORT and GEN STBD) select the onboard generator(s) and are for use at sea. As shown in Figure - 9, this panel is divided into four sections. Panel "A", Panel "B", the Shore Power Panel, and the Generator Control Panel.

The pilaster 50 Ampere, 120 Vac and 240 Vac port and starboard shore power inlets each have a 50 Ampere main circuit breaker near the power inlet. Since you must select either the starboard or port shore power inlets to be used at any one time, only one (1) 50-Ampere, 50-foot, shore cord for each voltage is provided. However, you can use shore power and run one or both generators to pick up loads.

To satisfy power requirements for 120/240 Vac when under way, your vessel is equipped with two Diesel, 8-kW motor generators (each equipped with a main ac circuit breaker) located below decks, aft of the engine-compartment. The generators can be used one-at-a-time or together as needed.

As shown in Figure - 16, The Galley "120/240 VAC Galley" Distribution Panel, is in two sections, one section for the 120 Vac appliances and the other for the 240 Vac appliances.

CAUTION

The 120/240 Vac distribution panel volt and ammeters monitor the power source in use. If the voltage drops below 110 Vac, any ac motor in use may be damaged.

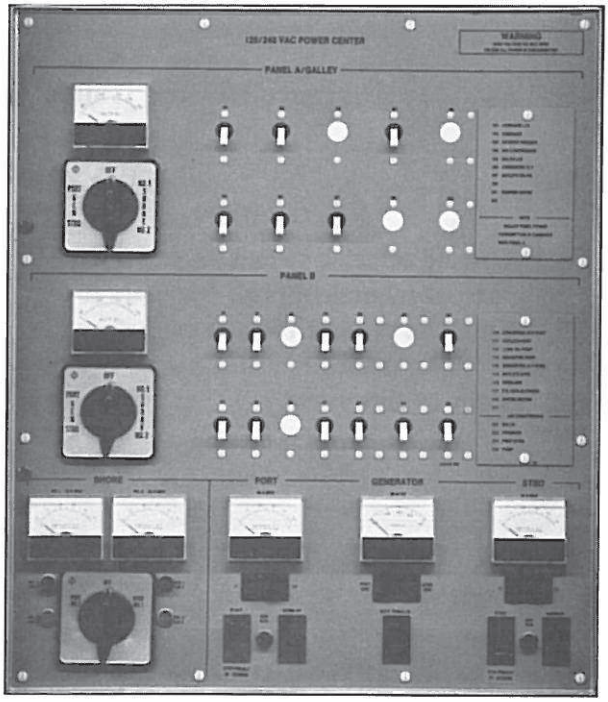


Figure 9 - The Salon "120/240 VAC Power Center"

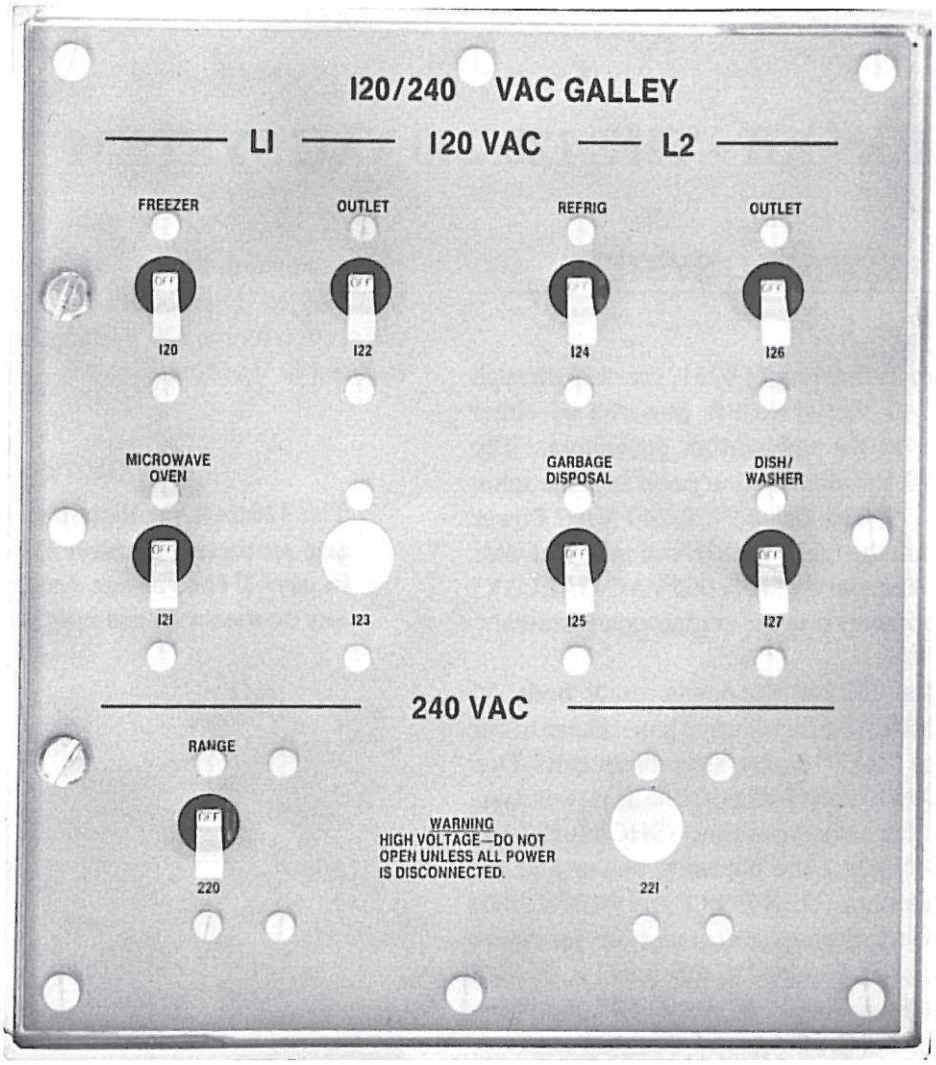


Figure 16 - The Galley "120/240 VAC Galley" Dist. Panel

CAUTION

To avoid selector switch damage, you must set all main circuit breakers to "OFF" to remove the ac load before switching from generator power to shore power or vice versa.

B. THE AC GENERATOR SYSTEMS

CAUTION

To avoid circuit overloading and tripping the circuit breakers, do not exceed a 40 Ampere current draw when using a generator.

The generator system consists of the two Diesel generators, their associated fuel and wet exhaust systems, and the circuit protection and switching circuitry on the main distribution panel.

C. GENERATOR OPERATION

1. The "PORT-GENERATOR-STBD" Power Distribution Panel. The main "120/240 VAC POWER PANEL" (see Figure - 9) has four sections, one controling the generator operation. This section has an ammeter for each generator. Each ammeter has a port/starboard **LOAD** switch allowing you to monitor either leg of the 120/240 Vac generator output. A frequency meter with a port/starboard selector switch is also mounted in this panel. This section has a "**START/STOP-WARM UP**" switch for each generator, a generator run "**GEN RUN**" indicator light, and a battery paralleling switch for the 12 Vdc battery banks.

NOTE:

The ac generator seawater cooling intake systems, the exhaust systems, and the piping systems are shown on Figure - 14, The Engine and Generator Cooling, Intake and Exhaust.

2. Before Starting the Generators

1. Check to be sure that the seawater seacock is open.

2. Check that seawater strainer is clean and is not leaking.

3. Check to be sure that the heat exchanger expansion tank on top of the generator is full of the proper coolant.

4. Check the generators lubrication oil level.

5. Select either the aft or forward fuel tank to draw from.

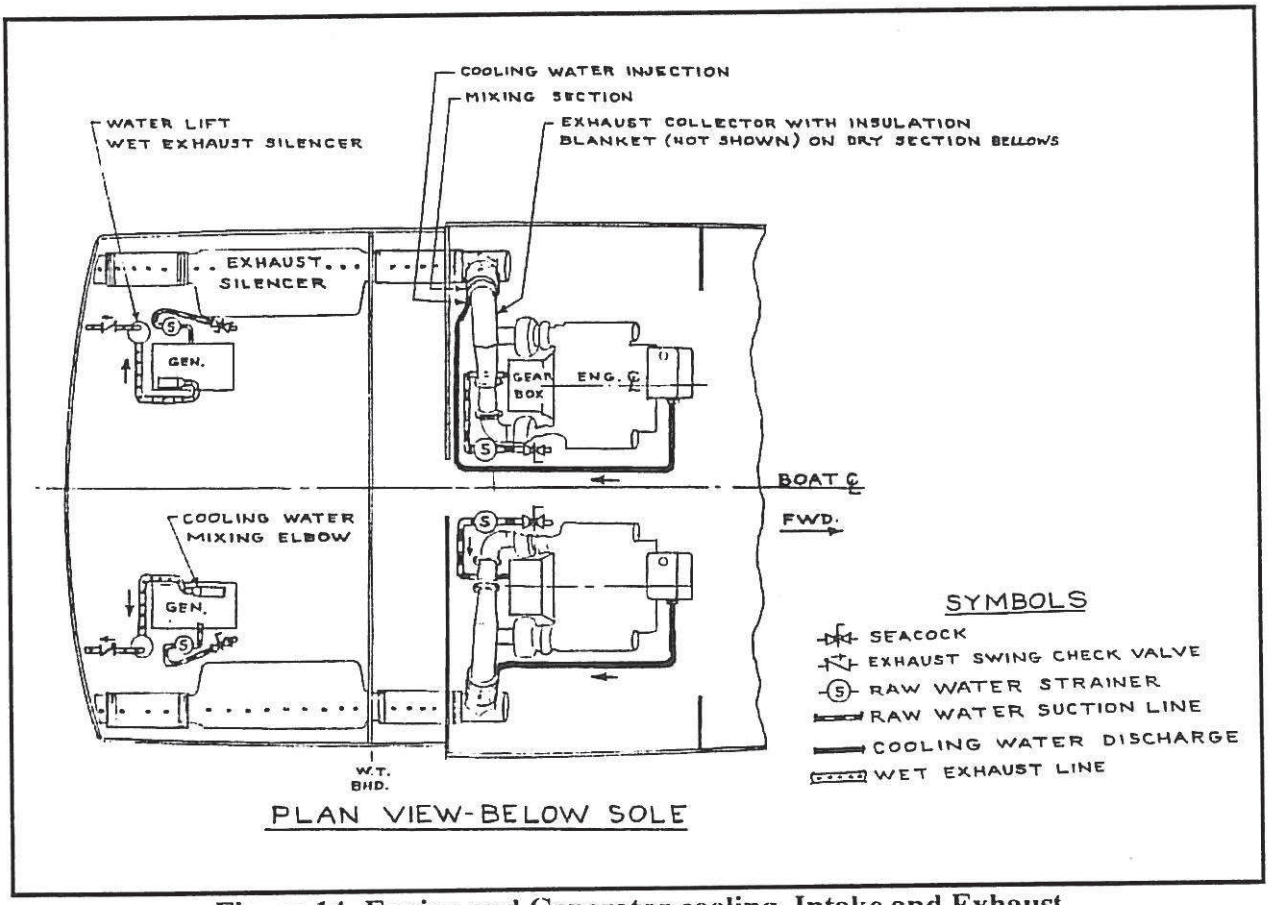


Figure 14- Engine and Generator cooling, Intake and Exhaust

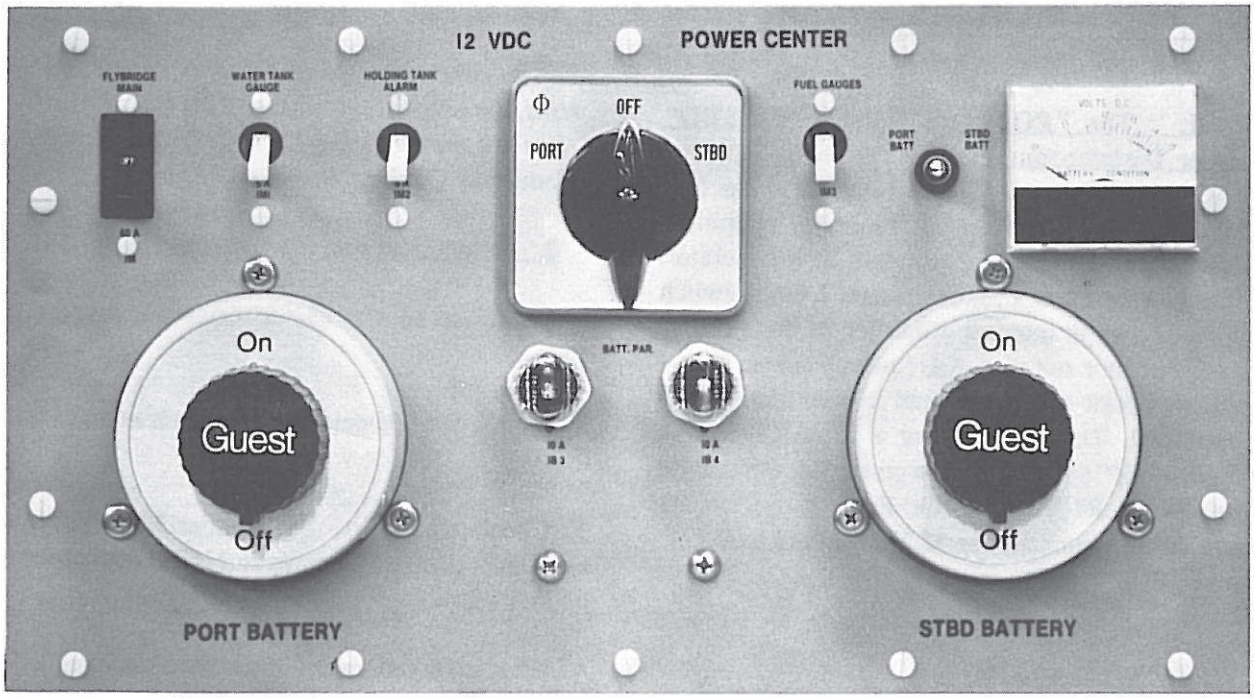


Figure 21 - The Companionway "12 VDC Supply" Dist. Panel

6. On the engine-compartment companionway 12 Vdc distribution panel (see Figure - 21, The Companionway "12 VDC Supply" Distribution Panel), set both the "PORT BATTERY" and the "STBD BATTERY" battery disconnect switches to "**ON**".

7. In the upper right hand corner of this panel, read the battery condition meter, use the battery meter select switch left of the battery condition meter to check both 12 Vdc battery bank voltage levels.

3. Starting the Generator

CAUTION

If generators won't start after several tries, their waterlift mufflers may fill with water. To keep seawater out of the generators' exhaust manifolds, use the drain plugs to empty the mufflers BEFORE moving your vessel.

CAUTION

When starting your generators, do not exceed 30 seconds of warm up or 30 seconds of cranking. Wait 2 or 3 minutes before trying again.

1) In the salon 120/240 VAC POWER PANEL lower right hand corner (see Figure - 9) is the generator control panel. On this panel, depress the "**STOP-WARM UP**" switch for up to 30 seconds, depending on the temperature.

2) Depress the "**START**" switch for 30 seconds or until the generator starts. Do not exceed 30 seconds of continuous cranking.

3) If the 12 Vdc battery banks are weak move the "**BATTERY PARALLEL**" switch into the "**PARALLEL**" position before cranking.

4) The **GEN. RUN** lamp illuminates when a generator is running.

5) Release the "**BATT. PARALLEL**" and the "**START**" switches.

TABLE II-XII-2, THE SALON 120/240-VOLT A.C. "A"PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
101	FORWARD LTS	106	CONVERTER 12 V
102	ICEMAKER	107	OUTLETS ER / FB
103	COCKPIT FREEZER	108	SPARE
104	AIR COMPRESSOR	201	WASHER/DRYER
105	AFT LTS	202	SPARE

TABLE II-XII-1, THE SALON 120/240-VOLT A.C. "B" PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
110	CONVERTER, 32 V, PORT	210	WATER HEATER
111	OUTLETS, PORT	211	SPARE
112	LUBE OIL PUMP	212	SALON (Air Conditioning)
113	SEAWATER PUMP	213	FORWARD(Air Conditioning)
114	CONVERTER, 32 V, STBD		
115	OUTLETS, STBD	214	PORT/STBD (StateRoom Air Conditioning)
116	WINDLASS		
117	E.R./GEN. BLOWERS	215	PUMP (Air Conditioning)

6) Repeat steps 1 through 5 for the other generator if you deside that you want both generators on the line.

7) After starting the generator(s), check to be sure that seawater is flowing from the exhaust outlet on the port and/or starboard corners of your vessel's transom. If there is no flow of water, to avoid damaging the generator(s), immediately shut them down until you solve this problem.

8) To get electric power from one or both generator(s):

a) set the ac power panel 4-position rotary Selector switch to "**GEN PORT**" or "**GEN STBD**", and

TABLE II-XII-3, THE GALLEY "120/240 VAC" PANEL

CIRCUIT BREAKER NUMBER	CIRCUIT NAME	CIRCUIT BREAKER NUMBER	CIRCUIT NAME
120	FREEZER	126	OUTLET
121	MICROWAVE OVEN	127	DISHWASHER/CMPCTR
122	OUTLET	220	STOVE
123	SPARE	221	SPARE
124	REFRIGERATOR		
125	DISPOSER		

b) set the circuit breakers for the desired appliances and equipment to "**ON**" (see Tables II-XII-1 and II-XII-2, The Salon 120/240 Vac Distribution Panel "A" and Panel "B" Circuit Breakers and Table II-XII-3, The Galley 120/240 Vac Distribution Panel Circuit Breakers).

4. Stopping the Generator(s)

NOTE:

The generators and the engine-and generator-compartment blowers automatically shut down if any Halon gas bottle discharges.

1. Remove the ac Load at the 120/240 VAC POWER PANEL and set the 4-position rotary selector switch on the VAC POWER PANEL to "OFF".

2. Manual Stop. Momentarily depress the "**START-STOP**" switch in the "**STOP**" position.

3. Repeat step 2 for the other generator.

4. Automatic Shut-Down. Your generators each have an automatic shut-down system that stops that Diesel engine before any of the following faults cause damage to your generators.

a. Low Oil Pressure

b. High Exhaust Temperature

c. High Water Temperature

D. THE 120/240 VAC SHORE POWER

WARNING

TO MINIMIZE SHOCK HAZARD:

1. PLUG CORD INTO BOAT FIRST.

2. UNPLUG SHORE-POWER END FIRST.

3. CLOSE SHORE POWER INLET COVER TIGHTLY. DO NOT ALTER SHORE POWER CABLE CONNECTIONS.

WARNING

DO NOT CUT OR DISCONNECT THE GREEN GROUNDING CONDUCTOR IN THE SHORE CORD AT THE DOCK OUTLET OR THE BOAT INLET. THIS CONDUCTOR IS NEEDED TO PROVIDE THE SAME GROUND POTENTIAL BETWEEN SHORE GROUND AND YOUR BOAT'S GROUND AND MINIMIZES THE SHOCK HAZARD TO PERSONS ON THE BOAT OR IN THE WATER.

TABLE II-XII-4, 15 KVA ISOLATION TRANSFORMER TAP CONNECTIONS

CONNECTION	VOLTS	AMPS	TAPS CONNECTED		CONNECT
60 HERTZ HIGH VOLTAGE INPUT BETWEEN H1 - H4	240	62.5	H2 TO 4	H3 TO 5	H2 TO H3
	216	69.4	H2 TO 3	H3 TO 6	H2 TO H3
	208	72.1	H2 TO 2	H3 TO 6	H2 TO H3
	198	75.8	H2 TO 2	H3 TO 7	H2 TO H3
50 HERTZ HIGH VOLTAGE INPUT BETWEEN H1 - H4	220	68.2	H2 TO 4	H3 TO 5	H2 TO H3
	198	75.8	H2 TO 3	H3 TO 6	H2 TO H3

CONNECTION	VOLTS	CONNECT	LEADS TO
LOW VOLTAGE (OUTPUT) * AS INSTALLED	120/240 *	X2 TO X3	X1 TO X3 TO X4

CAUTION

Before connecting or disconnecting the shore cords, ensure that all of the main circuit breakers are "OFF" or that the power selector switches are "OFF". This will help to prevent connector arcing and fitting damage.

CAUTION

The shore cords have a twist-to-lock fitting on each end. Ensure these are properly locked in place before switching the shore power circuit breakers to "ON". This will help to prevent connector arcing and fitting damage.

CAUTION

Each shore inlet is rated at 50 Amperes. To protect your inlet fittings from damage and prevent the inlet circuit breaker from tripping, do not exceed 50 Amperes current draw.

1. **The Shore Power Inlets**. Your Bertram has two 120 Vac (circuit number 1) and two (2) 240 Vac (circuit number 2) power inlets, one for each voltage, in a covered shore connection box in each pilaster. Both inlets feed isolation transformers with a 120/240 Vac output. Connecting either shore cord provides your vessel's 120 Vac and 240 Vac power. Each inlet and its associated circuit breaker is rated 50 Amperes. One 50-foot, 50 Ampere rated shore cord for each voltage is supplied since only one 120 Vac and one 240 Vac inlet can be used at any one time.

2. **Polarization (Isolation) Transformer Operation**. The isolation transformers provide the following advantages:

1. 120 and 240 Vac power to the distribution panels from either the 120 Vac or 240 Vac shore power.

2. Faulty electrical connections on the 240 Vac service between the dock and the isolation transformer will not cause damaging voltage changes on the line.

3. eliminate the need for the polarity lights.

4. Single pole circuit breakers can be used on the 120 Vac circuits.

5. Voltage taps for low shore voltage conditions.

NOTES:

a) See Subsection G for 15kW unit voltage tap adjustments.

b) A transformer secondary circuit breaker is located next to each transformer. This circuit breaker is part of the shore power system.

3. **The Shore Power Panel**. The "SHORE" power distribution panel section of the "120/240 VAC POWER PANEL" has two (2) sets of two each red indicator lamps. One indicator lamp in each set illuminates to show when the 120 Vac shore power is connected to your vessel and the other lamp illuminates to indicate when the 240 Vac is connected. One set of lamps is for the port side shore connections and the other set for the starboard. This panel has one ammeter for the 120 Vac input and one for the 240 Vac input.

4. **The rotary selector switch**. The "**PORT-OFF-STARBOARD**" rotary selector switch on the "SHORE" power panel allows you to shift the electrical load to the side of your vessel that is connected to the shore as indicated by the illuminated lights.

A four-position selector switch is located on both "PANEL A" and "PANEL B" of the "120/240 VAC POWER PANEL" and each allows you to select either port or starboard ship-board generator power or the 120 Vac (Nr. 1) or the 240 Vac (Nr. 2) shore power to supply your vessel's ac power requirements.

E. THE AC CIRCUIT PROTECTION

CAUTION

Do not replace existing circuit breakers with breakers with higher trip values. This change can cause circuit failures and/or fires.

A tripped circuit breaker may indicate a problem in that circuit or in equipment protected by that circuit breaker. If the same circuit breaker keeps tripping, the cause must be found and corrected to avoid possible equipment damage. As stated in the above caution, never replace any circuit breaker with one having a higher trip value than those that are already in any of your vessel's existing circuits. Your Bertram's ac circuit breakers are the one-pole common trip type for 120 Vac circuits and two- pole common trip type for 240 Vac circuits.

NOTES:

a) Bertram recommends that any future ac equipment be installed in the same manner using the proper sized circuit breakers and wire.

*b) If your vessel has the optional 120 Vac power windlass, keep its circuit breaker (breaker number 116), "**OFF**" except when the windlass is actually being used. Other branch circuit breakers may be on or off depending on your needs.*

F. THE GROUND FAULT CIRCUIT INTERRUPTERS

1. **General**. Circuit breakers and fuses on this vessel protect you and onboard equipment and circuits against over loads and short circuits. However, circuit breakers and fuses may not protect people from electric shock.. Ground fault, is a leaking of current to ground, often through the body of a person who is the electrical path to ground. It is the most common type of current responsible for electric shock accidents.

Your Bertram is equipped with Ground Fault Circuit Interrupters (GFCIs), in the galley, and in the port and starboard toilets (heads), on the flybridge, and in the engine-compartment which because of their likelihood of wet decks are the most likely places for this type of accident.

Except for a red **RESET** push-button and a black **TEST** pushbutton located between the two receptacles, GFCI receptacles look similar to the common, every-day, double 120 Vac receptacles.

2. **GFCI Outlet Operation**. For all practical purposes, each GFCI outlet is a standard double 120 Vac outlet except that if the GFCI outlet senses 6 or more milliamperes of ground fault current, this outlet will act as a circuit breaker and open this circuit. At that time, the "**RESET**" push-button will extend out of the receptacle plate. To reset a tripped GFCI outlet, depress the red "**RESET**" push-button until it locks in place. If the push button will not reset, there is a problem that requires attention.

3. **Testing**. To test a GFCI outlet, depress the black "**TEST**" push-button switch. The red "**RESET**" push-button switch should pop out. If so, depress the "**RESET**" push-button until it is once more locked in place. If, the "**RESET**" push-button does not pop out when the GFCI is tested, before using it, have that GFCI outlet checked and possibly replaced by a competent marine electrician.

NOTE:
Test circuit requires 120 VAC to operate.

G. EUROPEAN SHORE POWER

The onboard 15 kW, shore-power, multitap, polarization-transformer will provide you with 120 and 240 Vac power outputs if you have the 240V Shore Inlet connected to shore power. Changing the taps on the 15 kW transformer adjusts the output voltage to 120/240 Vac even if the input is as low as 198 Vac. Tap selection (as shown on the transformer) should be done by a qualified marine electrician. Tap connections are listed in Table II-XII-4, Isolation Transformer Tap Connections. The a. c. frequency (50 or 60 Hz.) depends on the shore power frequency.

The 7.5 kW isolation transformer cannot be adjusted for low input voltage conditions.

NOTE:

The onboard generator frequency remain unchanged. Their output is 120/240 Vac at 60 Hz. The standard ac equipment also remains unchanged as it was selected to be able to work on either 50 or 60 Hz. Motor driven equipment will be only slightly less efficient on 50 Hz. The Wiring Diagrams shows how these transformers are included in your vessel's electrical system.

H. AUTOMATIC CONVERTERS

Three onboard ac to dc converters change a 120/240-Volts ac input into a 32 Vdc or 12 Vdc output to charge the appropriate battery banks. When the batteries are fully charged, the converter(s) maintain a "trickle charge" condition. Bertram recommends that the converters normally be left in the "**ON**" position with either shore power or the generator supplying the power.

I. THE GALLEY 120/240 VAC DISTRIBUTION PANEL

As shown in Figure - 16, the 120/240 Vac galley power control center is a secondary distribution panel with no meters. This panel is in the engine-compartment mounted on the port side intake air plenum and has two sections. The top section is for the 120 Vac appliances and has eight circuit breakers and the bottom section is for 240 Vac appliances with two circuit breakers. These circuit breakers are listed on TableII-XII-3, The Galley 120/240 Vac Distribution Panel Circuit Breakers.

J. GALVANIC CORROSION OF UNDERWATER FITTINGS

1. Bonding. As a part of the electrical system, your Bertram is equipped with a bonding system designed to minimize stray current corrosion. The main grounding strap runs fore and aft through the bilge area. This main grounding strap is connected by jumpers to the underwater fittings and hardware as well as the engine block. All onboard ac equipment is also connected by a grounding conductor to this system.

2. Electrolysis. If your vessel is going to remain idle for extended periods of time, Bertram suggests that you use a zinc "fish". For details of this preventative maintenance procedure, see Part III, Maintenance.

3. Galvanic Isolator. The galvanic isolator on your Bertram is a solid state device designed to stop the accelerated underwater corrosion that can occur when the vessel is dockside and connected to shore power. This is a passive unit that requires no maintenance and it acts as an electrical filter to prevent the flow of dc galvanic corrosion currents through the power system (green "safety") grounding conductor without sacrificing the safety features of the ac grounding system.

To minimize the shock hazard when your vessel is connected to shore power, the shore power green grounding conductor is electrically connected to the

vessel grounding system. This, in effect electrically connects your vessel's underwater metal fittings (bonding system) to the shore ac grounding system and to other vessels which are connected to the shore grounding system. This condition can cause difficulties, in that your expendable zinc anode system may be overloaded to the point where it cannot furnish sufficient protection against this type of corrosion. To stop the overload, the galvanic path must be cut without cutting the green grounding conductor in your shoreline. To do this, a galvanic isolator is wired in series with the (green) shoreline grounding conductor and the ac panel or power selector switches.

The isolator has a buzzer alarm which is activated by ac current flow in the shoreline grounding conductor either from your vessel as an ac stray current through the bonding system or from the shore power source. This buzzer will not be activated by the onboard ac generators.

A grounding conductor is not normally a current carrying conductor; however, there are abnormal conditions when an ac current may flow in this conductor. Two of the possible conditions are:

1) A breakdown of the insulation between a current carrying conductor and the grounding conductor.

2) Incorrect or inadequate wiring on shore or on your vessel.

THE ABNORMAL CONDITION MUST BE CORRECTED. DO NOT DEFEAT THE BUZZER OPERATION. AC CURRENT FLOW IN THE GROUNDING CONDUCTORS MAY HAVE A VOLTAGE POTENTIAL SUFFICIENT TO CAUSE SERIOUS INJURY OR DEATH BY ELECTRIC SHOCK.

SECTION XIII - ACCESSORIES

A. GENERAL

Your Bertram is equipped with several accessory systems, not previously described, that are designed to increase your boating pleasure.

Systems descriptions and system operational details are discussed in their respective subsections.

B. THE ENTERTAINMENT CENTER OPERATION

NOTE:

The U.S. Coast Guard is warning boaters that their Loran receiver accuracy can be adversely affected by stray electronic impulses from their onboard television sets. The offending signals are harmonics of the horizontal sweep frequency and may be present any time the television set is operating.

1. General. For your entertainment, your Bertram is equipped with a multi-media, electronic, entertainment system. This system includes: (1) two television monitors; (2) a video cassette tape deck; (3) two am/fm tuner/amplifiers; and, (4) a compact disc player. All of these video entertainment components are interconnected to give you the maximum flexibility for the maximum enjoyment. As shown on drawing D 9231, sheet 7, all of the audio components are also inter-connected with five pairs of built-in stereo speakers located throughout your vessel.

2. Components. You have two (2) antenna sources, a built in 22-inch diameter, omni-directional, type antenna located within the flybridge structure, and the port and starboard cable "CATV" inputs. A three position selector switch (A, B, and C) mounted in a box in the salon allows you to select the input you want.

Position "A" is for the port side CATV connection;

position "B" is for the omni-directional antenna; and,

position "C" is for the starboard side CATV connection.

The selector box connects to a tv/fm Band Separator which separates the tv frequency signals from the fm signals which are sent to a signal splitter. One leg of this splitter is connected to an am/fm stereo receiver tuner/amplifier located in the master state-room. The other fm signal is sent to another am/fm stereo receiver tuner/amplifier in the salon. The master stateroom tuner/amplifier is equipped with its own set of stereo speakers.

The salon am/fm tuner/amplifier has its own set of stereo speakers in the salon; the salon tuner/amplifier has another set of stereo speakers, with an independent volume control, in the port guest stateroom; it has a third set of stereo speakers, with their own independent volume control, on the flybridge; and a forth set, also with their independent volume control is in the cockpit. The fifth set of stereo speakers is in the master stateroom. The compact disc player which is located in the salon can play through either am/fm receiver.

A color television monitor is located in the salon. This tv is connected to a VHS video tape recorder/player also in the salon. The color television monitor in the master stateroom is also connected to the video tape recorder/player.

3. Operation. This inter-connected entertainment system will give you and your guests the maximum operational flexibility. With two television monitors and a video tape player/ recorder on board, you and your guests can enjoy one tv program in the salon, another in the master stateroom, and record yet another. Similiarly, the two am/fm receiver/tuners allow different areas of your Bertram to listen to two different programs or some

areas or your entire vessel could listen to music from the compact disc player. Those in the master stateroom could be viewing tv while those in the salon could be watching a video tape and at the same time those in the cockpit and on the flybridge could be listening to a compact disc or an am or fm station.

NOTE:

The am/fm tuner/amplifier in the salon must be switched "ON" in order for you to use the compact disc player.

C. TELEPHONES

Your Bertram has two standard telephone jacks. One in the salon and the other in the master stateroom. The telephone inlets are on the port and starboard pilasters with the electrical and CATV connections.

D. THE LUBRICATION OIL TRANSFER SYSTEM OPERATION

⚠ CAUTION

Do not run the engines or the ac generators while changing oil. Damage will result.

1. General. The lubricating (lube.) oil transfer system (see Figure - 23, The Lube. Oil Transfer System), lets you remove, change, or add lubricating oil to the engines or transmissions and remove the used lubricating oil from the ac generators by the simply connecting and disconnecting two hoses equipped with quick-disconnect fittings and setting the appropriate valves. The lubricating oil pump is powered from the Salon 120/240 Vac Distribution Panel. Circuit breaker number **112** controls electrical power to the pump and must be set to "**ON**" to use the system.

2. Lube. Oil Transfer System Components. To operate this system, first locate each of the following system's components on Figure - 23 and then locate them in your vessel:

1) the lubricating oil pump with a 120 Vac motor and switch and a pipe nipple extending from each side;

2) the pump portside nipple (INTAKE) has a "**T**" fitting;

3) the quarter-turn ball valve on each leg of the "**T**" fitting;

4) the pump-out hose adapter (with a quick-disconnect fitting at the other end), extending down after the valve.

5) a connection to the tank supply hose from the lubricating oil tank extending straight out after the valve;

6) the nipple connected to the flow meter on the starboard (DISCHARGE) side of the pump;

7) an adapter to the fill-hose (with a quick-disconnect fitting at the other end) extends down from the flow meter;

8) a quarter-turn valve extends past the flow meter;

9) an elbow out and down from this valve connecting to the cockpit waste-oil, discharge-hose;

10) the discharge hose free end has a quarter-turn valve and is stowed under the engine-compartment companionway steps;

11) the generator suction hose from a quick-disconnect fitting on the web frame (short bulwark) near the pump to a "**T**" connection near the starboard ac generator aft end;

12) the two (2) hoses from the "**T**" to the port and starboard ac generators;

13) the two (2) engine and two (2) transmission quick-disconnect fittings;

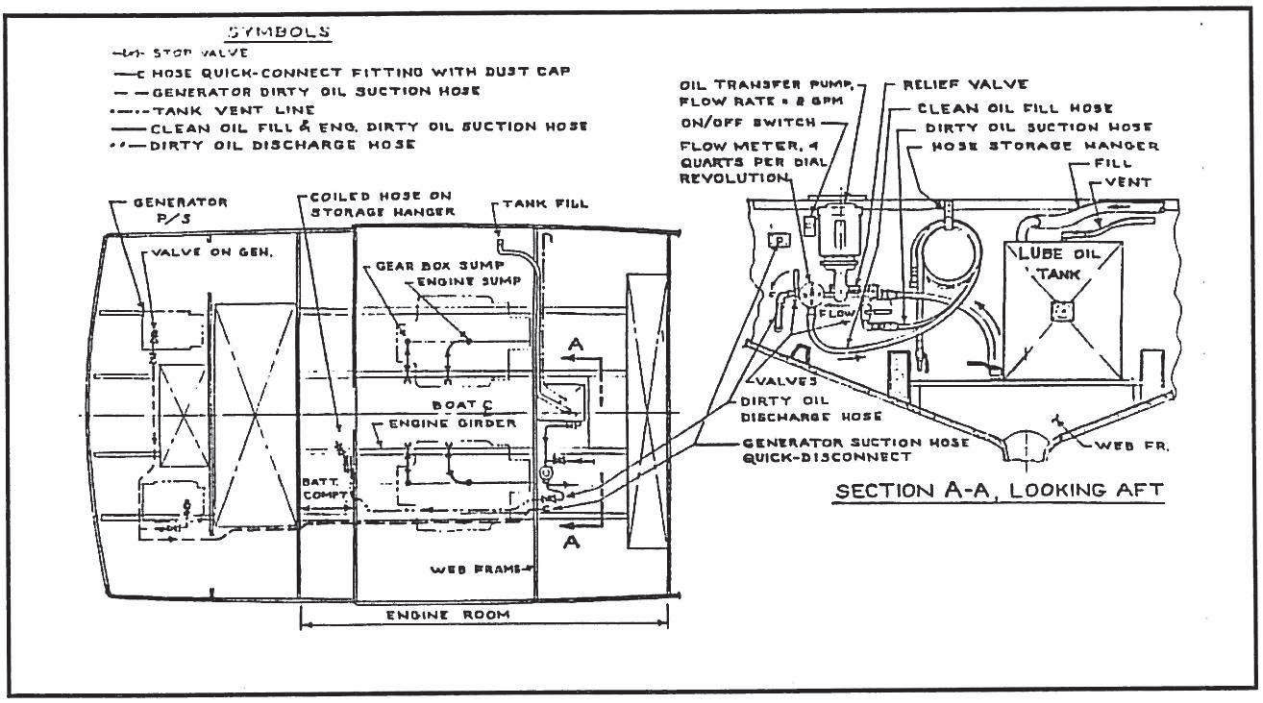


Figure 23 - The Lube Oil Transfer System

14) the two (2) engine sump and two (2) transmission sump lubricating oil level dip sticks;

15) the two (2) transfer hoses connecting the pump to any one of the four engine/transmission quick-disconnect fittings.

Ensure that all input hoses, all screw, and all quick- disconnect fittings be kept clean to avoid getting dirt and other contaminants into the lubricating oil.

3. The Engine/Transmission Pump Out Procedure. To pump the used lubricating oil out of the engines and/or the transmissions:

1) Unship the suction-oil, transfer-hose free end;

2) remove the quick-disconnect fittings dust caps from the suction-oil, transfer-hose and from the sump to be drained;

3) connect the suction-oil, transfer hose to the sump quick-disconnect fitting;

4) unship the dirty-oil, discharge-hose from its storage hanger on the bulkhead forward of the aft fuel tank;

5) arrange for the dirty-oil, discharge-hose free end to empty into a suitable dockside disposal tank or into containers suitable for proper disposal of used lubricating oil;

6) on the pump:

a) close the line valve from the oil tank to the pump (valve handle at right angles to the line);

b) open the line valve from the suction-oil, transfer-hose to the pump (valve handle parallel with the line);

c) open the valve to the dirty-oil, discharge-hose; and,

d) open the valve at the free end of the discharge hose.

7) switch the pump "**ON**";

8) when the selected sump is empty, switch the pump "**OFF**";

9) disconnect the suction-oil, transfer-hose from the sump;

10) repeat steps 2 and 3, and 7 through 9 for each sump;

11) wipe off the suction-oil, transfer-hose quick-disconnect connection and replace the dust cover;

12) restow the suction oil transfer hose in its hanger; and,

13) replace the dust cap on the sump fitting.

4. The Generator Pump Out Procedure.

CAUTION

To avoid generator damage, you MUST CLOSE oil sump, ball drain valves once used oil is out.

NOTE:

This system replaces or adds oil to the engines and transmissions and pumps used oil from the generators. Do not use it to put fresh oil in the generators for the following reasons:

1) The Diesel engines and the marine transmissions have different lubricating oil requirements than do the generators and
2) the length of the hose leading to the generators means that a quart or more of oil would always be in this hose.

Bertram recommends that this system be used only to remove used oil from the ac generators. Ensure that the sump ball valves are CLOSED before refilling the generators by hand and that you do not try to drain both ac generator oil sumps at once.

To pump the used lubricating oil out of the generators:

1) Unship the suction-oil, transfer-hose free end;

2) remove the suction-oil, transfer-hose quick disconnect fitting dust cap;

3) remove the generator oil-line, quick-disconnect fitting dustcap, (fitting is on the web frame, starboard of the pump);

4) push the quick-disconnect fittings together to fasten the hose to the generator oil line;

5) unship the dirty-oil, discharge-hose from its storage hanger on the bulkhead forward of the aft fuel tank;

6) arrange for the dirty-oil, discharge-hose, free-end to empty into a suitable dockside disposal tank or into containers suitable for proper disposal of used lubricating oil;

7) OPEN the sump ball valve on the generator to be drained;

8) on the pump:

a) close the oil storage tank to pump line-valve (valve handle at right angles to the line);

b) open the suction-oil, transfer-hose to pump line-valve (valve handle parallel with the line);

c) open the dirty-oil, discharge-hose line-valve;

d) open the dirty-oil, discharge-hose, free-end line-valve;

9) switch "**ON**" the pump;

10) when the generator sump is empty, switch "**OFF**" the pump;

11) CLOSE the sump ball valve on the empty generator;

12) OPEN the sump ball valve on the other generator;

13) repeat steps 8 through 10;

14) disconnect the suction transfer hose from the generator line;

15) wipe off the suction-oil, transfer-hose quick-disconnect fitting;

16) replace the dust cover;

17) close the suction-oil, transfer-hose, free-end line valve;

18) restow the suction-oil, transfer-hose in its hanger;

19) wipe off the dirty oil discharge hose nozzle;

20) replace the dust cap on the sump fitting; and,

21) restow the dirty oil discharge hose.

5. Filling or Refilling the Engines and Transmissions.

NOTES:

a) You should change engine lubrication oil filters with each engine oil change. This requires about one (1) additional gallon of oil per engine.
b) After running the engine, wait at least 1 hour for the oil to drain back into the engine sump and recheck the dip stick level;
c) After filling the transmission sump, start and idle the engine with gears in neutral. Then check the dip stick level. Continue to fill as required.

1) Unship the discharge oil transfer hose free end;

2) remove the quick-disconnect fittings dust caps from the discharge oil transfer hose and the sump to be filled;

3) connect the hose to the sump quick-disconnect fittings;

4) on the pump:

a) open the oil tank to the pump line valve (valve handle parallel to the line);

b) close the suction-oil, transfer-hose, to the pump line valve (valve handle at right angles to the line);

c) close the dirty-oil, discharge-hose, line-valve;

d) set meter to 0 (turn counter-clockwise)

5) switch the pump "**ON**" (its meter measures 4-quarts per revolution);

6) switch the pump "**OFF**" before the meter indicates you have reached the sump capacity;
7) check the oil level with the dip stick;

8) continue to fill as required;

9) switch "**OFF**" the pump;

10) disconnect the discharge-oil, transfer-hose from the sump;

11) replace the dust cap on the sump fitting;

12) repeat steps 2 and 3, and 5 through 11 for each of the three remaining sumps;

13) wipe off the discharge-oil, transfer-hose, quick-disconnect connection and replace the dust cover; and,

14) restow the discharge oil transfer hose in its hanger.

6. The Transfer Pump By-Pass Adjustment. This pump has a built-in by-pass control that is adjusted by the Bertram factory or the dealer. Under normal conditions no further adjustment is required. However, if a pump fails to deliver oil properly, which is usually caused by extreme cold weather, some adjustment may be required. The adjustment procedure is in Part III, Section IV.

E. THE SEAWATER WASHDOWN SYSTEM

CAUTION

1. Description.

SEAWATER FAUCET(S) should be clearly labeled to prevent the accidental use of seawater for drinking or cooking.

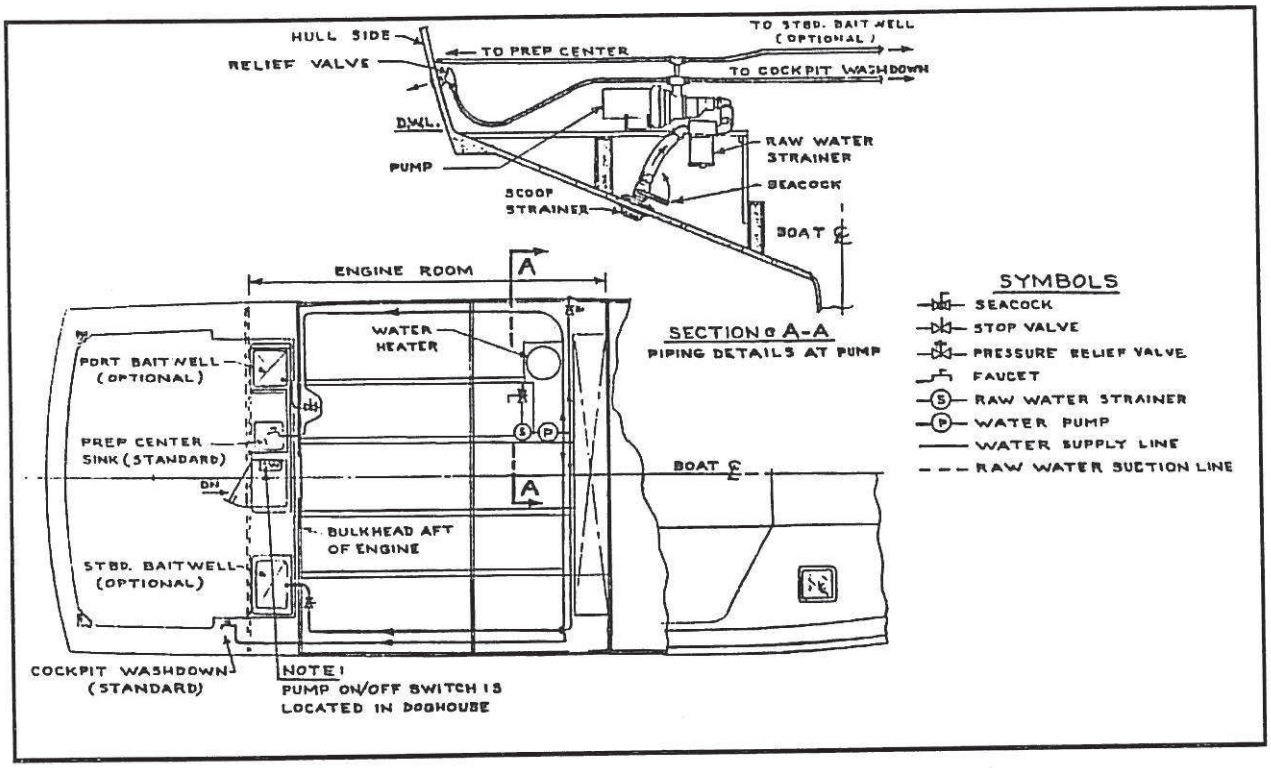


Figure 24 - The Seawater Supply and Washdown System

NOTE:

This system should ALWAYS be switched "OFF" when your vessel is left unattended.

The basic seawater washdown system is a standard convenience feature built into this vessel and designed to accomodate a fisherman's needs. Your seawater washdown system will make the cleaning of fish, the fish boxes, the bait wells, and the cockpit area while at sea both easier and neater as well as aerating the optional live baitwell(s) and/or washing off the anchor.

As shown on Figure - 24, The Seawater Supply and Washdown System, this system consists of:

1) a through hull fitting equipped with an intake strainer;

2) a seacock;

3) a strainer;

4) a seawater pump;

5) a circuit breaker (number **113** on the salon 120/240 Vac distribution panel) with an associated indicator lamp; and,

6) at least two seawater faucets, one in the cockpit and one in the preparation center.

In addition to the seawater washdown basic system there is one other optional arrangement available which is the seawater plumbing to a live baitwell in the cockpit preparation center.

2. The Seawater Washdown System Operation. The seawater washdown pump is powered by 120 Vac. This system is activated by switching "**ON**" the SEAWATER PUMP circuit breaker which is number 113 on the 120/240 Vac distribution panel in the salon.

Bertram recommends that the seawater pump be switched "**OFF**" except when in use. However, a relief valve and an overboard discharge through-hull fitting are provided to relieve the pressure on the system when the faucets are closed.

3. Baitwell (Optional) Operation. If your vessel has the optional baitwell, fresh seawater can be circulated through this device. The seawater washdown system supplies the fresh seawater. Once the washdown system pump is operating, all that is necessary is for you to open the valve to the baitwell. Since this baitwell may be on either the port or starboard sides of your vessel's cockpit, the location of the valve differs. If your baitwell is on the starboard side, the valve is above and behind the washdown pump (looking forward). If your baitwell is on the port side the valve is near the top of the battery compartment.

The seawater is circulated between two perforated pipes in the baitwell. To drain this device, it is necessary to unscrew the discharge pipe and remove it until the seawater has drained over the side. Then replace the discharge pipe and tighten hand tight.

F. WINDLASS (Optional)

1. General. If you have ordered the optional pulpit, a windlass either with or without the wildcat feature becomes yet another possible option. A windlass is intended only to lift up your anchor, it is not built or intended to be a mooring bitt and only in an emergency should it be used to drag a grounded vessel into deep water.

2. Operation.

WARNING

EXERCISE EXTREME CAUTION WHEN WORKING WITH A WINDLASS ESPECIALLY ONE EQUIPPED WITH A WILDCAT. THIS DEVICE HAS THE CAPABILITY OF INFLICTING SEVERE INJURY.

CAUTION

To avoid possible accidential operation, the windlass circuit breaker should always be in "OFF" except when the windlass is in use.

NOTES

a) This windlass should rotate only clockwise as viewed from the top. Do not operate in a counter-clockwise direction. The windlass will not function properly and damage will occur.

b) If your windlass has a wildcat, the chain links fit to the wildcat is critical. The chain should not jam, skip, or jump.

The capstan head is keyed directly to the windlass motor shaft and will revolve whenever the windlass motor is activated.

To raise an anchor line:

1) Set the windlass circuit breaker to "ON";

2) if you have chain at the end of your anchor line, set the chain latch;

3) wrap three (3) to four (4) turns of the anchor line around the capstan in a CLOCKWISE direction;

4) keep a small amount of pressure on the line; and,

5) step on the foot switch to activate the windlass.

If the line slips, take another turn and/or apply more pressure to the tailing line. The wildcat (which is an option on the windlass) is used to pull anchor chain, is driven by a friction system, and is not keyed to the main shaft.

G. AIR COMPRESSOR

1. General.

WARNING

THIS COMPRESSOR/PUMP IS NOT EQUIPPED FOR NOR MEANT TO SUPPLY BREATHING QUALITY AIR. TO USE THIS COMPRESSOR AS AN AIR SUPPLY COULD RESULT IN SERIOUS LUNG INJURY OR EVEN DEATH.

Your Bertram has an air compressor whose primary function is to provide compressed air for your dual air horns. This compressor is in the engine-compartment aft of the forward fuel tank and to the port of the lubrication oil tank. The compressor runs on 120 Vac and is controlled by circuit breaker **104** on salon 120/240 Vac distribution panel "**B**" (see Table II-XII-2).

WARNING

DO NOT TAMPER WITH THE COMPRESSOR SAFETY VALVE OR THE AUTOMATIC REGULATOR SWITCH MECHANISM. TAMPERING WITH EITHER DEVICE COULD RESULT IN SEVERE INJURY AND/OR EQUIPMENT DAMAGE.

On top of the compressor is a control box with two air pressure gauges, a regulator knob, an ASME safety valve, an "**OFF/AUTO**" switch, and a standard compressed air fitting. One pressure gauge shows tank pressure, the other shows air line pressure (in psig).

2. Operation. Normally the circuit breaker for this compressor is in the "**ON**" position any time that the engines are operating (when maneuvering signals might be needed). Keep in mind, however, that it is necessary to have an ac power source to supply the 120 Vac power to the compressor motor.

When the operating switch on the control box is in the "**AUTO**" position, the compressor motor is automatically switched "**ON**" when the pressure in the tank drops below 80 psig and is switched "**OFF**" when the tank pressure reaches 100 psig.

H. OVERHEAD ROD LOCKER

CAUTION

Do not mount equipment on top of door. Additional weight may cause inadvertant opening of door.

Do not mount rods and/or any other equipment on the top of the overhead rod locker door. Neither the hinges nor the latches are designed to take additional weight. If this door is loaded with gear and the latches fail, the door will swing down unexpectedly and could cause injury.

I. BUILT-IN VACUUM SYSTEM

1. General.

CAUTION

To avoid electric shock, do not use on wet surfaces or pick up water or damp materials.

CAUTION

To prevent fires, do not pick up hot ashes, cigarette butts, or flammable powders, nor operate near flammable gases or liquids.

CAUTION

To avoid possible injury, do not change the bag when the hose is connected.

To make it easier for you to keep your Bertram "shipshape", she is equipped with a built-in vacuum system located in the salon. This system's accessories will let you to reach all of the staterooms and heads as well as the salon and galley areas. However, this system is not designed NOR intended to be used in the bilges or in the engine- and generator-compartments.

2. Operation. This system is powered by 120 Vac and is automatically switched "**ON**" when you plug in the hose. The system is also automatically switched "**OFF**" when you remove the hose from the hose receptacle. The system accessories (hose, extension wands, and vacuum heads) are connected or disconnected by a slight twisting motion. This system uses easily replacable dust bags that are available from Bertram (Bertram part number 181433) or from the manufacturer in packages of five as part number 54062 BAG, DISPOSABLE. The secondary filter (WAL-VAC part number 54230 FILTER, SECONDARY) should be washed with a mild detergent as required and should be replaced when worn or torn.

This system is made by:

WAL-VAC INC.,

318 MART St. S.W.

Grand Rapids, Michigan 49508

SECTION I - PERIODIC MAINTENANCE

A. GENERAL

The maintenance required by your Bertram during a boating season and throughout the year, will depend to a great extent on the conditions under which your vessel is used and/or stored. For instance, adequate ventilation of the cabin during periods of non-use will reduce the interior maintenance from the standpoint of minimizing mildew and odors and keeping the exterior waxed will minimize the need for exterior maintenance.

Above and beyond the pleasure we all get from using well designed, well built, and properly maintained equipment, there are additional or over riding considerations such as our health. One health problem that everyone wants to avoid is carbon monoxide poisoning. To prevent the leaking and escape of exhaust gases, a periodic and thorough inspection should be made of the entire engine and a.c. generator exhaust gas systems with special emphasis on checking for faulty hoses and/or loose hose connections.

In this section, a suggested basic minimum preventative maintenance program is given for a vessel under "average use" conditions. This program should be used in conjunction with the detailed periodic maintenance programs given in each of the manufacturer's operating manuals for major on-board components such as your engines, a.c. generators, and other on board systems.

B. ON-BOARD MAINTENANCE SUPPLIES

To perform the preventative maintenance items listed in this section and for the minor maintenance tasks that arise from time to time, Bertram suggests that you have an on-board tool kit. This tool kit should include as a minimum the following items:

1) a selection of wire and paint brushes;

2) a selection of files;

3) a set of open end wrenches;

4) a set of socket wrenches with 1/4 and 1/2 inch drives;

5) emery and crocus cloth and steel and bronze wool;

6) spray cans of metal primer and engine touch up paint;

7) a small (5 inch by 7 inch) inspection mirror;

8) assorted hand tools including: straight and Phillips screw drivers, hammers, gas pipe and long-nosed pliers, "Vise Grip" and "Channel Lock" pliers in small, medium, and large sizes, electrical crimp-on connector tool, hand held Volt-Ohm-meter, 1/4- inch or 3/8-inch electric drill and assorted bits.

C. DAILY BEFORE PUTTING TO SEA

__ 1) Check the fuel and fresh water tank levels.

__ 2) Pump the bilges dry by moving each BILGE PUMP switch on the flybridge control console instrument panel from its normal AUTO position to the MAN position. (While pumping the bilges, check bilge pump and sump pump switch operation). Return the BILGE PUMP switches to AUTO.

__ 3) Use the MANUAL OVERRIDE switch on the blowers to ventilate the engine- and the a.c. generator compartments. (While you are ventilating, check the blower operation).

__ 4) Check the engine and generator lubricating oil levels.

__ 5) Check the lube oil tank level (if installed).

__ 6) Check the engine and the generator coolant levels.

__ 7) Check the transmission oil levels.

__ 8) Drain water from the fuel oil/waterseparator.

__ 9) Check the air filter/turbocharger silencer indicators; if necessary, replace the filter elements.

__ 10) Check the fuel,water, and lubricating oil systems on the engines and the generators for leaks.

__ 11) Check that all engine and generator belts are in good condition and have the proper tension.

__ 12) Check that all cooling seawater seacocks are open.

__ 13) Visually check all seawater strainers for dirt accumulation. Clean as necessary.

__ 14) Check the fluid level in all batteries; add water as necessary.

__ 15) Once each engine is started, check that a water stream is coming from its engine exhaust transom outlet.

__ 16) With the a.c. generators running, check the generator cooling seawater flow by observing generator exhausts. Water should be exhausting at both transom outlets.

__ 17) Check the 8Volt and 12Volt battery water level (see Part III, Section IV Battery Care).

__ 18) Check for a slow drip at the shaft stuffing boxes.

__ 19) Check for the proper operation of the navigation and anchor lights.

__20) Check the steering system reservoir sight glass for the proper hydraulic steering fluid level (the reservoir is mounted midships on the transom).

__ 21) Check the pressure gauge on top of the steering system reservoir for proper pressure level (in psi).

D. DAILY AFTER DOCKING

__ 1) Top off (refill) the fuel and water tanks.

__ 2) Wash down the boat with fresh water.

E. EVERY 25 HOURS OR TWICE PER SEASON

A regular fuel filter canister inspection every 25 hours of operation or at least twice per season is mandatory to remove all sediment and water which may have collected. Close inspection of this canister at this time for possible deterioration due to corrosion or other reasons is necessary and canister replacement is required if such signs are evident. A complete inspection of the entire engine fuel system for possible leaks or damage should be done.

__ 1) Check the hatch dogs on the forward and cockpit hatches for proper operation and the hatches for "snug" fit.

__ 2) Check the fuel filters/water separators for accumulated dirt and/or water, clean/empty as necessary (see the label text in the above caution on each fuel filter):

__ 3) Check that the engine mounting bolts and the propeller shaft coupling bolts are tight.

__ 4) (Detroit Diesel engine-equipped vessels only) With the engines off, check the operation of the emergency shutdown system cables and flappers by pulling the "T" handles on flybridge control station. Reset the flappers after checking to be sure they have closed properly.

__ 5) Check the engine and a.c. generator compartments and completely inspect the engines and the a.c. generators on the inboard and outboard sides including the engine mounts, etc, for rust and corrosion. Rust must be wire brushed down to bare metal, primed, allowed to dry, and painted. While looking for rust, check for leaking hoses and/or gaskets, loose wires, loss of electrical ground, and the oxidation of leads and connectors.

F. EVERY 100 HOURS OR 60 DAYS

The following 100 hour/60 day checklist lists items that should be checked during the routine inspection and maintenance associated with each area indicated.

1. Vessel Exterior

__ 1) Exterior fiberglass finish - clean and wax.

__ 2) Clean hardware and apply protective polish.

__ 3) Tighten loose fittings.

__ 4) Clean exterior seat cushions with a mild soap solution or a light Clorox solution. Rinse off with fresh water.

2. Vessel Interior

__ 1) Completely air out the boat.

__ 2) Clean, dry. and air out all the life jackets.

__ 3) Use your nose and eyes to check your boat. If any mildew is found:

- __ a) Thoroughly washdown any mildewed painted or other hard surfaces with a Clorox solution.
- __ b) Wash mildewed vinyl surfaces with commercial cleaners such as "409", "Fantastic", or the equivalent.
- __ c) Clean "Novasuede" surfaces per Table III-I-1.

CAUTION

Do NOT use a Clorox solution or any solvents on vinyl headliner and wallcoverings. Clean vinyl with a mild soap and warm water. Clean "Novasuede" per Table III-I-1.

__ 4) Operate all of the drawers and doors. Slight adjustments may be necessary on the doors and/or drawers due to expansion from moisture. Drawers can be made to slide easier by using a wax or solid lubricant.

__ 5) Check that all hand held fire extinguishers are:

- __ a) secure in their mountings;
- __ b) free from rust and/or corrosion;
- __ c) have a full charge.

__ 6) Check for proper operation of the bilge alarm float switch.

3. Forward Stateroom

__ 1) Check for the proper operation of each light.

__ 2) Check that there is electrical power to the 120 Vac duplex outlets.

__ 3) Check the bow hatch for smooth operation, secure locking, and for a water-tight fit.

__ 4) Check the air conditioner for cooling and heating.

__ 5) Check the entertainment modules, the t.v., and the telephone for proper operation.

4. Companionway to the Forward Staterooms

__ 1) Check the forward-compartment bilge pump and its associated bilge pump float switch for proper operation. Each switch has a white cover with a red TEST button at one end. When the TEST pushbutton is depressed:

Table III-I-1, Cleaning "Novasuede"

Stain	Cleaner
Coffee, wine, milk, soft drinks, ink, and chocolate	Mild household detergent in warm water
Grease and lipstick	Upholstery solvent

__a) the bilge water level switch float is raised;

__b) the bilge pump operates;

__c) the instrument panel "BILGE PUMP" operating lamp illuminates.

__ 2) Manually raise the bilge flood alarm float to test the alarm light and bell.

5. Port Guest Stateroom

__ 1) Check for the proper operation of each light.

__ 2) Check that there is electrical power to the 120 Vac duplex outlet.

__ 3) Check the air conditioner for cooling and heating.

__ 4) Check the stereo volume control for proper operation.

6. Starboard Guest Stateroom

__ 1) Check for the proper operation of each light.

__ 2) Check that there is electrical power on both sides of the 120 Vac duplex outlet.

__ 3) Check the air conditioner blower control for proper operation.

7. Port Head

__ 1) Check for the proper operation of the lights.

__ 2) Check for electrical power to the 120 Vac GFCI duplex outlet.

__ 3) Check both lavatory water faucets for proper operation.

__ 4) Check the lavatory sink drain for plugging and leaks.

__ 5) Check the proper operation of the toilet.

__ 6) Check both shower water faucets for proper operation.

__ 7) Check the shower sump pump for proper operation and clean the pump filter.

__ 8) Check the head exhaust blower for proper operation.

__ 9) Check head circulating fan.

8. Starboard Head

__ 1) Check for the proper operation of the lights.

__ 2) Check for electrical power to the 120 Vac GFCI duplex outlet.

__ 3) Check both lavatory water faucets for proper operation.

__ 4) Check the lavatory sink drain for plugging and leaks.

__ 5) Check the proper operation of the toilet.

__ 6) Check both shower water faucets for proper operation.

__ 7) Check the head exhaust blower for proper operation.

__ 8) Check head circulating fan.

9. Galley

__ 1) Check the proper operation of the lights.

__ 2) Check for electrical power in both sockets of the 120 Vac GFCI duplex outlet.

__ 3) Check both water faucets for proper operation.

__ 4) Check the galley sink drain for plugging and leaks.

__ 5) Clean and check the stove burners for proper operation.

__ 6) Clean and check the microwave oven for proper operation.

__ 7) Check the refrigerator for proper operation and clean.

__ 8) Check the freezer for proper operation and clean it with a solution of baking soda in water.

__ 9) Check the exhaust fan for proper operation.

__ 10) Check the disposal for proper operation.

__ 11a) Check the dish washer for proper operation (run a load of dishes) and clean with commercial detergent in water.

__ 11b) Check the trash compactor for proper operation and clean with commercial detergent in water.

10. Laundry Center

First, turn OFF the main ac circuit breakers.

__ 1) Check the power conections.

__ 2) Use a flashlight and mirror to examine the water connections to the washer for leaks, tighten if required.

11. Engine Compartment

__ 1) Carefully follow the Diesel engine and marine transmission manufacturer's periodic preventative maintenance program as specified in the appropriate manufacturer's manuals supplied as a part of your vessel documentation.

__ 2) Check the stuffing boxes. A slight drip is desirable as the seawater lubricates the packing. However, if the stuffing box is leaking excessively, follow the procedure discussed in Part III, Section - IV, Maintenance Procedures.

__ 3) Check the engine exhaust hoses and hose clamps.

__ 4) Manually raise the bilge flood alarm float to test the alarm light and bell.

__ 5) Check the seawater strainers which should be free of all foreign matter. If the strainers need cleaning:

__ a) Close the appropriate seacock;

__ b) loosen the wing nuts atop the strainer body;

__ c) swing the top to one side and remove the strainer basket for cleaning;

__ d) replace the basket;

__ e) resecure the top;

__ f) reopen the seacock;

__ g) check for leaks.

__ 6) Check for tight engine mounting bolts. If loose, realign the engine. To make later realignments easier, grease these bolts. The propeller shaft alignment procedure is discussed in Part III, Section - IV.

__ 7) Check all engine hoses and hose clamps.

__ 8) Check the fuel lines, flare nuts, and valves for leaks.

__ 9) Check the control cable brackets for tightness.

__ 10) Lubricate the threaded cable ends and check the adjustment nuts for tightness.

__ 11) Check electrical connections for corrosion and clean.

__ 12) Check the exhaust blowers for proper operation.

__ 13) Check the exhaust hoses and hose clamps for leaks.

__ 14) Check that wires are not rubbing against sharp edges and that the insulation has not been worn off.

__ 15) Check the gauge senders and alarm system connections.

__ 16) Check the seawater system lines and fittings for leaks.

__ 17) Check the seawater pump for proper operation and leaks.

CAUTION

To eliminate a possible fire hazard and avoid violating the law by pumping fuel overboard, do NOT allow fuel to spill onto the engine compartment deck or collect in the bilge.

__ 18) Unscrew and remove the drain plug from the bottom of each fuel/water separator, drain any accumulated water and any residual fuel into a container suitable for disposal and reinstall the drain plug.

__ 19) Check that the engine-compartment sump pump screen and strainer are clean.

__ 20) Check that the engine-compartment bilge pump and its associated bilge pump float switch operate properly.

__ 21) Check the cockpit seawater washdown system lines and fittings for leaks.

__ 22) Check the seawater pump and the relief valve for proper operation and for leaks.

__ 23) Check the the following items on the air conditioning:

NOTE:
Do not loosen and "flare nut" fittings on any line.

__ a) The condensing units for rust and loose fittings;
__ b) the seawater hoses clamps for loose fittings;
__ c) clean seawater strainer;

__ d) the proper pump operation;

__ e) corrosion free and tight electrical connections.

12. Batteries

NOTE:
Always turn off all dc power and the converters prior to cleaning or working on battery terminal connections.

WARNING

THE GASES THAT ESCAPE FROM ANY CHARGING LEAD ACID BATTERY ARE AN EXPLOSIVE MIXTURE OF OXYGEN AND HYDROGEN. THIS MIXTURE WILL EXPLODE WITH GREAT VIOLENCE AND SPRAY BATTERY ACID IF A SPARK OR OPEN FLAME IS ALLOWED TOO CLOSE.

CAUTION

1. Do not overfill battery cells. Overfilling causes acid leaks during charging which corrodes the battery terminals and cables.
2. Never add acid to a battery cell.

__ 1) Check each 8 Volt and 12 Volt battery cell with a hydrometer. The cells will read between 1.250 and 1.265 if the battery is fully charged.

__ 2) Add distilled water if necessary.

__ 3) Service the battery terminals by doing the following:

- __ a) Remove the NEGATIVE battery cable terminal first and then the POSITIVE terminal;
- __ b) scrape the battery terminals and the inside of the cable clamps;
- __ c) wipe off the top of each battery with a cloth wetted with ammonia or baking soda in water, do not allow this mixture to get into the battery cells;
- __ d) wipe off the top of each battery with a cloth wetted with fresh water;
- __ e) Remove all accumulated liquid from battery boxes;
- __ f) coat both the terminals and the clamps with petroleum jelly or a silicone based grease;
- __ g) reassemble the battery cable terminal connections ensuring that each terminal clamp is tight, attach POSITIVE terminal then NEGATIVE terminal.

NOTE:
See Part III, Section IV, Spilled Battery Acid

13. Lazarette (AC Generator Compartment)

CAUTION

To eliminate a possible fire hazard and avoid violating the law by pumping fuel overboard, do NOT allow fuel to spill onto the generator compartment deck or collect in the bilge.

__ 1) Remove and clean the screen on the bilge pump.

__ 2) Check the bilge pump and the pump float switch for proper operation.

__ 3) Manually raise the bilge flood alarm float to test the alarm light and bell.

__ 4) Check the trim tab hydraulic fluid level; for service, see Part III, Section III - F. THE TRIM TAB SYSTEM.

__ 5) Check each trim tab motor, pump, and cylinder operation.

__ 6) Inspect both rudder ports for leaks. The rudders use a packing gland similar to the propeller shaft stuffing box. The procedure described in Part III, Section IV for packing the propeller shaft stuffing boxes should be followed to stop excessive rudder post leaking.

__ 7) Check the following steering system components for tightness, fluid level, and for smooth, proper operation:

- __ a) The hydraulic fluid reservoir is in the lazarette near the transom and has a sight glass as a fluid level indicator that should show the fluid level to be about two- (2) inches from the top;
- __ b) clevis bolts;
- __ c) rudder arms;
- __ d) lock nuts;
- __ e) lock bolts.

__ 8) Add grease to the both tie rod end fittings and to both rudder upper bearing fittings.

__ 9) Carefully follow the manufacturer's periodic preventative maintenance schedule for your vessel's generators as specified in the generator operator's manual.

__ 10) Check the generators mounting bolts for tightness.

__ 11) Check the generators for oil leaks. Leaks are to be corrected by the generator manufacturer.

__ 12) Check and clean generator seawater strainers.

__ 13) Inspect all generator fuel lines, fuel-line flare nuts, and valves for leaks.

__ 14) Check for fresh water system line and fitting leaks.

__ 15) Check the fresh water pump for proper operation and for leaks. (Instructions for adjusting this switch are inside the pressure switch box cover.)

14. Flybridge Control Console.

__ 1) Try switches, gauges, and controls for proper operation.

__ 2) Check the electrical connections for tightness and signs of corrosion. Clean if necessary.

__ 3) Lubricate the control heads as required.

G. AS REQUIRED

__ 1) Haul your vessel out of the water, scrub her bottom, and if necessary repaint with anti-fouling paint.

__ 2) Change the lubricating oil "spin-on" filters each time you change the lubricating oil.

__ a) Remove the drain plug and drain the oil;

__ b) Remove the center stud from the filter base;

__ c) detach the filter shell, element, and stud as an assembly;

__ d) discard the filter gasket;

__ e) clean the filter base;

__ f) discard the used filter element;

__ g) wipe out the filter shell;

__ h) install a new element on the center stud;

__ i) place a new gasket on the filter base;

__ j) reposition the filter shell on the filter base;

__ k) install and tighten the center stud.

H. CREVICE CORROSION

__ When your vessel is in wet storage, you should rotate both shafts about once a week to prevent crevice corrosion, which may occur on propeller shafts in the area of the struts and shaft logs if the shafts stay in the same position over a long period while your vessel is in the water.

I. ELECTROLYSIS

If your vessel is idle for extended periods, Bertram suggests that a zinc "fish" be hung over the side in the water on a heavy wire with a clip at the other end of this wire attached to your vessel's electrical bonding system.

The use of a zinc "fish" will help control the electrolytic action affecting the components mounted through the hull. When a zinc has greatly disintegrated, it should be replaced as it will no longer be effective. Zinc "fish" can be purchased from marine supply stores or they can made up if desired. Remove the zinc from the water before any attempt is made to move the boat under power. Replace standard transom zincs as required.

J. MAINTENANCE OF THE PORTABLE FIRE EXTINGUISHERS

1. General

The portable (hand held) fire extinguishers should be examined at least monthly for at least the following:

__ 1) That they are properly secured in their intended mounts;

__ 2) that they have not suffered rust, corrosion, or mechanical damage;

__ 3) that they are fully charged. Extinguishers that have pressure gauges or indicators should show that the pressure is within the prescribed limits; for fire extinguishers without pressure gauges or indicators, for those that use Halon, and for the CO2 portable fire extinguishers, the proper procedure is that each fire extinguisher be periodically weighed and the exact weight be noted on the tag attached to the extinguisher;

__ 4) that the tamper proof seal proves that the extinguisher has not been operated;

__ 5) that the nozzle orifice is unobstructed and the extinguisher hose is in good condition.

2. Portable Fire Extinguisher Service

Have a firm specializing in fire extinguisher maintenance make an annual full check on all portable fire extinguishers as per the maintenance instructions on the extinguisher's nameplate. This firm should attach a tag to the extinguisher showing the date of each maintenance check.

3. After Using a Fire Extinguisher

After any use, portable fire extinguishers must be recharged by a qualified fire extinguishing service facility or the extinguisher should replaced with a comparable unit.

K. FIXED FIRE EXTINGUISHER SYSTEM MAINTENANCE

NEVER ATTEMPT TO DISASSEMBLE ANY PART OR PORTIONOF YOUR FIXED FIRE EXTINGUISHER SYSTEM. THIS SYSTEM CONTAINS LIQUIFIED GAS AT HIGH PRESSURE AND SERIOUS INJURY COULD RESULT.

1. Halon Fixed Fire Extinguisher

The systems maintenance does not require that this system be emptied and hydrotested at any regular interval. However, according to the manufacturer, it is necessary that the Halon system be examined once-a-month for accidental damage and to ensure that no equipment has blocked the system operation. The Halon tank (less the brackets) should be removed and carefully weighed on an accurate (certified) scale at least one-every-six-months. The exact weight for each unit should be noted on the tag provided for this purpose attached to the unit. If the measured weight falls more than 5% below that shown on each unit's name plate, that unit must be immediately removed from service.

2. Diesel Engine Emergency Stop System

Your Bertram is equipped with Diesel engines that have an emergency stop feature. This feature consists of a spring-loaded flapper that is released by pulling the shut-down "T" handles on the flybridge control console and reset by going into the engine-compartment and manually recocking the engine cutoff flapper on top of each engine.

Other than checking this system to ensure that both "T" handles pull freely and the flappers close and reset properly once every 25 hours or twice per season, there is no scheduled maintenance for this equipment.

SECTION II - DIESEL ENGINE TROUBLESHOOTING

1. GENERAL

This section cannot replace a competent engine mechanic, but it may serve to keep your engines in service if a problem arises.

The information is presented in the form of a table to help you in troubleshooting your Diesel engines.

The table lists some potential engine problems, the apparent cause or causes of these problems, and some suggested solutions.

Other information on troubleshooting your engines is included in the engine manufacturer's documentation. These publications are included in your operator's information packet as a part of your shipboard documentation.

WARNING

LOUD NOISE CAN DAMAGE YOUR HEARING. TO PREVENT POSSIBLE HEARING LOSS, BEFORE YOU ENTER THE ENGINE/GENERATOR COMPARTMENT WHEN THE ENGINES OR THE AC GENERATOR ARE RUNNING, BERTRAM STRONGLY RECOMMENDS THAT YOU PUT ON HEARING PROTECTION (EAR MUFFS OR EAR PLUGS) WITH AN OSHA NOISE REDUCTION RATIO OF AT LEAST 20 dB.

2. SPARE PARTS YOU MAY WISH TO KEEP ON HAND

While you're away from home port, you may wish to keep on hand replacement air, fuel and lubricating oil filters, extra engine lubricating oil for the main engines and the generator, and extra transmission lubricating oil.

You may also choose to keep aboard a spare fuel pump and a spare engine cooling system thermostat.

Rags or shop wipes are also handy to have aboard, but you should store them with care.

CAUTION

Oily or fuel-soaked rags and wipes may be subject to spontaneous combustion. Do not keep used rags and wipes in the engine room. They should be stored in a fire-resistant container specifically intended for such storage.

3. TABLE III-II-1 - DIESEL ENGINE TROUBLESHOOTING

TABLE III- II-1 - DIESEL ENGINE TROUBLESHOOTING

PROBLEM	CAUSE	SOLUTION
1. Engine doesn't turn over when START push-button is pressed.	Main battery disconnect switch is turned to "**OFF**".	Turn main battery disconnect to "**ON**".
	32-Volt d.c. engine circuit breakers switched "**OFF**".	Switch circuit breakers **3F1** and**3F2** on the flybridge 32-Volt distribution panel to "**ON**".
	Battery cable(s) loose or corroded.	Tighten, clean, or replace cable(s), clean battery terminals.
	Battery bank or cell low or dead.	Charge or replace battery bank or cell.
	Battery bank or cell low or dead.	Use BATTERY PARALLEL switch.
	Starter motor cable(s) loose or corroded.	Tighten, clean, or replace cable(s).
2. Non-operation or chattering of starter solenoid.	Loose battery cables or low battery voltages.	Tighten cable connections, check battery voltages.
3. Engine runs rough, stalls	Fuel filters clogged.	Clean or replace fuel filters.
	Fuel lines or fittings leaking.	Check fuel lines for leaks.
	Insufficient fuel flow/aeration of fuel.	Check tank gauges. Switch tanks, refuel.
	Fuel control linkages binding.	Inspect and adjust.
	Insufficient air intake.	Inspect intakes for air silencer obstructions. Check emergency shutdown adjustment.

TABLE III- II-1(continued)

PROBLEM	CAUSE	SOLUTION
4. Engine over-speeds or runs on.	Loose or jammed throttle linkage	Tighten or free linkage.
	When a Diesel's RPMs increase, you have an internal malfunction. A stuck injector, a faulty governor, or a ruptured lube. oil seal.	If a Diesel seems to run normally at cruising speeds but does not slow down when throttle is backed off, DO NOT put throttle in idle until you are sure that you have lost engine control. Check throttle linkages. Keeping the engine in gear prevents engine self destruction. TO SHUT DOWN ENGINE: **IN THE ORDER SHOWN** 1. Switch "**ON/STOP**" switch to **STOP**. 2. Pull Emergency "**SHUTDOWN**" "**T**" handle 3. Shut off fuel supply.
5. Engine oil pressure too high.	Wrong grade of lube oil.	Watch closely, if oil pressure exceeds the manufacturer's upper limit, stop engine.
	Oil filters dirty.	Change oil filters.
	Engine not yet up to normal operating temperature.	Watch as engine temperature rises to normal operating temperature.
	Relief valve stuck.	Clean and adjust, or replace (follow procedure in engine manual).
6. Excessive oil consumption.	External oil leaks.	Check and tighten all oil line connections. Add oil. Monitor and shut down engine if necessary.
	Internal oil leaks.	Shut down engine.
	Worn or damaged engine parts.	Monitor, add oil, and shut down engine if condition persists.

TABLE III- II-1(continued)

PROBLEM	CAUSE	SOLUTION
7. Engine surges.	Air in fuel system.	Shut down engines, bleed air from fuel system.
	Clogged fuel filters.	Change fuel filters.
	Areation of fuel.	Reduce speed (fuel consumption).
	Unstable governor.	Adjust governor buffer screw. Check for free movement of flyweights (follow procedure in engine manual).
8. Transmission gear fails to engage.	Loss of gear oil.	Shut down engines, add gear oil. Check for leaks.
	Strainer or filter clogged or dirty.	Clean strainer, replace filter.
	Loose, broken, or maladjusted linkage.	Inspect linkage and correct as necessary.
9. Unusual noise in transmission or engine.	Loss of oil	Shut down engine. Check oil. Refill and resume operation at reduced speeds.
	Worn gears.	Shut down engine.
10. Loss of gear oil pressure to transmission.	Loss of gear oil.	Check all high pressure oil lines for leaks and repair. If unable to repair, secure engine.
11. Engine coolant temperature too high.	Faulty thermostat.	Replace thermostat.
	Leaky hoses.	Check hoses, tighten clamps.
	Seawater flow reduced.	Check seacocks, hoses, strainers, and the heat exchanger flow.
	Loss of coolant.	Check for ruptured hose. Add coolant.
12. Excessive smoke.	Refer to Diesel engine manufacturer's manual.	

TABLE III- II-1(continued)

PROBLEM	CAUSE	SOLUTION
13. Engine oil level rises, oil looks and feels gummy.	Coolant leaking into the lubricating oil.	Check for internal engine leakage.
14. Engine oil level rises, oil looks and feels very thin.	Diesel fuel oil leaking into the crankcase.	Check for leaky fuel pump. Repair or replace fuel pump, replace oil filters and lubricating oil. DO **NOT** OPERATE UNTIL YOU CHANGE THE OIL.
		Check for leak(s) in fuel injector lines.
15. Hot water in bilge.	Engine cooling water or seawater leaking.	Check all cooling system hoses, tighten all clamps.

SECTION III. ON-BOARD SYSTEMS TROUBLE SHOOTING

A. TROUBLE SHOOTING USING THE ENGINE ALARMS

Once alerted to a potential problem by the engine alarm horn and the illumination of one or more engine alarm lights, you can isolate and possibly correct the problem by taking the steps listed in the following procedures:

1. Engine Oil Pressure. If the engine alarm horn sounds and either engine "OIL PRES" light illuminates to indicate that it has detected a low engine oil pressure condition (4 pounds per square inch, gauge [psig], do not change the value of this switch); but do check the following:

1) The oil pressure gauge (verify the low oil pressure condition).

2) Low lube oil in the crankcase.

3) A leak in the oil system.

4) A defective alarm circuit or switch.

2. Coolant Temperature. If the alarm sounds and the engine "WATER TEMP" alarm light illuminates indicating that it has detected an engine over-heat problem, check the following:

1) Check the engine temperature gauge (verify the high temperature condition).

2) Low coolant in the heat exchanger.

3) A restricted seawater strainer. [The "**EXHAUST TEMP**" alarm light should also illuminate.]

4) A closed or partially closed seacock. [The "**EXHAUST TEMP**" alarm light should also illuminate.]

5) Defective water pump(s).

6) A defective thermostat.

7) A defective circuit or alarm switch.

8) A collapsed water suction hose [check for this problem with the engine running at high speed and with no load, but after the engine has cooled down].

3. Gear Oil Temperature. If the alarm sounds and the "GEAR TEMP" alarm light illuminates indicating a gear box overheat problem, check the following:

1) Low transmission fluid

2) Clutch slipping (check control cable adjustment)

3) Transmission Cooling System

4) Defective circuit or alarm switch

4. Exhaust Temperature. If the alarm sounds and the "EXHAUST TEMP" light illuminates, that indicates an exhaust system overheat problem, check for the following:

1) The flow of water from exhaust outlet at transom

2) Restricted seawater strainer

3) Closed or partially closed seacock

4) Defective sea water pump

5) Collapsed water suction hose

6) Defective exhaust cooling seawater temperature sensor or the sensor alarm circuit (located on the engine exhaust seawater discharge system exhaust riser).

B. THE FRESH WATER SYSTEM

1. The Water Pump. Your automatic water pump responds to a demand for hot or cold fresh water. This pump maintains an average static pressure of 30 psig. Normally, the only maintenance required for this pump is a periodic check of the water pump's pressure sensing device. The pump pressure switch is factory set to cut out at 32 psig To reset the pump, tighten the pressure adjustment (clockwise) to increase the cutout pressure or loosen it (counter-clockwise) to reduce it. The settings on this pressure sensitive device may change with time. Reset instructions for the pressure sensitive device are under the switch cover.

Occasionally the fresh water pump air bag may lose its charge. If this happens, the pump may cycle rapidly or it may shut down as if the tank were dry. This condition requires factory service and repair.

2. The Water Heater. The thermostat on this heater is preset by the manufacturer at 140 to 145° F, which Bertram recommends as maximum. The water heater is connected to the Salon "120/240 Vac" Distribution Panel at circuit breaker number 210. Only qualified/trained technicians should work on or attempt to adjust this unit.

3. The Shower Sump Pump. The shower sump is located in the bilge below the cabin sole. This sump has its own submersible pump equipped with an automatic float switch. This pump will automatically discharge the shower water and/or the air conditioning condensate overboard. The filter screen between the pump and the float switch should be inspected on a routine basis to ensure the screen remains clean.

C. THE FRESH WATER SYSTEM TROUBLE SHOOTING TABLE

See (Table III-III-1, Trouble Shooting The Water Pump). Table III-III-1 is a list of possible problems, their possible causes, and a list of suggested solutions.

D. THE HYDRAULIC STEERING SYSTEM MAINTENANCE

See (TABLE III-III-2, Trouble Shooting The Steering System). Table III-III-2 is a list of possible problems, their possible causes, and a list of suggested solutions.

1. Hydraulic System Filling and Purging

NOTE:

"Hynautic" steering oil is preferred; however, you may use the following listed hydraulic steering oils, or any hydraulic fluid that meets the specifications of MIL-H-5606. Heavier oils such as automatic transmission oil Type A or Dextron II may be used, if necessary, but will cause harder steering.

Texaco #15 Exxon Univis J-13 Castrol AWH-15
Castrol Aero-585-B Shell Tellus 15

a. Adding Hydraulic Steering Fluid.

CAUTION

1. Loss of steering WILL occur if the relief valve screws are not securely closed.
2. Do not apply excessive force which WILL result in damage to screw and relief valve.

1) Locate the two (2) screws with the pinned 1/2-inch hex head nuts on the top of the relief valve.

2) Loosen and back-off these screws by hand, turning them counterclock-wise until they stop.

3) Remove the hex head plug from the top of the reservoir.

4) Fill the reservoir with the proper oil to within 1/2 inch of the top.

5) Replace the hex head plug.

NOTE:

The reservoir is fitted with a tire type air valve. Use any tire air pump or compressor with a matching fitting to pressurize the system.

6) Slowly pressurize the reservoir to 40 to 45 psig. (As the air pressure rises, the hydraulic fluid flows into the system. Stop pressuring when the fluid level drops to within 2 inches of the bottom of the reservoir.)

7) Release the air pressure through the air valve.
8) Repeat steps 3, 4, 5, and 6.
9) With pressure stabilized at 40 to 45 psig, check all connections for leaks.

b. Complete Refill and Systems Purging. If it is necessary to completely drain and refill your steering system, first do the nine steps given in Subsection a, then do the following:

1) Go to the highest helm position and crack open the port and starboard line connections.

2) Allow the air trapped in the system to escape until the hydraulic fluid appears.
3) Retighten the port and starboard line connections.

TABLE III-III-1. TROUBLE SHOOTING THE FRESH WATER PUMP.

PROBLEM	CAUSE	SOLUTION
1. Pump cycles, no apparent water use.	Leak in pressure lines.	Repair leak.
	Leak in suction lines.	Repair leak.
	Dirt under check valve seat causing pump to lose its prime	Remove, clean, and replace check valve.
2. Pump motor operates, no water supplied.	Broken suction or supply water line.	Repair or replace the broken line.
3. Pump cycles rapidly with use of minimal (0.5 to 1 ounce) of water.	Deflated or leaking tank bladder.	Reinflate per procedure. If leaking, return to boat dealer for repair or replacement.
4. Water leaks from pump seal.	Defective seal.	Replace seal.
6. Pump runs, won't reach cut off pressure level.	Worn pump stator.	Replace worn stator.
	Leak in system.	Repair leak.

4) Disconnect the cylinder rod from the rudder.

5) Crack open the fitting connections on the cylinder.

6) Let the trapped air escape until hydraulic fluid appears.

7) Tighten the fitting connections.

8) Verify that the reservoir is at least 3/4 full. If not, repeat steps 7, 8, and 9 in Subsection a.

9) Go to your vessel's highest helm position and turn the wheel slowly (2 to 3 seconds per revolution) 170 times in the SAME direction.

10) If your vessel has two helm positions, repeat step 9 at the lower position.

11) Repeat steps 5, 6, and 7.

12) Verify that the reservoir is at least 1/2 full. If it is not, repeat steps 7, 8, and 9 in Subsection a.

13) Repeat steps 9 and 10 in the OPPOSITE direction.

14) Repeat steps 5, 6, 7, and 12.

15) Close the two relief valve screws with the pinned hex head nuts by turning clock-wise.

16) Use a wrench to carefully snug down the relief valve screws, do not force.

17) Go to a helm station.

18) Turn the steering wheel in one direction until you feel the resistance that indicates "HARDOVER".

19) Go to the cylinder.

20) Crack open the fitting at the end of the cylinder with the rod extending from it.

21) Allow the trapped air to escape until hydraulic fluid appears.

22) Retighten the fitting.

23) Go back to the helm station.

24) Turn the steering wheel in the other direction until you again feel "HARDOVER".

25) Repeat steps 19. 20, and 21.

26) Go back to the helm station.

27) To check purge, turn steering wheel lock-to-lock. The usual is 6.5 turns +/- 0.5 turns with properly purged steering system. Excessive turns require that steps 18 through 27 be repeated.

28) After 24 or more hours, recheck purge.

29) Check system for leaks.

30) Check reservoir gauge for pressure loss.

31) Open the relief valve screws.

32) Start at the top helm.

33) Turn 40 turns in one direction.

34) Repeat at any lower helm(s)

35) Repeat steps 32 and 33 in the opposite direction.

36) Close the two relief valve screws with the pinned hex head nuts by turning clock-wise.

37) Snug down carefully with a wrench, do not force.

38) Verify: 6.5 turns lock-to-lock

Reservoir level 1/2 to 2/3rd's full.

Reservoir pressure 20 to 30 psig.

TABLE III-III-2. TROUBLE SHOOTING THE STEERING SYSTEM

PROBLEM	CAUSE	SOLUTION
1. Steering stiff at dock & under way.	High viscosity hydraulic fluid used in system.	Drain high viscosity fluid, replace with low. MIL-0-5606 aircraft hydraulic fluid, Texaco #15, or Shell "Tellus" #15 or equiv.
	Restriction(s) in port and/or stbd lines, tubing, or fittings.	Find restrictions and repair or replace the damaged lines, tubing, and/or fittings.
	Helm shaft binding.	Adjust for adequate clearances.
	Cylinder out of alignment.	Remount cylinder per manufacturer's installation information.
	Fittings in cylinder overtightened.	Remove & inspect fitting. A circular mark is reason to replace.
	Rudder stuffing box(es) too tight.	Loosen packing & jam nuts on stuffing box.
	Damaged or bent rudder post(s).	Replace rudder post.
2. Fluid leaking.	Worn rod or shaft seal.	Return unit for factory repair as soon as possible, the problem will only get worse.
	Pinched or cut parting line "O" ring.	Return unit to factory for repair.

TABLE III-III-2, - CONTINUED

PROBLEM	CAUSE	SOLUTION
3. Helm pumps in only one direction.	Dirt in makeup check valve.	Return unit to factory for overhaul.
	Air in the system.	Repurge system per maker's instructions.
4. Helm has no STOP in either direction.	Air in the system.	Repurge system
	Valve screws on relief valve have been left open.	Close and tighten the valve screws.
5. Helm takes excessive turns from hardover to hardover.	Excessive air in the system.	Repurge system
6. System seems to always need to be purged.	Air saturated hydraulic fluid.	Repurge the system using 20 to 30 PSI.
	Hydraulic fluid foaming.	Repurge the system using 20 to 30 PSI.
7. Rudders drift excessively.	Relief valve screws left open.	Close and tighten the relief valve screws.
	Air in the system.	Repurge system
	Internal leakage in relief valve.	Return unit to factory for repair.
	Cylinder internal seals worn & leaking.	Return unit to factory for repair.

TABLE III-III-2, - CONTINUED

PROBLEM	CAUSE	SOLUTION
8. Loss of fluid & pressure in reservoir.	Fluid leak in the system.	Check all components and fittings, repair or replace as needed.
9. Loss of pressure in system, but no loss of fluid.	Air leak in upper reservoir.	Repressurize. If problem continues, check for leaks. Repair & repressurize.
10. Visible fluid leak from tubing.-	Damaged hydraulic tubing.	Replace or repair

E. THE TOILET SYSTEM TROUBLE SHOOTING TABLES

See (TABLE III-III-3, Trouble Shootin The Toilet System). This table includes a list of possible problems, their possible causes, and a list of suggested solutions.

F. THE TRIM TAB SYSTEM

a) use a flashlight or work light to check the hydraulic fluid level in the trim tab motor/pump;

b) if fluid is needed, use a "Phillips" screw driver to remove the motor/pump cover retaining screw;

c) remove the plug from the starboard forward corner of the motor/pump;

d) add the correct hydraulic fluid as needed per the manufacturer's operator's manual; and,

e) replace the plug, the motor/pump cover, and the cover retaining screw.

f) Check each trim tab motor, pump, and cylinder opertaion.

TABLE III-III-3, TROUBLE SHOOTING THE TOILET SYSTEM.

PROBLEM	CAUSE	SOLUTION
1. Pump does not empty the bowl.	Obstructed suction pump.	Remove obstruction.
	Worn suction stator.	Replace Stator.
	Closed discharge line valve.	Open discharge line valve.
2. Pump does not supply water to the bowl.	Clogged seawater suction line or seawater strainer.	Remove obstruction.
	Closed intake seacock.	Open intake seacock.
	Worn supply stator.	Replace stator.
3. Pump motor does not operate.	Tripped circuit breaker.	Reset circuit breaker.
	Blown solenoid fuse.	Replace fuse.

SECTION IV - MAINTENANCE PROCEDURES

A. PROPELLER SHAFT ALIGNMENT

1. General. Two separate propeller shaft alignment procedures were performed by Bertram to ensure that your vessel's propulsion system was aligned correctly at the factory. These same procedures are necessary any time that an engine has been moved or the shaft line changes due to underwater gear repairs.

2. Parallel or Bore Misalignment. The first procedure is the parallel or bore alignment. In this case, a misalignment occurs when the centerline of the transmissions and the centerline of the mating propeller shafts ARE parallel but ARE not coaxial. The allowed misalignment shall be less than 0.005 inches. Since the slip fit of the pilot surfaces of these two shafts holds the shafts in alignment, it is most unlikely that this alignment will change unless you replace an engine, move an engine, or seriously damage the underwater gear. To do a parallel or bore alignment procedure requires precision measuring equipment and a competent technician.

3. Angular or Face Misalignment. This misalignment occurs when the centerlines of the marine transmission and the mating propeller shaft are not parallel and therefore the mating faces of the marine transmission and the mating propeller shaft can not be parallel. In the case of angular or face misalignment, the formula to determine allowed amount of misalignment is 0.0005 inches per inch of the propeller shaft companion flange outside diameter, measured at the mating surface of the flanges.

4. Allowable Angular or Face Misalignment. Using the formula given in the preceding Section and using as an example a 5.0 inch outside diameter companion flange, the allowable amount of misalignment is 0.0025 of an inch. The angular or face misalignment should be checked periodically to ensure the proper alignment and therefore the optimum performance. The initial alignment check is considered a part of the predelivery preparation. After delivery, this alignment is an owner maintenance responsibility.

Bertram recommends that you:

1) Open the two couplings before haulout.

2) To check the alignment after launching:

a) Let your vessel settle in the water for a day or two before making the final alignment adjustments.

b) Remove all of the bolts in the coupling flanges at the end of the marine gear.

c) Slide the shaft aft until the flanges are about 1/4 of an inch apart.

d) Press the flanges together by hand with a 0.010 of an inch or larger feeler gauge between them.

NOTE:

At this point gauge thickness is not vital. What is important is that as you bring the flange faces closer together that the differences between the opposite side gaps stay within the allowed tolerance. You find this difference by subtracting the thickness of the thinner feeler gauge from that of the thicker.

e) Place a feeler gauge between the flanges at 90° or less intervals around the flange to assure equal clearance.

f) With correct alignment, the 0.010 inch or larger feeler gauge will be a tight fit all around the coupling edges.

g) Repeat steps d, e, and f, while gradually moving the two flanges closer together until they touch, using the formula to calculate allowable misalignment.

3) Engine alignment is best accomplished by an experienced mechanic working with the proper tools. Keep this in mind before attempting to move a marine engine on its mountings.

B. PROPELLER INSTALLATION

Propeller installation completes your vessel's propulsion system. With the engine output converted to vessel movement at this point, mating the shaft to the propeller must be done properly to provide maximum shaft and propeller life. If you must replace either the propeller or the shaft, follow these guidelines:

1) Inspect the shaft keyway and the key for the proper radii (see Sketch 1 on Figure - 25, Propeller Installation Sketch).

2) Each propeller is keyed to a shaft with a locating pin extending down from the key, check that the key fits snugly in its slot with the pin in its matching hole in the shaft keyway as shown on Sketch 2 on Figure -25.

3) Check the fit of the propeller on the shaft with the key.

4) If the key does not fit, carefully file the propeller keyway using gentle and even file strokes along the whole keyway.

5) Place the propeller on the shaft (without the key) and seat the propeller on the shaft taper. The fit should be tight with no wobble and no space between the shaft and forward and aft ends of the propeller hub.

6) Mark the location of the propeller on the shaft at forward end of the hub with a sharp pencil as shown on Sketch 2 on Figure - 25.

7) Remove the propeller.

8) Insert the key into the shaft keyway, ensuring that the locating pin is in its hole in the propeller shaft keyway.

9) Reinstall the propeller.

10) Ensure that the propeller is fully seated with the forward end of the hub touching the pencil line you made in Step 6.

11) Use a feeler gauge to check for 0.006 and 0.010 inch clearance between the top of the key and the bottom of the keyway in the propeller hub.

12) Remove the propeller.

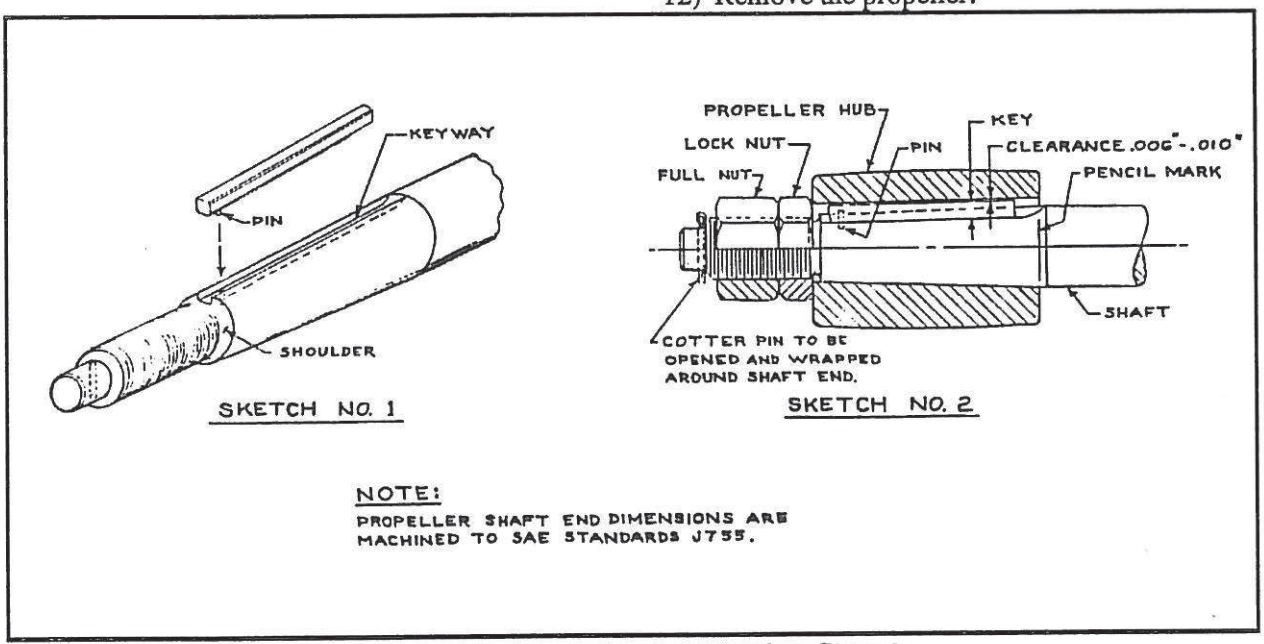


Figure 25 - Propeller Installation Sketch

13) Coat the bore with any nongraphite, waterproof grease.

14) Reinstall the propeller.

15) Install the plain (full) nut.

16) Torque the nut with a wrench to seat the propeller.

17) Remove the full nut and install a jam (half) nut.

18) Tighten the jam nut slightly more than finger tight.

19) Install full nut.

20) Lock both nuts together by holding the jam nut while tightening the full nut. The completed installation should match Sketch 2 on Figure -25.

21) Install a cotter pin and bend the legs.

The sequence and method of nut installation, as described above, is in accordance with S.A.E. Specifications #J-755.

C. PROPELLER SHAFT REPLACEMENT

CAUTION

When using any type of hammer against metal, be sure to wear safety glasses and to take all other usual precautions against injury.

1. General. To replace a propeller shaft it is necessary that you remove the hexagon or slotted nut that holds the coupling on to the engine end of the propeller shaft. To do this you must first loosen and remove the bolts that fasten the coupling to the transmission flange and push the shaft aft until you have room to work (4 to 6 inches).

2. Coupling Removal. To remove the coupling nut:

1) Place standard 1-3/4 inch socket wrench in the coupling shaft nut cavity (in the center of the coupling flange), so that the 1-3/4 by 5 nut is secure within the socket.

2) Bertram recommends that you use a small to medium lead, lead shot, or other soft faced mallet to strike the breaker bar fitted to the socket wrench sharply to loosen the nut. Repeat if necessary.

3) Hold the shaft with one hand and use the wrench to unscrew the nut.

4) Remove the nut.

5) Tap around the coupling's aft end with the lead mallet to remove the coupling from the tapered propeller shaft.

3. Coupling Installation.

1) Place the new shaft in position.

2) Inspect the shaft keyway and the key for the proper radii. See (Figure - 26, The Driv e Line Assembly).

3) Check the fit of the key in the shaft keyway. If the key does not fit, carefully file the coupling keyway using gentle and even file strokes along the whole keyway.

4) Place the coupling on the shaft (without the key) and seat the coupling on the shaft taper. The fit should be tight with no wobble and no space between the shaft and forward and aft ends of the coupling hub.

5) Mark the location of the coupling on the shaft at forward end of the hub with a sharp pencil.

6) Remove the coupling.

7) Insert the key into the shaft keyway, ensuring that the key is clear of the radius at the shaft end of the propeller shaft keyway.

8) Reinstall the coupling.

9) Ensure that the coupling is fully seated with the forward end of the hub touching the pencil line you made in Step 5.

10) Use a feeler gauge to check for 0.006 and 0.010 inch clearance between the top of the key and the bottom of the keyway in the coupling hub.

11) Remove the coupling.

12) Coat the bore with any nongraphite, waterproof grease.

13) Reinstall the coupling.

14) Place the nut on the end of the shaft.

15) Use the wrench to tighten as far as possible, taking care not to mar or scratch the shaft.

16) Using the lead mallet, strike the ear of the wrench two (2) or three (3) times to tighten the nut.

D. SHAFT LOG and STUFFING BOX

1. **The Shaft Log**. The shaft log recess is the tunnel in which each propeller shaft turns. In your Bertram, the shaft logs are a part of and are constructed of the same material as is the hull (as shown in Figure 26, Drive Line Assembly). Each stuffing box is attached to its shaft log recess by a flexible hose held in place by hose clamps. This flexible hose serves to absorb any normal shaft vibration.

2. **Stuffing Boxes**

CAUTION

Do not over tighten the packing gland on the stuffing boxes. If this gland is too tight, the packing may become glazed and the shaft may be scored. A slight drip is necessary.

Stuffing boxes keep water from leaking in around the shaft into the boat. The stuffing box components are the braided flax packing and the packing gland. A tight packing gland stops excessive stuffing box leakage. However, a slight drip is necessary (about one drop each 3 seconds). Seawater lubricates the propeller shafts. If leaking is excessive, retighten the packing gland. Do not over tighten or you may glaze the packing and could score the shaft. If the packing is too tight, the gland will get too hot to comfortably hold with your bare hand. When running at full speed, the gland should feel warm.

3. **Repacking a Stuffing Box**. If you must repack the stuffing box:

1) Remove the boat from the water;

2) remove the sprayshield;

3) unbolt the packing gland;

4) slide the packing gland forward on its shaft;

5) remove the old packing and install sufficient 1/4 inch by 1/4 inch new packing rings to come about 1/4 inch of filling the stuffing box; (always use tallow flax packing and do not spiral the packing around the shaft, each packing ring must be separate.);

6) slide the packing gland aft;

7) tighten the packing gland until the shaft will not turn to seat the packing;

8) relaunch the boat;

9) back the gland off until the shaft is free to turn and there is the slight drip necessary for proper shaft lubrication;

10) run the shaft for a while, reset if necessary; and,

11) replace the sprayshield.

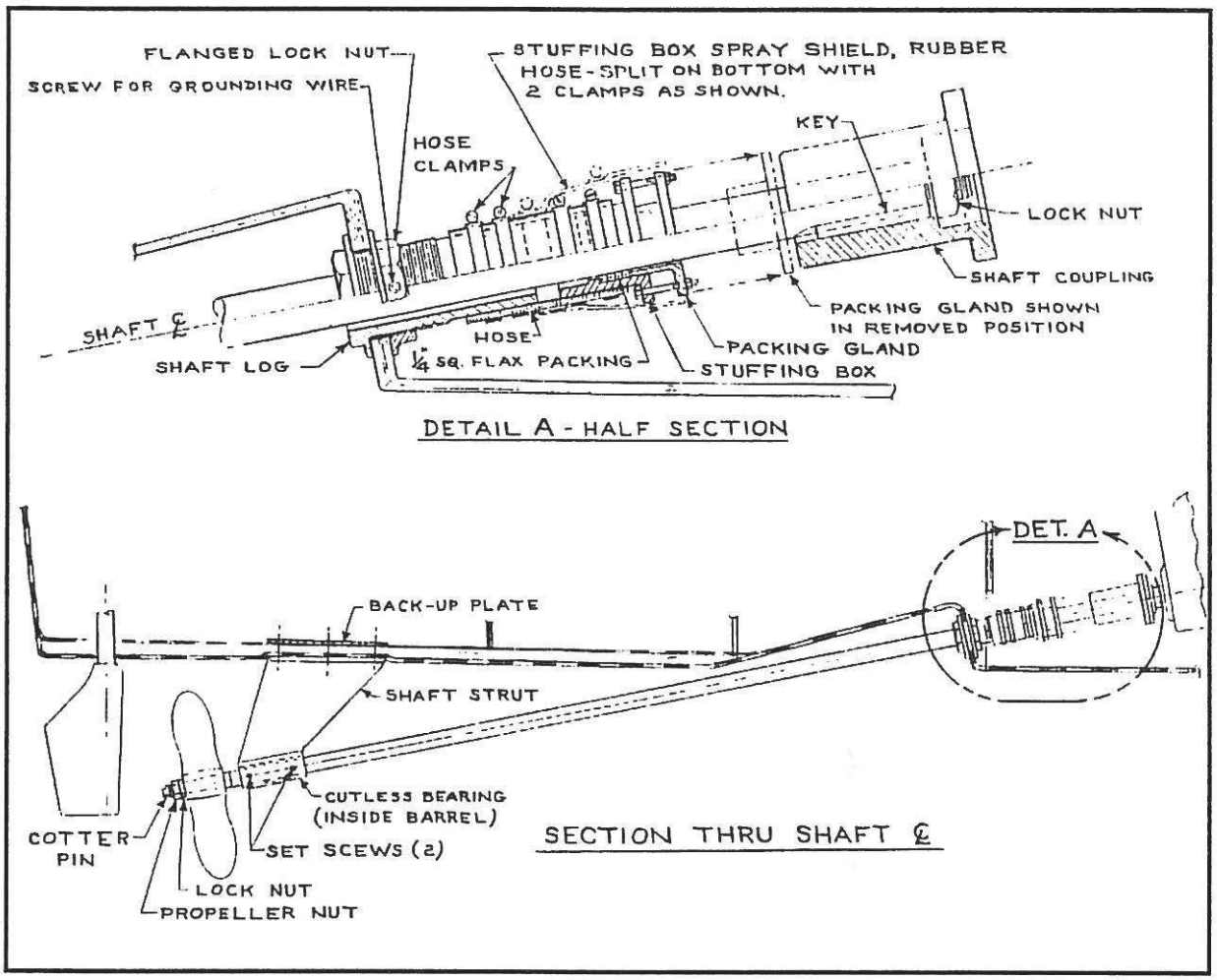


Figure 26 - The Drive Line Assembly

E. SHAFT LOG SPRAYSHIELD

Each stuffing box has a rubber hose sprayshield to prevent dripping water from being sprayed around the engine compartment.

F. RUDDER STUFFING BOXES

When tightening the packing gland, remember that it is not necessary or desirable to have a rudder stuffing box drip, only be sure the rudders turn freely. Otherwise, the two rudder stuffing boxes are packed in the same manner and with the same material as are the two propeller stuffing boxes,

G. RUDDER ALIGNMENT

The twin rudders on your Bertram should ALWAYS be kept parallel and never "toed" in nor "toed" out.

H. BATTERY CARE

WARNING

GASES ESCAPING FROM ANY CHARGING LEAD ACID BATTERY ARE AN EXPLOSIVE MIXTURE OF HYDROGEN AND OXYGEN. THIS MIXTURE WILL EXPLODE WITH GREAT VIOLENCE AND SPRAYING OF BATTERY ACID IF A SPARK OR OPEN FLAME GETS TOO CLOSE.

1. **Distilled Water**. The first choice for adding liquid to the electrolyte is distilled water. If distilled water is not available, a good grade of potable (drinking) water can be used if this water is free of minerals, particularly iron. Adding water to a cell will temporarily lower the specific gravity of the electrolyte in that cell. However, this does not mean that the cell has lost any of its charge.

2. **Filling Procedure**.

1. Do not overfill battery cells. Overfilling causes acid leaks during charging which corrodes the battery terminals and cables.

2. Never add acid to the battery.

1) Inspect each cell;

2) fill each cell with distilled water, when required, (the top of the plate separators should never be exposed); and,

3) fill until the liquid level is about 3/8 of an inch above the top of the separators.

Do not overfill

(Excessive liquid will cause acid to spill out the vents when the battery is charging which causes corrosion at the terminals and the battery cables.)

3. **Excessive Loss of Liquid**. Under proper operating conditions, your batteries should require only a slight amount of distilled water every few weeks. If excessive water is required, this is frequently a sign that the battery is being overcharged and the engine alternators and converter should be checked.

I. BATTERY GASES - EXPLOSIVE HAZARD

TO AVOID SPARKS

1. Do not disturb the battery connections while charging.

2. When working on battery terminals be sure that:

a. the engines are not running;

b. all dc loads have been turned off;

c. the converters have been turned off;

d. you are not wearing rings or metal watchbands; and,

e. you use extreme caution to avoid having wrenches or other tools contact both terminals.

J. SPILLED BATTERY ACIDS

If battery acid is spilled, the following immediate actions are required to check or eliminate its damaging effects.

1. **Acid splashed in the eye**:

1) should be washed out immediately and continuously with plenty of cold, fresh water for at least twenty (20) minutes.

2) If cold, fresh water is not available, use milk or any available fresh water based potable liquid to dilute the acid.

3) always see a doctor as soon as possible.

2. Acid splashed on other parts of the body, the clothing, or parts of your vessel should be:

1) removed immediately by washing thoroughly with cold water; and,

2) the area neutralized with a solution of baking soda or household ammonia in water.

3. If a considerable amount of acid is spilled from the battery, the battery should be replaced. This is a job for a battery repairman.

K. DIESEL FUEL

WARNING

NEVER ADD COMMERCIALLY MARKETED DIESOHOL OR GASOHOL TO DIESEL FUEL. THIS MIXTURE CREATS BOTH EXPLOSIVE AND FIRE HAZARDS.

Use only high quality Diesel fuel that meets the engine manufacturer's specifications. See their manual for details. Small amounts of isopropyl alcohol (isopropanol) may be used to prevent fuel line freeze-up in winter months. No more than one (1) pint of isopropyl alcohol should or need be added to each 125 gallons of Diesel fuel for adequate protection.

L. ELECTRICAL REPAIRS

WARNING

BEFORE OPENING ANY 120/240 VAC DISTRIBUTION PANEL OR SERVICING ANY 120/240 VAC EQUIPMENT:

1) DISCONNECT SHORE POWER CORD; AND,

2) STOP THE GENERATORS.

CAUTION

Do not replace your vessel's circuit breakers with breakers of higher amperage ratings than those installed by Bertram. Select breakers for the spare circuits on the dc and ac distribution panels with ratings that do not exceed the current carrying capacity of the wires in each branch circuit.

NOTE:

Bertram recommends that electrical maintenance be performed by a qualified marine electrician. The 120/240 Vac circuits can deliver a lethal shock. Also if repairs or modifications are done incorrectly, there is the danger of an electrical fire.

Point-to-point wiring diagrams of each of the circuits installed on your Bertram are included with this manual.

M. THE BILGE PUMP SYSTEMS

1. **The Automatic Bilge Pump Switches.** Each of the three bilge pumps and the engine/generator-room sump pump has its associated water level sensing switch mounted slightly above it. This mounting arrangement ensures that there will be a positive shutdown signal to the pump when the bilge is nearly dry.

The proper operation of these switches should be checked periodically. Checking the switch entails depressing the TEST pushbutton on the switch cover.

2. **Cleaning the Pumps.** Each submersible pump has a strainer on the bottom of its intake that must be kept clean and free of debris. The engine-room sump pump has strainers in the suction line and at the pick-up that must also be cleaned periodically.

N. THE LUB. OIL TRANSFER SYSTEM BY-PASS ADJUSTMENT

The lubrication oil transfer system has a built-in by-pass control on the side of the transfer pump body. This control is factory preset by Bertram. Under most conditions, no further adjustments need be made. However, if your transfer pump is not working properly this is usually caused by extremely cold weather and this by-pass may have to be adjusted according to the following procedure:

1) Loosen the lock nut on the by-pass;

2) have at least four gallons of lubricating oil in the storage tank;

3) close the used oil discharge valve;

4) open the tank supply valve;

5) have a one gallon container at hand;

6) insert a quick-disconnect fitting (BYD #21821) into the fill oil transfer hose;

7) switch "ON" the pump;

8) fill the system lines (check by pumping about one quart of oil into the container);

9) with the pump still running, remove the quick-disconnect fitting from the fill oil transfer hose;

10) the following will happen:

a) the flow of oil should stop;

b) the pump will either stop or run free;

11a) if the pump stops - turn the by-pass screw counter-clockwise until the pump runs free, then turn the by-pass screw clockwise until the pump sees a slight load (the slight load is determined by a small drop in pump rpm noticed when turning the by-pass screw clockwise);

11b) if the pump runs free, turn the by-pass screw clockwise until the pump sees a slight load (the slight load is determined by a small drop in pump rpm noticed when turning the by-pass screw clockwise);

12) retighten the locknut.

O. COCKPIT HATCH DOG ADJUSTMENT

Hatch dogs on the cockpit hatches require adjustment to eliminate seepage. To avoid overcompressing the gaskets, these dogs should not be overtightened. Turn the nut on the under side of the hatch dogs to adjust the fitting tightness. Where possible, someone must be in the compartment below the hatch when you test for seepage.

1) Lift and turn the hatch dogs 1/4 turn to release the hatch.

2) Loosen the upper "jam" nut on the bottom of each hatch fitting so that you can tighten the lower

"locking" nut until the hatch is "snug" against the gasket all the way around.

3) After all hockpit hatch dogs are adjusted, use a flashlight to check for seepage after water is poured over the hatches and surrounding deck.

4) Repeat steps 1 through 3 to eliminate any seepage.

P. RECALIBRATING FUEL GAUGE SENDERS

Bertram adjusts the fuel gauge senders before delivery. However, if maintenance work is done on the fuel tank or the adjustment screws are inadvertantly disturbed, the following steps are necessary to recalibrate these senders.

1) Mark the relative position of each sender to the sender mounting plate on each tank.

2) Mark and disconnect the wires leading to the sender.

3) Loosen, remove, and set aside the five (5) mounting screws that hold the sender in place on top of the tank.

4) Lift the sender straight up from its tank, letting the Diesel fuel drain back into the tank.

5) Allow the sender to dry at least two (2) hours before starting recalibration procedure. Residual fuel will give wrong readings and invalidate the recalibration.

6) Reconnect the "SND", "NEG", and "POS" wires.

7) On the companionway 12 VDC SUPPLY PANEL: Set circuit breaker number 1M3 to "ON".

8) Wait five (5) minutes for the gauge to warm up.

9) Use small slotted screw driver to turn both the "FULL" and "EMPTY" adjustment screws full clockwise (CW).

10) Slowly turn the "EMPTY" adjustment screw counter-clockwise (CCW) until the gauge meter just stops moving downward. The needle should be on or just below the empty mark.

11) Turn the "EMPTY" adjustment screw clockwise to ensure that the needle immediately starts moving upscale.

12) Slowly turn the "EMPTY" adjustment screw counter-clockwise again until the gauge meter just stops moving downward. The needle should be on or just below the empty mark. This is the "EMPTY" reference mark. If in doubt, repeat step 11) and 12).

13) Use a dip stick to determine the level of fuel in the tank. Put the sender probe into the tank. The tank should be level and at least one/half (1/2) full by measurement.

14) Slowly turn the "FULL" adjustments screw counter-clockwise (CCW) until the gauge meter shows the fuel level in the tank.

15) If you accidently turn the "FULL" adjustment screw so that the needle moves past the actual fuel level, turn the "FULL" screw to its full clockwise position and repeat step 14).

16) Remove the sender probe from tank. The needle should move to EMPTY or just above. Carefully shake the probe a few times to remove residual Diesel fuel. The gauge should now read EMPTY. Make no further adjustments.

17) Replace the probe in the tank and replace and tighten down the five (5) screws.

Q. TRANSDUCER BOX FILLING

Your Bertram has a pair of transducer boxes built into her hull. These boxes are located, one on each side of the lube. oil transfer tank, which is aft of the forward fuel tank and forward of the forward engine-compartment web-frame. Each transducer box is fitted with screw-down cover and each cover is sealed with an "O" ring. The cover of each box has a fitting with a scew in plug to allow the box to be filled with oil after the transducer is attached to the cover and the cover replaced on the box. Ensure that when the cover is replaced with the transducer(s) attached, that the cover is firmly and evenly screwed down all the way around and that the "O" ring is sufficiently compressed to make a good seal.

The oil used to fill the transducer box(es) is important to the percentage of efficiency loss. Bertram recommends that you these box(es) with one of the following oils:

1. EXXON "UNIVOLT" N 60 or N 61

2. any mineral insulating oil that meets the specifications of ANSI/ASTM D 3487, Type I or Type II.

R. OVERHEAD ROD LOCKER LATCH ADJUSTMENT

Do not mount equipment on top of door. Additional weight may cause inadvertant opening of door.

To adjust the overhead rod locker latches:

1) With the latch in the open (unlatched) position, tighten the adjustment nut on each latch 1/2 turn.

2) If the latch(es) are still are still too loose, repeat step 1).

S. INSPECTION AND REPAIR OF EXHAUST RISER INSULATION

1. Inspection.

a. Frequency of Inspection

1) Biannualy;

2) after repair work on the exhaust system; or,

3) if damage to the insulation is observed or suspected.

b. How to Inspect

NOTE:

Inspect only when the exhaust system is cool.

Visually examine the insulation for any one or more of the following conditions that will require repair:

1) Crack(s);

2) split(s);

3) tear(s); and/or,

4) a light colored threadbare appearence.

2. REPAIR PROCEDURE.

a. Material: DEVCON - WEAR RESISTANT LIQUID

Stock Nr. - 11220

b. Purchase from:

1) Bertram Yacht Spare Parts; or,

2) Hanlon and Wilson
P.O. Box 641
Jeanette, Pa. 15644

c. Preparation

1) Surface Preparation. The surface of the area to be repaired and the surrounding surface area for two (2) inches must be completely dry, and free of all oil, dust, and/or cleaning agents.

2) Mixing.

Mixing by volume:

Four (4) parts of resin to one (1) part of hardener.

Mixing by weight:

Nine (9) parts of resin to one (1) part of hardener.

In a well ventilated area, add the hardener to the resin. Mix thoroughly until a uniform consistancy is obtained which should take approximately 4 minutes. Be sure to stir in the material from the bottom and sides of the mixing container.

3) Application. Pour, trowl, or brush a one-half inch (1/2") thick coating of epoxy over the properly prepared surface. Epoxy working time (pot time) is 50 minutes at 75°F.

4) Cure

NOTES:

a) Never expose epoxy to a direct flame.

b) Carefully read the instructions and especially the warnings on the epoxy containers before using this product.

A one-half inch (1/2") thick section of epoxy will harden in four (4) hours at 75°F. This same 1/2-inch section will be fully cured in 16 hours at 75°F. The epoxy will not cure properly at temperatures below 60°F. To speed up the cure time, place a heat lamp approximately 18 inches from the repaired area.

SECTION V. - STORING YOUR BERTRAM

A. DRY STORAGE

Indoor storage is the generally preferred method for storing your Bertram providing there is good ventilation and the location is otherwise safe and dry. For any special instructions on a covering for outdoor storage, refer to "Docking Plan" drawing.

1. Dry Bilge

1) "**OPEN**" all valves and/or seacocks;

2) flush each toilet two or three times to clean out the system;

3) have the holding tank flushed and pumped out;

4) where possible, drain the water from the following to prevent damage from freezing in cold climates and water stagnation in warm climates:

a) Tanks;

b) fresh water lines;

c) seawater cooling system lines for the engines and a.c. generators;

d) all bilges;

e) sewage lines; and,

f) pumps.

5) If the local weather requires, add a non-alcohol based antifreeze to low position water lines that you cannot drain.

6) If possible, remove the fresh water pump and its motor for storage. If the pump must stay on-board for the winter, drain thoroughly and remove the pump inlet and outlet connections.

2. Electric and electronic Equipment. The best practice is to remove and store the electrical and electronic equipment in a safe, warm, and dry place over the winter.

3. Ventilating Your Bertram

1) Open the windows and hatches sufficiently to allow the air to circulate.

2) Leave the locker doors and the drawers open.

3) Wash and thoroughly dry the ice chests and the refrigerator.

4) If possible clean and store mattresses and cushions in a dry place. If they must be left aboard, prop up on one end for the maximum ventilation.

5) Synthetic, nylon and polypropolene, dock, anchor, and working lines need only proper handling and occasional cleaning.

6) Natural fiber anchor, working, and dock lines should be carefully dried and kept in a cool, well ventilated place.

CAUTION

When preparing the toilets for storage, do not put oil on any rubber or leather parts.

7) With any ships toilet, after the holding tank, the seawater supply, and the discharge lines are flushed and drained; apply a light coat of oil to all metal parts.

8) To protect chrome, stainless steel, or aluminum deck hardware:

a) First remove all salt deposits with fresh water,

b) then clean with a good quality, non-abrasive type metal cleaner; and,

c) give items a light coat of grease.

4. Diesel Engines and Motor-Generators

NOTE:

Diesel engine maintenance should be performed by a trained, qualified diesel mechanic.

1) Clean the air cleaners thoroughly, do not service the air cleaners with oil;

2) cover or seal exposed air intake openings;

3) clean governor linkage thoroughly;

4) lubricate only the metal ball joints with graphite, do not lubricate the plastic ball joints;

5) with the engine still warm, drain the engine lubricating oil;

6) replace the lubricating oil;

7) remove the fuel injectors;

8) pour in two (2) tablespoons of rust inhibitor oil (SAE 10 substitute) into each cylinder;

9) crank the engine over by hand several complete revolutions to lubricate cylinder walls, pistons, and rings;

10) lubricate fuel injector threads lightly;

11) install fuel injectors;

12) remove and replace oil filters;

13) clean crankcase breather valve;

14) drain the entire cooling system including:

a) water cooled exhaust manifolds;

b) water cooled exhaust lines;

c) heat exchangers; and,

d) engine cylinder blocks;

15) If freezing temperatures are expected, the cooling systems may be filled with a good quality ethelene glycol antifreeze.

16) Remove dust and dirt deposits from control box and junction boxes with dry, low-pressure air.

17) Cover or seal all exposed openings (i.e., exhaust outlets, cooling passages, hoses, etc.).

18) Inspect exhaust system for deterioration and/or leaks.

CAUTION

Discharged batteries are subject to severe damage if exposed to freezing temperatures. Store all batteries in a fully charged condition and maintain charge during storage.

19) Disconnect batteries and remove from your vessel.

20) Coat the battery cable connections with grease.

21) During storage, check and replace battery fluid and use a trickle charger to maintain the battery voltage

B. WET STORAGE

Follow A. (Dry Storage) ,except that:

1) all seacocks and valves must first be checked for freedom of movement and then placed in the "**CLOSED**" position and

2) that the vessel's batteries will remain on board with the main battery switches in the "**OFF**" position;

All of the other steps required to prepare your vessel for dry storage applies to wet storage also. However, Bertram also recommends that:

1) The zinc "fish" be used as pointed out in the Maintenance Section under "Electrolysis";

2) the bilge pumps should be in the "AUTO" (automatic) mode; and,

3) provision for dockside electrical power should be made to keep the batteries charged.

C. FITTING OUT

To ensure maximum boating safety and that you get the maximum pleasure and enjoyment from your Bertram after an extended lay up, a thorough check of your vessel and her on-board equipment is necessary with the required maintenance being done as indicated. The following list is intended only to serve as a guide for the more important items to be accomplished (not necessarily in the order to be done.)

NOTE:

PRE-LAUNCH and Post Launch Checks
In all likelihood, if you are taking delivery of a new bertram, she has been delivered to you in the water with all of the following checks made by your Bertram dealer. However, if your Bertram was hauled and stored for the winter, and you are fitting out for the new season, be sure to these checks are made.

D. PRE-LAUNCH

Check to be certain that:

1) All thru-hull fittings and their associated strainers are clean and secure;

2) both shafts should turn freely;

3) the propeller nuts, jam nuts, and cotter pins are secured;

4) the rudders fit well in the rudder port; and,

5) the set screws holding bearing shells on the struts are in place.

E. POST-LAUNCH

Check to be certain that:

1) If moored, that the electrical, water supply and discharge, and sewage discharge lines are secured at both ends;

2) all fittings are tight;

3) both propeller shaft stuffing boxes are properly adjusted;

4) the shaft alignment is checked per the procedure outlined in Part III, Section IV of this manual;

5) the rudder packing glands are properly adjusted;

6) the bilge pumps are working; and,

7) the heat removal blowers are working.

F. ELECTRICAL SYSTEM CHECK

Before putting to sea for the first time after taking your Bertram out of storage, check to ensure that:

1) The batteries are properly charged. If they indicate a reading of less than 1.220 sg. have them charged.

2) The engine wire looms are:

a) In good repair;

b) Secure;

c) away from the exhaust manifolds; and,

d) all electrical connections are tight.

3. Check each piece of standard and optional electrically operated equipment to make sure each is working properly.

G. DIESEL ENGINE and AC GENERATOR CHECK

NOTE:

Diesel engine maintenance should be performed by a trained, qualified diesel mechanic.

Before putting to sea for the first time after taking your Bertram out of storage, check to ensure that:

1) The following are (1) in good repair; (2) secure; and, (3) all fittings are tight:

a) The fuel lines;

b) the cooling lines;

c) the exhaust system; and,

d) the engine mount fastenings.

2) Check that the engines, transmissions, and shafts are in the proper alignment per the specifications given in Part III, Section IV of this manual.

3) Remove all protective wrappings;

4) wipe the oil off of all the exposed engine and generator parts;

5) remove the plugs from the exhaust outlets;

6) visually inspect each engine and motor-generator for signs of damage and/or rust;

7) check the oil level;

8) if removed for dry storage: reinstall the batteries;

a) be sure the batteries are fully charged; and,

b) that the proper polarity is observed (ground is negative).

9) check fuel system for moisture or contamination, if moisture or contamination is found:

a) bleed the fuel system;

b) clean the primary fuel filter; and,

c) replace secondary fuel filter.

10) check closed cooling system and top up anti-freeze mixture;

11) Open sea cocks;

12) turn on fuel and prime the engines and motor-generators;

13) remove all loads and start the engines and motor-generators;

NOTE:

Diesel engines and motor-generators may be slow to start due to the rust inhibiting oil or to rust in the cylinders. Excessive smoke and rough operation will occur until the oil or rust inhibitor is burned off.

14) Do not apply a load until the engines or motor-generators run smoothly. Then apply not more than a 50% load for the first hour then slowly work up to the maximum load.

H. CONTROLS CHECK

Before putting to sea for the first time after taking your Bertram out of storage, check to ensure that:

1) The clutches are properly adjusted;

2) all clutch fittings are secured;

3) that the shift levers on the transmission have full engagement when control levers on the flybridge are moved to full ahead or full astern;

4) both throttles are properly adjusted;

5) all throttle fittings are secured;

6) check to be sure that the throttle and governor linkages move freely;

7) the steering is positive;

8) the steering linkage is secure;

9) the steering system hydraulic fluid reservoir has the correct amount of hydraulic fluid;

10) the rudder moves freely; and,

11) all gauges and indicators are fully operational (check after starting engines).

SECTION VI. - FIBERGLASS CARE

A. GENERAL

These maintenance recommendations will help you keep this unique material in factory new condition.

B. SEASONAL CARE (at fitting out time)

1) Clean the surface with soap and water.

2) Treat with white automotive type polishing compound; use this polish lightly and follow the manufacturer's directions.

3) Wax and polish the gelcoat surface with a paste type of automobile wax.

NOTES:

a) Some modern paste wax products provide both rubbing and waxing action in one. These products are acceptable.

b) fiberglass repairs more extensive than those described here should be made only with the help and advice of your Bertram dealer.

1. Loss of Gloss To restore store the glossy appearance of the gelcoat surfaces, a light buffing may be advisable.

1) For hand buffing, use a slightly abrasive rubbing compound similar to DuPont Number 7l; or

2) If a power buffer is used, Bertram recommends that MirrorGlaze Number 1 or a similar product be used.

3) After buffing, the gelcoat surface should be waxed and polished as described above for "Seasonal Care".

2. Stains. The fiberglass gelcoat surface on your Bertram was chosen to retain its beauty and be highly resistant to most stains. Table III-VI-1, Stain Removers For Fiberglass, lists the Bertram recommended stain removers. If none of the methods shown in Table III- VI-1 are successful, it may be necessary to sand down through the gelcoat to remove the stain.

3. Scratches & Abrasions. Those scratches and/or abrasions that do not penetrate the full thickness of the gelcoat can usually be treated by lightly sanding and buffing the area. Larger scratches that do penetrate the gelcoat but do not go deeply into the fiberglass or weaken the structure can also usually be repaired as follows:

1) Clean the damaged area first with mineral spirits or turpentine to remove dirt and wax, then follow with a detergent and rinse, and allow to dry completely.

2) Secure a small amount of pigmented gelcoat resin who's color matches the color of the area to be repaired. This material should be available to you from your Bertram dealer.

3) Add two drops of catalyst per cubic inch of gelcoat and mix thoroughly; the mixture will gel in approximately 15 minutes.

4) Fill the scratch with the mixture before the mixture hardens.

5) Round the patch off to about 1/16 of an inch to 1/8 of an inch above the surrounding surface.

6) Lay a piece of waxed paper or cellophane on top of the patch and press lightly to remove any trapped air. Take off the waxed paper after at least 20 minutes and allow the patch to cure overnight.

TABLE III-VI-1, STAIN REMOVERS FOR FIBERGLASS

STAIN	RECOMMENDED REMOVER
Common stains	Household detergent, in water or straight
Crayon, lipstick, & shoe polish	Alcohol
Ink spots	Ajax cleanser
Resistant stains	Ammonia cleaners or a weak solution of hydrochloric acid

7) Lightly sand the area with 600 grit wet sandpaper.

8) Finish the patch by rubbing and buffing with a commercial buffing compound.

C. PAINTING FIBERGLASS SURFACES

NOTE:

Do not paint on zinc(s) and use only the manufacturer's recommended paint on depth sounder transducers.

1) Thoroughly clean all of the dirt and grease from the fiberglass part to be painted with mineral spirits, turpentine, or other commercial solvents.

2) Wash with a detergent and water solution and rinse.

3) After the surface is dry, sand it lightly with garnet, fine oxide, wet and dry, or 220 sandpaper. Wipe the surface clean of all dust.

4) Apply two thin coats of primer following the directions of the marine paint manufacturer.

5) Apply the marine paint as recommended by the manufacturer.

D. BOTTOM ANTI-FOULING PAINT

1. General. Bottom anti-fouling paints should only be applied per the manufacturer's instructions. Before repainting any vessel's bottom, a check should be made to ensure that the brand and type of paint chosen are fully compatible with the type presently on the vessel's bottom.

NOTE:

Some types of bottom paint are not compatible unless a primer is used first.

2. Before Applying Anti-Fouling Paint. Preparation before applying any additional anti-fouling paint should include making sure the trim tab assemblies are covered (masked off), particularly the hydraulic cylinder piston rods. Take care to ensure that the lower portion of the cylinder where the ram comes out of the cylinder has been fully protected.

E. BOTTOM BLISTERS

Regardless of the quality of the materials used and of the care taken in construction, bottom blisters may occur on any fiberglass hull. If you do observe bottom blisters, Bertram suggests that you contact the Bertram Service Department before you attempt any repairs.

F. NON-FIBERGLASS PLASTICS

In addition to Fiberglass Reinforced Plastic (FRP), better known as fiberglass, your Bertram has both acrylic and Acrylonitrile Butadiene Styrene (ABS) parts. These parts are light weight and are very strong. However, they are relatively soft and their surfaces can easily be scratched by improper cleaning. The scrubbing that may be necessary to clean a badly soiled fiberglass deck or hull surface should never be used to clean these parts.

When installing or reinstalling an acrylic or ABS part that is fastened with screws, do not use a power screwdriver to run the screws all the way down. Make the last few turns by hand to avoid over-tightening and stress-cracking the part.

1. Acrylic Parts

Do not use solvents such as lacquer thinner, acetone, or mineral spirits, and do not use abrasive cleaners for cleaning acrylic parts. Use mild detergent in warm water and 100% natural (cotton) cloths or a commercial plastic cleaner such as "Novus" Number 1 Plastic Polish. Use "Novus" Number 2 Plastic Polish as directed to remove fine scratches.

Acrylic plastics are much tougher than glass and are resistant to stains, sea spray, and sunlight. However, they are readily scratched by hard objects, grit, or abrasives such as scouring powders and they are readily attacked by solvents such as acetone, mineral spirits and lacquer thinner.

To clean acrylic plastic, use a prepared commercial cleaner such as *Novus* plastic polish number 1 or a solution of a mild detergent such as *Formula 407* or *Fantastic* in warm water with a soft, 100% cotton cloth.

2. ABS Plastics

Do not use solvents such as lacquer thinner, acetone, nor mineral spirits nor an abrasive cleaner for cleaning ABS plastic parts. Use a mild detergent in warm water and 100% natural (cotton) cloths on painted ABS surfaces. Use a commercial liquid cleaner such as *Armorall* on unpainted ABS surfaces.

Bertram uses both painted and unpainted ABS plastic parts.

Unpainted ABS can be cleaned with a commercial plastics cleaner such as *Armorall* cleaner.

Painted ABS looks very much like fiberglass but must not be scrubbed. Painted ABS should be cleaned with a solution of water and mild detergent such as *Formula 407* or *Fantastic*, using a soft sponge or a soft all-cotton cloth.