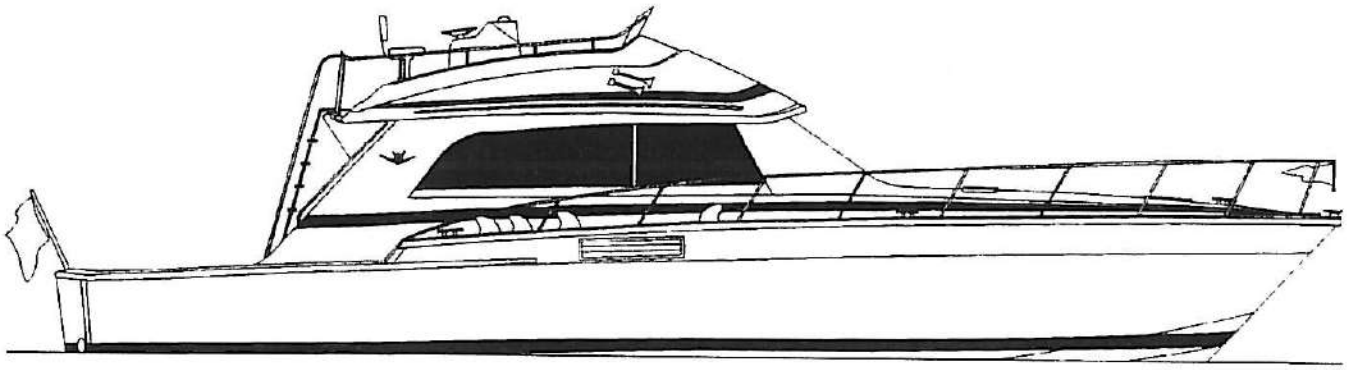
BERTRAM



Operator's Manual

54' Convertible

Model 545
Part Number 18A7740
Rev. D
Issue 0672

BERTRAM YACHT
A DIVISION OF BERTRAM-TROJAN, Inc.

3663 NW 21st Street
Miami, Florida 33142

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 four 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, trouble-shooting, and service information.

Part IV contains supplementary illustrations including the docking plan and electrical and mechanical drawings.

In addition to this operator's manual you will find:

1) an envelope containing important warranty information -- open this immediately;
2) a package containing 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.

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

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:

WARNING

Failure to heed a WARNING may result in death or serious injury.

CAUTION

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 which may not be 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.

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Part I: Introduction

Section 1

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 that were 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.

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

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 yachts up to 72 feet in length.

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.

In the engineering and design areas, this is a basically conservative engineering-oriented company, but it has led the way in several areas. Bertram was 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.

An ongoing program of research in design, material applications and construction methods provides results that -- when proven -- are applied to Bertram vessels. Only the finest techniques are used to produce power boats that carry on the Bertram legend of strength and beauty.

Section 2

Terminology

There are three Glossaries included here for your reference.

The first covers terms and definitions peculiar to Yachting.

The second explains terms used to describe Waves.

The third covers terminology used in describing Weather.

These glossaries are not 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.

Yachting Terms

Abaft. Closer to 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. Toward the stern; abaft.

Athwartships. Along a line running perpendicular to the keel.

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

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.

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

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 stem. 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.

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.

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

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 ---

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.

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);

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.

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Section 1

Technical Data

Vessel Specifications

Vessel Name

Hailing Port

Owner's Name

Owner's Address

Hull Number | Door Key Number | Registration Number

Length Overall	54 feet, 0 inches
Beam	16 feet, 11 inches
Draft	5 feet, 0 inches
Fuel Capacity	1419 U.S. gallons[1]
Water Capacity	250 U.S. gallons
Tonnage *(a volume unit of measure)*	
Gross	53.39
Net	42.71
Displacement *(in pounds)*	75,400 (with full fuel & water, 8 people and 1,200 pounds of gear)

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

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

Main Engines and Transmissions

Port Engine Serial Number	Starboard Engine Serial Number
Port Gear Serial Number	Starboard Gear Serial Number
Engine Manufacturer	Detroit Diesel Corp.
Model Number	12V92TA
Gear Manufacturer	Zahnradfabrik Friedrichshafen AG
Model Number	BW195
Gear Ratio	1.52:1
Fuel Filter (Primary)	Racor 75/1000MA
Element	Racor 2020SM
Fuel Filter (Secondary) and Element	AC TP-624
Lube Oil Filter and Element	AC PF-911
Air Filter Element	Donaldson P12-4860

Propulsion System Alarm Settings

The table below shows the approximate settings of the propulsion system audio/visual alarms.

Table 1-1: Propulsion System Alarm Settings

Function	*Approximate Setting*
Engine Coolant High Temperature	210°F +/- 8°F
Engine Oil Low Pressure	4 psig
Transmission Oil High Temperature	210°F +/- 8°F
Engine Cooling Seawater High Temperature	180°F

Engine Batteries

Manufacturer	Surrette
Model Number	8ST-205
Voltage	8Vdc
Capacity	205 Ampere-hours
Cold Cranking Capacity	900 Amperes
Reserve Capacity	380 Minutes

Lubricating Oil Transfer System

Tank Capacity	40 gallons
Pump Flow Rate	2 gallons per minute

Propeller Shafts

Material	Stainless steel
Bertram Part Number	08D4362-30

Propellers

Style	3-Blade Cupped (Equipoise)
Diameter	30 inches
Pitch	34 inches
Material	Nibral
Port Rotation	Left Hand (Bertram Part No. 08S30149-33)
Starboard Rotation	Right Hand (Bertram Part No. 08S30149-34)

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

Fuel Tanks

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

Table 1-2: Fuel Gauge Readings vs. Fuel Tank Contents

Gauge Reading	*Fwd Tanks (each)*	*Aft Tank*	*Aux Tank*
FULL	280* gallons	609* gallons	250* gallons
3/4	187* gallons	426* gallons	186* gallons
1/2	102* gallons	153* gallons	123* gallons
1/4	33* gallons	39* gallons	60* gallons
EMPTY	0 gallons	0 gallons	0 gallons

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

Diesel Generators

Port Generator Serial Number	Starboard Generator Serial Number
Manufacturer	Onan
Model	15MDL3-3CR
Capacity	15kW
Voltage	120/240Vac
Phase	Single
Frequency	60 Hz
Fuel Filter - Primary Element	Racor 500MA
Fuel Filter - Secondary Element	Onan 1491758
Lube Oil Filter	Onan 122-0602

Generator Batteries

Manufacturer	Surrette
Model Number	8D-210-300
Voltage	12Vdc
Capacity	210 Ampere-hours
Cold Cranking Capacity	900 Amperes
Reserve Capacity	390 Minutes

Ventilation and Exhaust Blowers

Head Exhaust Blowers:	Three 150 cfm (cubic feet per minute), 32Vdc (one in each head)
Head Ventilation Blowers:	Three 55 cfm (cubic feet per minute), 32Vdc (one in each head)
Galley Exhaust Blowers:	One 110 cfm, 120Vac
Engine/Generator Room Fume Removal Blowers:	Two 250 cfm, 32Vdc, thermostatically controlled (**ON** at 110°F and **OFF** at 90°F) with manual override switch

Bilge and Sump Pumps

Bilge Pumps	1,750 gallons per hour rated capacity
Engine Room Sump Pump	330 gallons per hour rated capacity
Shower Sump Pump	550 gallons per hour rated capacity
Engine-Driven Auxiliary Bilge Pump (Optional)	1,680 gallons per hour rated capacity at 1,400 rpm

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

Navigation Lights

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

Table 1-3: Replacement Navigation Light Bulbs

Location	Size	Replacement Bulb
Side Lights	12V, 25W	Aqua-Signal Part #90400002
Bow Light	12V, 25W	Aqua-Signal Part #90400002
Stern Light	12V, 12cp	Perko Part #70 No. 0
Anchor Light	12V, 6cp	Perko Part #337 No. 11

This page contains no additional data.

Performance Charts -- Factory-Generated

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

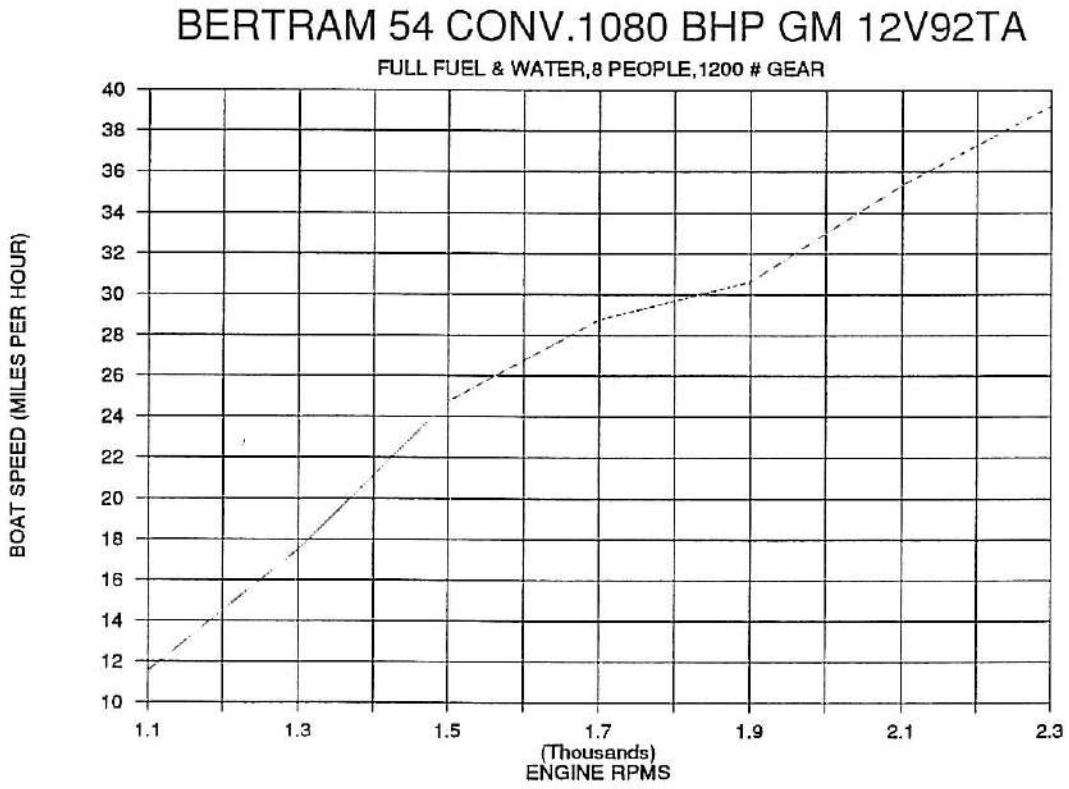
Many factors may affect actual performance obtained. These may include, but are not limited to, installation of certain options, presence of a tuna tower, boat loading and trim, weather conditions, water depth, engine and boat condition, propeller condition, manufacturing tolerances, and other factors.

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 an example. *They should be used for reference only.*

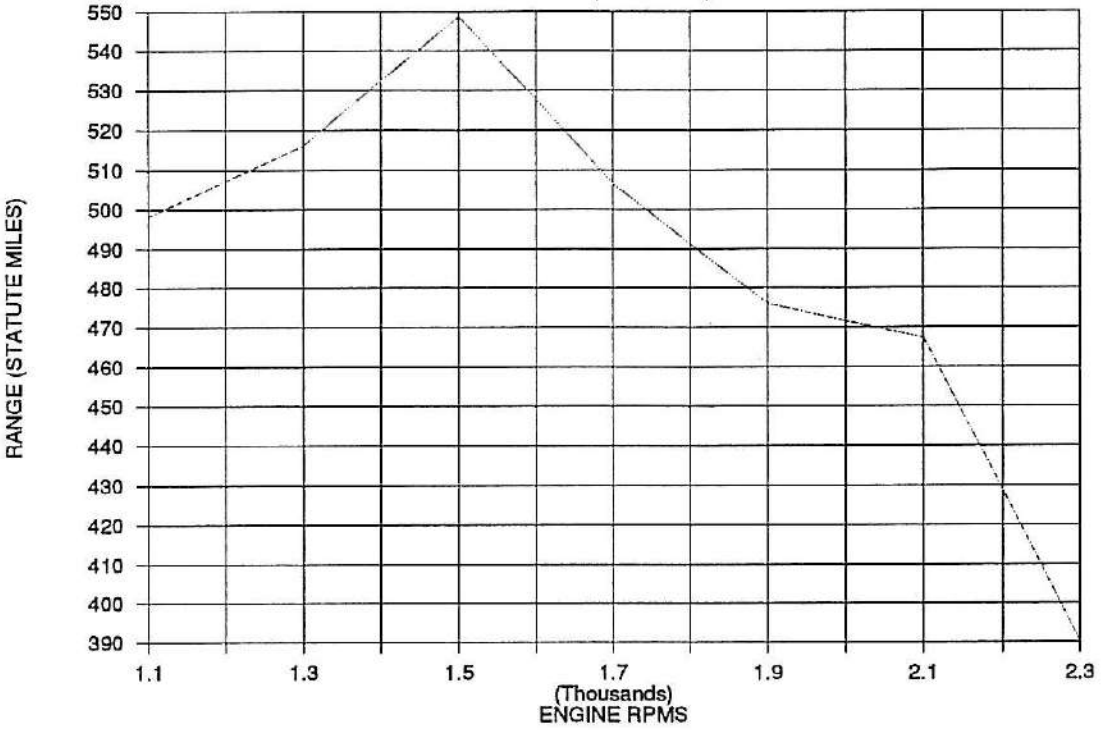
The last three charts are left blank for you to plot in curves of data you obtain on your own boat.

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



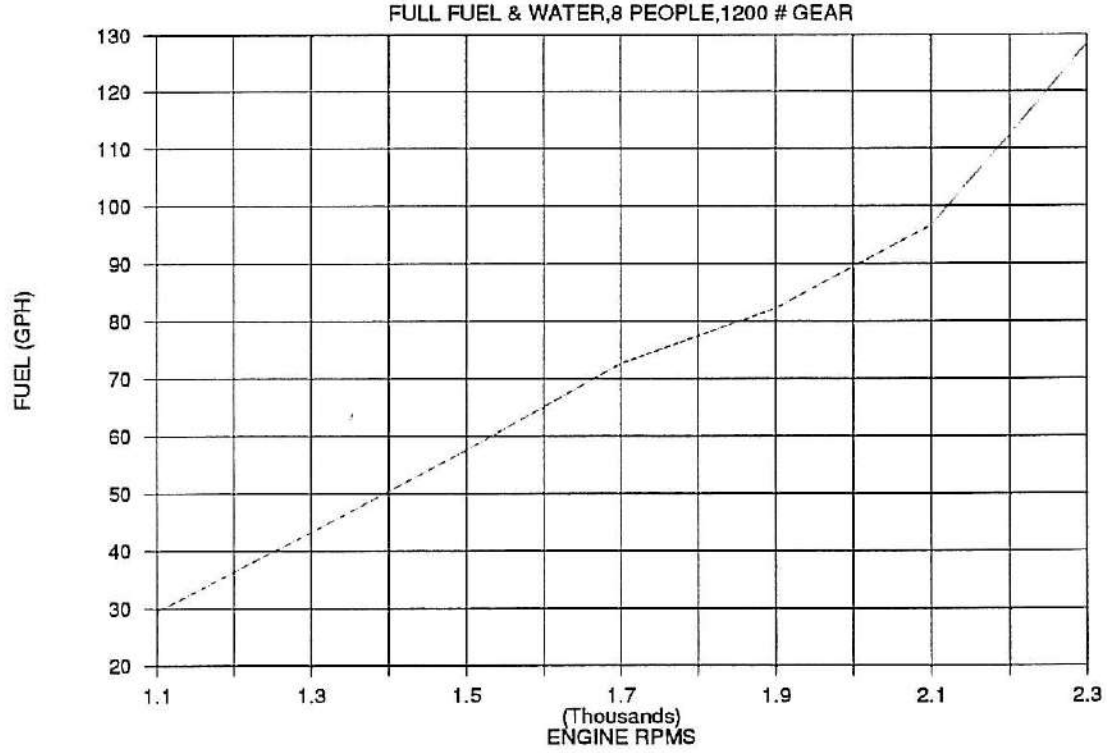
BERTRAM 54 CONV. 1080 BHP GM 12V92TA

FULL FUEL & WATER,8 PEOPLE, 1200 # GEAR



BERTRAM 54 CONV.1080 BHP GM 12V92TA

FULL FUEL & WATER,8 PEOPLE,1200 # GEAR



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.

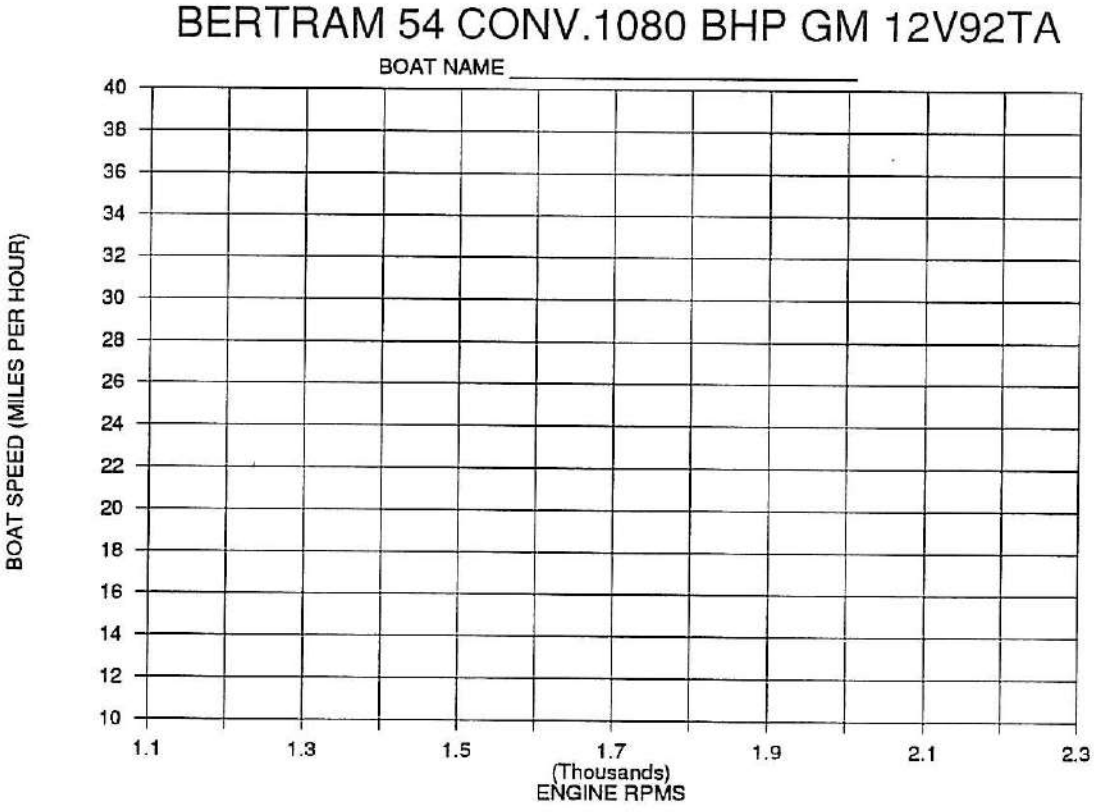
Based on prudent seamanship, Range is calculated on 90% of the fuel tank label capacity.

The three charts on the previous pages are furnished as an example. *They should be used for reference only.*

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:

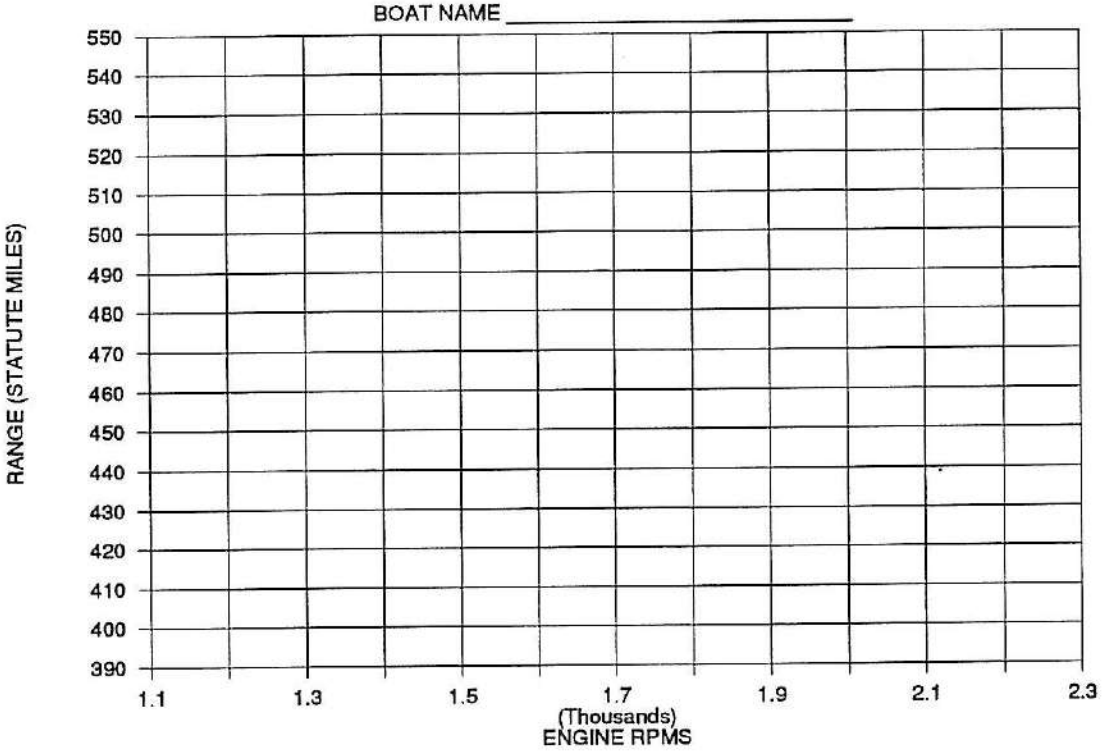
You should use the charts you have generated with your own vessel when planning your trips.



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

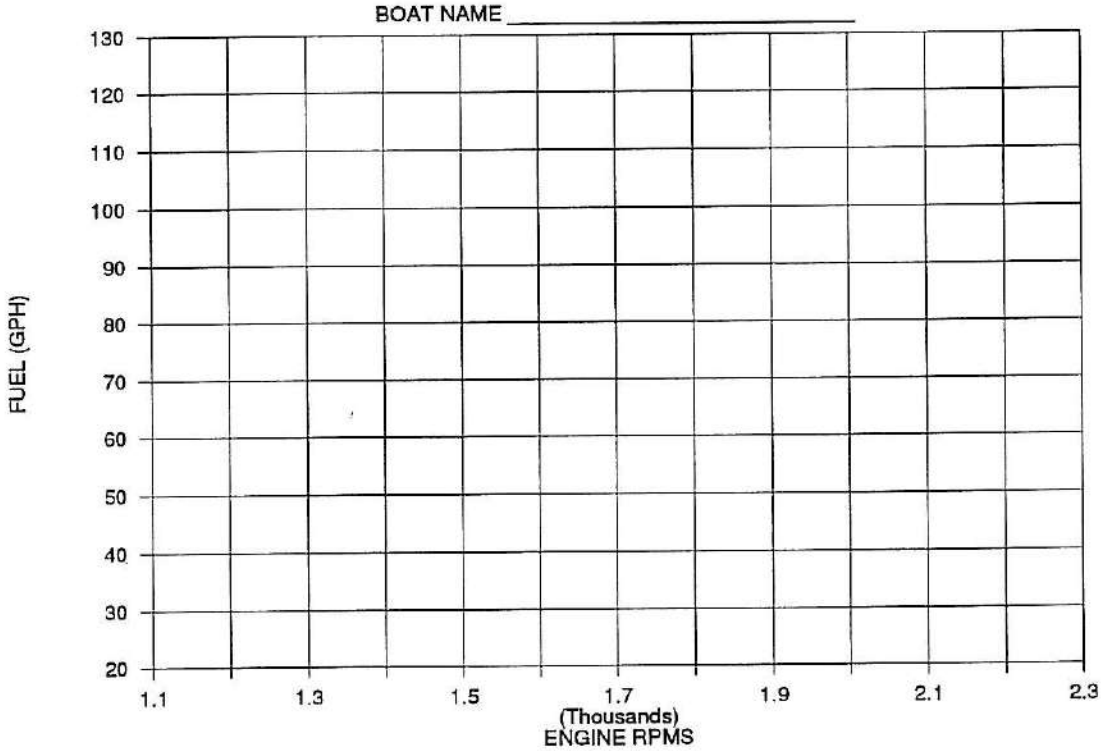
BERTRAM 54 CONV. 1080 BHP GM 12V92TA

BOAT NAME _____



BERTRAM 54 CONV.1080 BHP GM 12V92TA

BOAT NAME _____



Section 2

Operating Your Bertram

This section describes your Bertram's controls, instruments and indicators, and explains how to operate the vessel.

It also alerts you to precautions that help minimize the chances of injury to you or your guests aboard, and of damage to your vessel.

NOTE:
Do not attempt to operate this vessel until you are familiar with the contents of this manual and the manuals of all your vessel's on-board systems. Included in or with this manual are the appropriate ***Warning*** *and* ***Caution*** *notices plus operating and maintenance information for each factory-installed system.*

Your Bertram's underway maneuvering controls and almost all of your Bertram's remaining functions are managed from the flybridge control station. The exceptions are:

1) some of the main electrical distribution functions; these are managed from distribution panels in the salon, the galley, and the engine/generator room (***Section 10A***, ***Section 10B*** and ***Section 11***);
2) entertainment functions; these are managed from the salon and the cabins;
3) galley appliances;
4) fuel tank selection; this is managed from the engine/generator room (***Section 5*** under ***Fuel System***);
5) climate control functions; these are managed from the cabins (see the Owner's Manual, provided separately);
6) lubrication oil transfer; this is managed from the engine/generator room.

Flybridge Control Station

NOTE:
The instrument and switch panels are protected by hinged clear acrylic covers. Do not discard these covers. The switches are not waterproof, and electrical damage may result if water gets behind these panels.

The controls, instruments and alarm systems on the flybridge control console are shown in Figure 2-1. This is your vessel's main navigation and engine control station (if you are heavily involved in deep sea fishing, an optional Cockpit Engine Control Station is available, but it is not a navigation station; it is discussed in ***Part II, Section 4***).

The flybridge navigation and engine control station is equipped with:

- engine controls;
- transmission controls;
- rudder controls;
- engine performance instruments;
- battery condition meters;
- system and accessory control switches and indicators;

- alarm systems switches and indicators;
- generator running indicators;
- trim tab controls;
- horn switch;
- magnetic compass;
- emergency engine stop;
- optional features you have ordered.

Engine, Transmission and Rudder Controls

All the controls necessary to operate your Bertram's engines and maneuvering functions are located on the flybridge control console. These controls include throttles, clutch/transmission controls, and the steering controls.

Throttle Controls

The main engine throttle controls for your Bertram are twin levers on the flybridge control console, starboard of the helm. The starboard lever controls the starboard engine's speed, and is connected to the engine's governor mechanism by push-pull cable. The port lever similarlycontrols the port engine.

Push the levers forward to increase engine speed and pull back to reduce speed. The farthest aft position is the **IDLE** position.

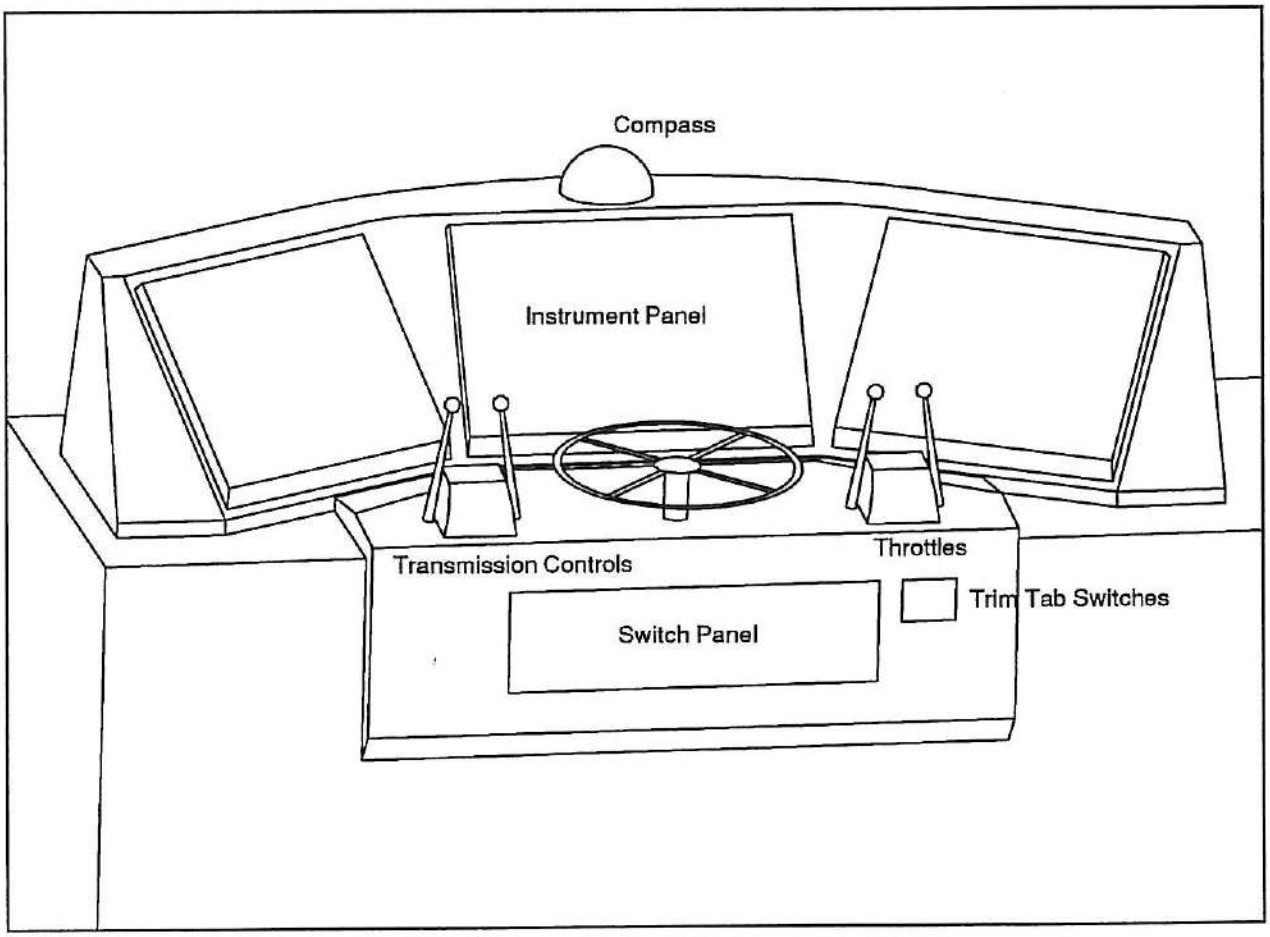


Figure 2-1: Flybridge Control Console

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.

The engine synchronizer compares the rpm of the "slave" engine to that of the "lead" engine. When the rpm do not match, the synchronizer 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".

You should use the synchronizer only when you are in open waters, not in confined areas or when maneuvering.

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** light on the flybridge instrument panel will illuminate.
4) Move the "slave" (starboard) engine throttle to the maximum speed position. (There should be no change in starboard engine rpm.)
5) Both engines are now under the control of the port "lead" engine throttle.

Once the synchronizer controls the "slave" engine, the starboard throttle control is not functional. Although moving the starboard throttle to its maximum speed position is not absolutely necessary to the synchronizer's operation, this step eliminates the unnecessary strain of moving this cable and its linkage from the synchronizer, thus reducing wear on the synchronizer and prolonging its life.

NOTE:
If the master throttle is moved all the way back to idle or all the way forward to full throttle, the synchronizer will automatically deactivate. The unit is inoperative and must be reactivated by switching OFF and ON again after a throttle position change.

To Disengage the Sychronizer:

1) Switch the synchronizer to **OFF**.
2) The red **SYNCHRONIZER** light on the flybridge instrument panel will extinguish.
3) Move the "slave" engine throttle to idle.

The starboard "slave" engine throttle automatically reengages the engine throttle linkage. A built-in safety collar on the synchronizer ensures a positive return to idle speed when you switch the synchronizer OFF and move the throttle back to idle.

Clutch & Transmission Controls

CAUTION

To avoid transmission damage while maneuvering, do not shift until engine speeds have dropped to idle.

The clutch/transmission controls for your Bertram are twin levers with black knobs on the flybridge control console, port of the helm. A detent at the midpoint of the levers' travel lets you feel the **NEUTRAL** position.

Push the levers forward of **NEUTRAL** to put the transmissions in **FORWARD**, and pull the levers back past **NEUTRAL** to put the transmissions in **REVERSE**.

Before shifting gears to the opposite direction, it is vital that you *always* throttle back your engines, let them to slow to an idle, and pause with the transmissions in idle. This pause lets

the hydraulic pressure within your transmissions drop to a lower level, with three positive results:

1) it reduces transmission wear and tear;
2) it allows easier shifting;
3) it allows you to be sure you have fully engaged the transmission(s) in forward or reverse.

Maneuvering at speeds above **IDLE** should almost always be done with the rudders only and should not normally involve reversing either transmission.

Rudder Control System

To help you maneuver at normal cruising speeds, your Bertram is equipped with a positive-control hydraulic steering system moving twin balanced rudders.

The rudders are stern mounted and the flybridge control station is about amidships, so steering effect seems different from a car, where the steering action takes place up front. Essentially, though, the results are the same.

The 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 the drag on your vessel.

See ***Part III, Section 3*** under ***Onboard Systems Troubleshooting*** for detailed information on refilling and purging your hydraulic steering system. Figure 3-1 in that section is an illustration of the system.

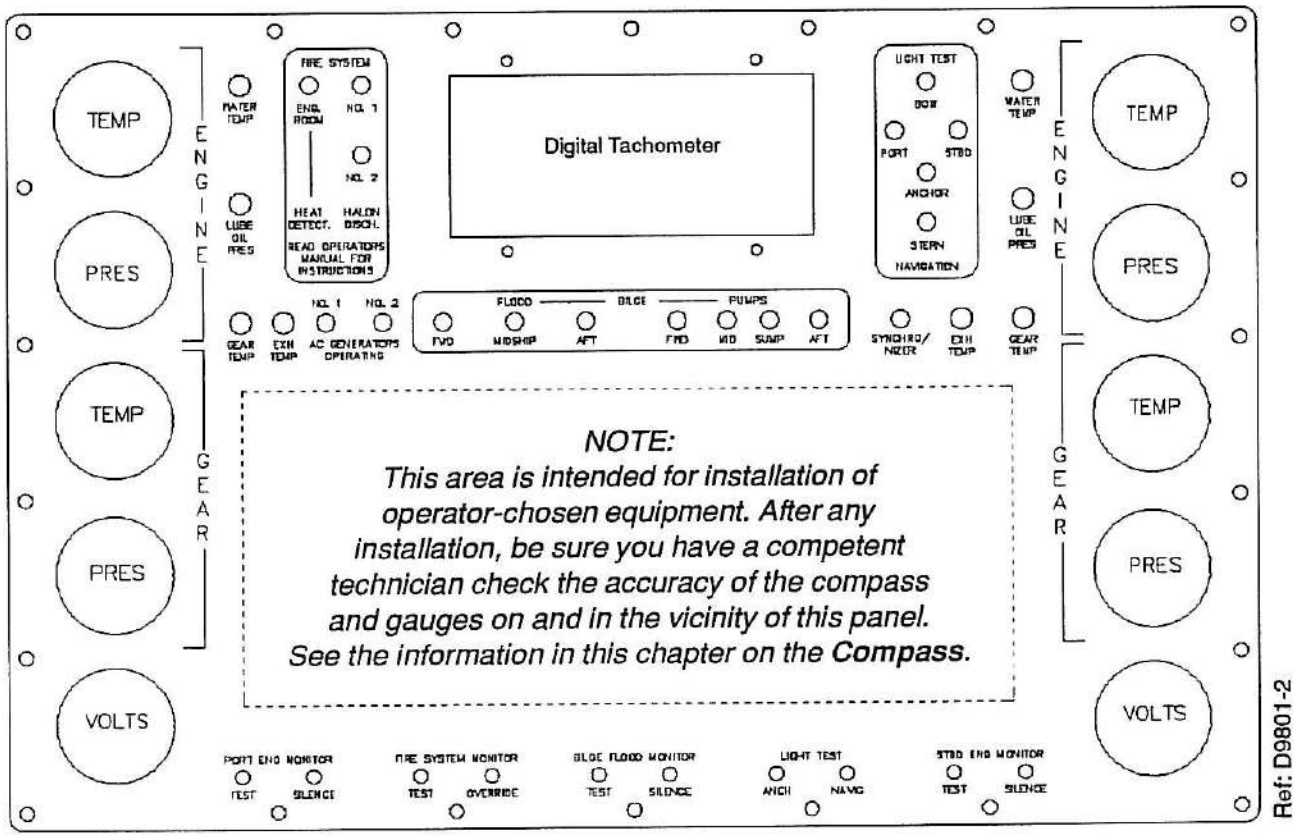


Figure 2-2: Flybridge Control Console Instrument Panel

Cockpit Engine Control Station (Optional)

For vessel owners heavily involved in deep sea fishing, an optional Cockpit Engine Control Station is available. This control station is -- as its name implies -- a station for **engine control only.** It is not intended for use in navigating your vessel.

Although it does have throttle and transmission controls, it is not equipped with a steering wheel (helm), engine performance gauges, or alarm monitors.

If your Bertram has this optional system, please read the information in ***Part II, Section 4*** on the ***Cockpit Engine Control Station.***

Engine Performance Instruments

As shown in Figure 2-2, the instrument panel has a dual digital tachometer in the center and two sets of four engine performance gauges, one mounted on each side. The port gauge set is for the port engine/transmission and the starboard set is for the starboard engine/transmission. These gauges keep you aware of the status of each critical engine system parameter. Reading from top to bottom, they are:

a) **ENGINE COOLANT TEMPERATURE;**
b) **ENGINE OIL PRESSURE;**
c) **GEAR OIL TEMPERATURE;**
d) **GEAR OIL PRESSURE .**

Tachometer

The digital dual tachometer mounted in the top center of the instrument panel displays a continuous digital readout of your main engines' speed in revolutions per minute (rpm). This serves you several ways:

- it gives a good indication of relative engine performance;
- it permits engine speed settings for fuel efficiency;
- it helps to estimate speed, which is useful in solving navigational problems involving speed, time, and distance;
- it serves as a visual synchronizer to balance engine speeds.

Operation

The engine tachometer simultaneously displays both engines' speeds 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 drop from your Bertram's maximum rpm is a good indication that something could be wrong. You should stop and check your engines and running gear to limit any damage.

Estimating Speeds

You can use your tachometer to make a series of timed test runs back and forth over a measured course at different rpm readings. These will give you a good tool for estimating speed, but there is no direct correlation of rpm to the speed of the boat across the bottom. Several factors affect the accuracy of your calculations:

- slippage of the propellers;
- the effect of wind on the vessel's superstructure;
- the effect of tides or currents;
- the condition of the vessel's bottom;
- variations in load.

Visual Engine Synchronizer

The digital tachometer has a built-in visual "synchronized" indicator feature (this feature should not be confused with the mechanical engine synchronizer. The indicator shows you

which engine is running faster by illuminating a small bar under one of the numbers across the bottom of the instrument. The illuminated numbers indicate the difference in rpm (20, 40, 60 or 90) between the engines. You can adjust one of the throttles to bring the engines to the same rpm. When the engines are synchronized, a **SYNC** indicator is illuminated between the digital readouts.

Engine Coolant Temperature Gauges

The two engine coolant temperature gauges indicate the temperature of the coolant circulating through each engine in degrees Fahrenheit (100-250°F) and Celsius (40-120°C). These temperature gauges are at the top of the engine instrument clusters.

Engine Lube Oil Pressure Gauges

The engine lubricating oil pressure gauge for each main engine is calibrated 0-80 psig (pounds per square inch gauge) and kiloPascals (0-500 kPa). These gauges are the second instrument in each gauge cluster.

Almost all serious engine trouble is reflected in this gauge. Therefore, if there is a radical change in oil pressure, immediately bring the engine back to **IDLE**, place the transmission in **NEUTRAL**, and shut the engine down until the source of the pressure change can be determined. Check the level in the oil pan and check for oil leaks in the lube oil piping system.

Gear Oil Temperature Gauges

There is an oil temperature gauge for each transmission, calibrated in degrees Fahrenheit (125° to 300°F) and degrees Celsius (50° to 150°C). These gauges indicate gear box (transmission) lubricating oil temperature, and are the third instrument in each gauge cluster.

Gear Oil Pressure Gauges

There is an oil pressure gauge for each transmission, calibrated in pounds per square inch gauge (0 to 350 psig) and millibars (0 to 25 mbar). These gauges indicate the gear (transmission) lubricating oil pressure.

A sudden drop in gear oil pressure could indicate a major transmission problem; immediately bring the engine back to **IDLE**, place the transmission in **NEUTRAL**, and shut the engine down until the source of the pressure change can be determined.

The gear oil pressure gauges are the fourth instrument in each gauge cluster.

Engine Performance Alarms

Engine performance alarm systems are discussed in ***Part II, Section 5***.

Battery Condition Meters

Below the gear oil pressure gauges are battery condition Voltmeters calibrated from 24 to 40Vdc. These meters monitor the voltage levels in your 32Vdc battery banks.

System and Accessory Control Switches and Indicators

The system control switches are on the flybridge console just below the helm. They are protected from weather and salt spray by a hinged transparent cover.

NOTE:
The accessory switch panel is protected by a hinged clear acrylic cover. Do NOT discard this cover if it becomes scratched or damaged. The switches are not waterproof, and electrical damage may result if water gets behind the panel.

The switches are grouped on the panel by function. From port to starboard, these are the **ENGINES, FUEL PRIMING, BILGE PUMPS, LIGHTS, DOCKING LTS** and **ENGINE SYNCH** switches.

Engine Switches

(The procedure for starting and stopping your engines is discussed in ***Part II, Section 5***.)

There are five switches in the **ENGINE** group:

1) a three-position **ON -- OFF -- STOP** toggle switch for the port engine.
2) a red two-position momentary contact **START -- COLD START** toggle switch for the port engine.
3) a **BATTERY PARALLEL** switch used to parallel both 32Vdc battery banks when starting the engines.
4) a three-position **ON -- OFF -- STOP** toggle switch for the starboard engine.
5) a red two-position momentary contact **START -- COLD START** toggle switch for the starboard engine.

Fuel Priming Switch

(The **FUEL PRIMING** switch is not connected; no fuel priming system is needed on this vessel.)

Bilge Pump Switches and Indicators

Bilge Pump Switches

There are three 2-position mode-selector toggle switches for the **BILGE PUMPS**:

1) the forward (**FWD**) bilge pump switch controls the pump under the forward cabin sole.
2) the midships (**MID**) bilge pump switch controls the engine/generator room bilge pump.
3) the aft (**AFT**) bilge pump switch controls the stern bilge pump.

Each switch selects the operating mode, **MANUAL** or **AUTO** (automatic) for its bilge pump. On the instrument panel above the switch panel are amber indicator lamps that illuminate when a bilge pump is operating.

For your protection, these three switches have no **OFF** position; this prevents an inadvertent bilge pump shutdown.

The bilge pumps can be set on **MANUAL** (operate continuously) or on **AUTO** (controlled by the bilge pump sensor and switch).

Bilge pump switches are normally kept in the **AUTO** position.

A separate engine/generator room sump pump is always in automatic mode.

Bilge Pump and Bilge Flood Indicators

The bilge pump and bilge flood indicators are discussed in ***Part II, Section 7***.

For more information about bilge pump and sump pump systems, operation and maintenance, refer to ***Part II, Section 7*** and ***Part III, Section 4***.

Light Switches and Indicators

There are three switches in the **LIGHTS** group on the switch panel:

1) a three-position toggle switch turns **ON** either the navigation lights or the anchor light (center is **OFF**);
2) a two-position switch turns the instrument panel lights **ON** or **OFF**;
3) a two-position switch turns the compass light **ON** or **OFF**.

On the lower part of the instrument panel are two **LIGHT TEST** push-button switches. You can test the light systems by turning **ON** either the **ANCHOR** or **NAVIGATION** light switch and pushing the corresponding **LIGHT TEST** push-button. The corresponding lights in the **LIGHT TEST** indicator block (to the right of the tachometer) should illuminate: when you push the **ANCH** test button, the light marked **ANCHOR** should illuminate; when you push the **NAVIG** test button, the lights marked **BOW**, **PORT**, **STBD** and **STERN** should illuminate.

For further information on use of navigation lights, refer to ***Part II, Section 4*** under ***Navigation and Running Lights***.

Docking Lights (Optional) Switches

These switches control the optional docking lights.

NOTE:
The docking lights are to be used only for docking. When underway, only your navigation lights may be showing.

There are two switches in the **DOCKING LTS** group:

1) a two-position toggle switch turns **ON** the forward docking light;
2) a two-position switch turns **ON** the aft docking light.

Engine Synch (Optional) Switch and Indicator

The **ENGINE SYNCH** switch turns **ON** or **OFF** the optional electromechanical engine synchronizer. This device uses engine speed information it collects to continuously match the slave (starboard) engine's speed to that of the master (port) engine.

On the instrument panel below the **LIGHT TEST** panel is a **SYNCHRONIZER** indicator that illuminates when the engine synchronizer is in operation.

Fire Alarm System Indicators

On the **FIRE SYSTEM** panel (to the left of the tachometer), there are two sets of warning lights.

On the left side, there is s single indicator that is illuminated when the engine/generator room heat detectors sense an overtemperature (fire) condition. At the same time they are illuminated, the **FIRE** bell sounds.

On the right side of the **FIRE SYSTEM** panel, there are two indicator lights (**NO. 1** and **NO. 2**) that are illuminated when their respective Halon fire extinguishing systems discharge.

The fire alarm system and fire extinguisher is discussed in ***Part II, Section 3.***

Generator Running Indicators

Below the **FIRE SYSTEM** indicators on the instrument panel are two indicator lights marked **AC GENERATORS OPERATING**. The **NO. 1** light illuminates when the port generator is running, and the **NO. 2** light illuminates when the starboard generator is running.

Trim Tab Controls

Maintaining Original Trim

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, we suggest that you spend at least a few minutes becoming familiar with the way 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 on board.

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 assume a planing attitude. This is her most efficient attitude: about 5 degrees bow up.

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 engines' rpm at the maximum bow-up attitude. Plan to cruise either under or over that speed.

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.

As a rule, Diesel cruising rpm should be about 10% less than wide open rpm. Gasoline engine cruising rpm should be about 15 to 20% less than wide open rpm.

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.

Trim Tab System

Your trim tab system is electro-hydraulic and is powered from the 32Vdc distribution panel (Figure 10B-1).

The two trim tabs (one on each side of the transom) can adjust your Bertram's underway trim. They can also adjust list if you are navigating adverse seas or wind conditions or if you have unusual load conditions.

You operate each trim tab with a rocker-type switch mounted on a panel on the starboard side of the flybridge control console below the throttles (Figure 2-1). The top of the trim tab switch panel is marked **BOW DOWN**.

Depressing and holding the lower part of a trim tab rocker switch (**BOW UP**) raises the trim tab to its top position. **UP** is the normal operating position and is the best for most cruising conditions and speeds.

Depressing the upper part of a trim tab switch (**BOW DOWN**) extends the hydraulic cylinder, 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 attitude of approximately 5° bow up.

NOTE:
Do not depress one Trim Tab switch BOW DOWN and the other BOW UP or hold a switch in BOW DOWN or BOW UP for an extended period. Either action will trip the circuit breaker, which you must manually reset to reactivate the trim tab system. See ***Part II, Section 10B*** *for breaker location.*

Trim Tab Use

WARNING

Before you run an inlet or if you have a following sea, move trim tabs to full UP position to reduce the risk of broaching or pitchpoling.

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 can put your Bertram "on plane." If you want to lower her bow, lightly depress the **BOW DOWN** switches to extend the trim tabs slightly. 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.

Your trim tabs are mounted on the hull where the transom meets the bottom, and are vulnerable to damage if used improperly.

NOTE:
Too much BOW DOWN trim at any speed will reduce the vessel's speed and may also degrade the handling characteristics of your vessel.

NOTE:
Except in an emergency situation, never go into reverse or back down quickly from any speed above idle while either or both of your trim tabs are in any position except the full up position. If you do reverse or back down suddenly, it is possible that the reverse pressure of the water pushing against the trim tabs could damage the trim tab hydraulic cylinders and/or the cylinders' internal seals.

NOTE:
Always return both trim tabs to the full up by depressing and holding the BOW UP rocker switches prior to trolling just in case it is necessary to "back down" on a fish. Again, this is to prevent damage to the trim tab hydraulic cylinders and/or the cylinders' internal seals.

NOTE:
Check 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.

Always raise both trim tabs to the full up position prior to docking. This helps prevent marine growth from developing on the exposed hydraulic rams.

Side-To-Side Leveling with Trim Tabs

While under way, you may find that your vessel lists to one side or the other. This is usually due to 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 attempt at trim adjustment does not completely correct the list, repeat operations (a) and (b) until you achieve a satisfactory adjustment.
d) for a list to starboard, reverse this procedure.

Horn Switch

The momentary-contact **HORN** toggle switch is located starboard of the trim tab switches. Push the toggle switch up to sound the horns.

Magnetic Compass

Your Bertram is equipped with a lighted, compensating marine compass mounted on top of the instrument panel console (Figure 2-1).

CAUTION

The compass aboard this vessel is not compensated by Bertram Yacht. Compass 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:

- nearby ferrous metal (iron and steel) objects including tools, some beverage cans, etc.;
- magnetic fields generated by nearby electrical or electronic equipment, including other compasses;
- 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.

Any time any electronic equipment, gauge, or instrument is added, removed, or replaced on or near the instrument panel, compass deviation should be checked by a competent compass technician.

The magnetic compass can be the most important navigation instrument on a boat. 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:

- one or more magnets;
- a calibrated card;
- a jeweled pivot;
- the compass bowl;
- a means of illumination 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.

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 friction 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.

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.

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

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.

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.

Emergency Engine Stop

Bertram has provided a mechanical emergency shutdown system intended for use with the fixed fire extinguishing system. Use of the Emergency Engine Shutdown system is covered in ***Part II, Section 5.***

NOTE:
*This system should be used to shut down your engines **only in an emergency.** Under normal operating conditions, you should stop your engines by idling them and simply holding the ON/STOP rocker switches in STOP until both Diesel engines have completely shut down.*

Gauges and Meters Not on the Flybridge

Fuel Gauges

Aft Tank

The **AFT** fuel tank gauge is on the top of the aft tank; you can read it by lifting the small hatch in the cockpit sole.

Forward Tanks

The **FWD** fuel tank gauges are mounted on their inboard forward corners. Each fuel level indicator uses an enclosed column of small metal flags (white on one side and red on the

other) that are flipped over from one color to the other when a magnet on a float passes them. The height of the column of red flags indicates fuel remaining.

Tank Gallonage

Fuel tank gallonage -- the amount of fuel in gallons in your tanks as shown by your fuel gauges -- is shown in Table 1-2 in ***Part II, Section 1***.

NOTE:
Because your fuel tanks are shaped to fit the hull, the gauge readings are not linear. Fuel gauges indicate only the relative depth of fuel in the tanks. You must use Table 1-2 in ***Part II, Section 1*** *to determine the approximate amount of fuel in the tanks.*

Tank Selector Valves

Mounted in the engine/generator room are fuel tank selector valves for the main engines and generators. Operation of these selector valves is discussed in ***Part II, Section 5***.

Electrical Panel Gauges and Indicators

Your Bertram has four electrical distribution and control panels. One panel is on the flybridge, accessible from the door on the right side of the console; two panels are aft in the salon, in a cabinet on the starboard side; and the fourth panel is in the engine/generator room. Some of the gauges are discussed here, but you should refer to ***Part II, Section 10A***, ***Part II, Section 10B*** and ***Part II, Section 11*** for a more extensive explanation of these panels.

Your Bertram is factory-equipped with indicators and meters that you need to:

- monitor the status of your vessel's electrical and non-electrical systems;
- ensure efficient operation;
- properly maintain your Bertram.

Therefore, you should:

1) become familiar with the function of each of your Bertram's gauges and meters;
2) note what constitutes "normal" readings or operating ranges of each gauge and meter.
3) check your gauges and meters carefully when you first start your engines;
4) make it a habit to frequently check your gauges and meters when underway;
5) be aware that:
   a) all engine gauges operate through the ignition circuit;
   b) none of the gauges returns to any particular position when the ignition is switched **OFF**.

NOTE:
During operation, there may be some slight fluctuations in gauge readings. This is normal.

NOTE:
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 engines, transmissions, and lubricating oils reach normal operating temperature.

NOTE:
Paying attention to your gauges is important, but it does not replace visual engine/generator room inspections. You ***must*** *check the engine/generator room* ***regularly.***

Section 4

Maintenance Procedures

Lubrication Oil Transfer System

CAUTION

Do not run the engines or the a.c. generators while changing oil. Damage will result.

The lube oil transfer system (Figure 4-1) lets you remove, change, or add lubricating oil to the engines or transmissions, and remove used lubricating oil from the ac generators. You must only connect and disconnect two hoses and set the appropriate valves. The hoses have quick-disconnect fittings.

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 Diesel fuel oil, gasoline or lubricating oil as well as any bilge pump discharge. Violators are subject to a penalty of $5,000.00.

Lube Oil Transfer System Components

The lubricating oil pump is powered from the Salon 120/240Vac Distribution Panel (Figure 11-1). Circuit breaker **#153 – LUBE OIL PUMP** must be **ON** to use the pump.

To operate this system, first locate each of the following components on Figure 4-1 and then locate them on your vessel:

1) The lubricating oil pump with its 120Vac motor and switch, mounted amidships on the aft engine room bulkhead next to the converters. The pump has a pipe nipple extending from each side. The pump switch is on the starboard side of the pump motor.
2) A "T" fitting mounted on the pump portside nipple (**INTAKE**) is followed by a quarter-turn ball valve and an adapter to fit the hose from the lubricating oil tank. This input is labeled **TANK OIL SUPPLY.**
3) The other leg of the "T" is fitted with a right angle adapter that mates with the pump-out (suction) hose. This input is labeled **WASTE OIL REMOVAL.**
4) The pump starboard side nipple (**OUTPUT**) is connected to the flow meter followed by a quarter-turn ball valve and an adapter to fit the hose to the cockpit waste oil discharge valve. This fitting is labeled **COCKPIT WASTE DISCH.**
5) Extending down from the flow meter is an adapter to the tank supply hose from the lubricating oil tank. This fitting is labeled **CLEAN OIL FILL.**

6) The waste-oil discharge hose free end has a quarter-turn valve.
7) The generator suction hose connects a quick-disconnect fitting on the port side inboard stringer aft of the port engine to a "T" connection on the port side inboard stringer near the forward end of the engine.
8) Hoses connect the "T" to the port and starboard ac generator oil drain fittings.
9) Each generator oil drain fitting has a quarter-turn valve.
10) On the inboard side of each engine and each transmission is a quick-disconnect fitting protected with a red dust cover.
11) Near the oil fittings on each engine and transmission are the engine sump and transmission sump lube oil level dipsticks;
12) A suction or a pressure transfer hose can connect the lube oil pump to any of the four engine/transmission quick-disconnect fittings.

Be sure all input hoses and all screw-type and quick-disconnect fittings are kept clean to avoid getting dirt and other contaminants into the lubricating oil.

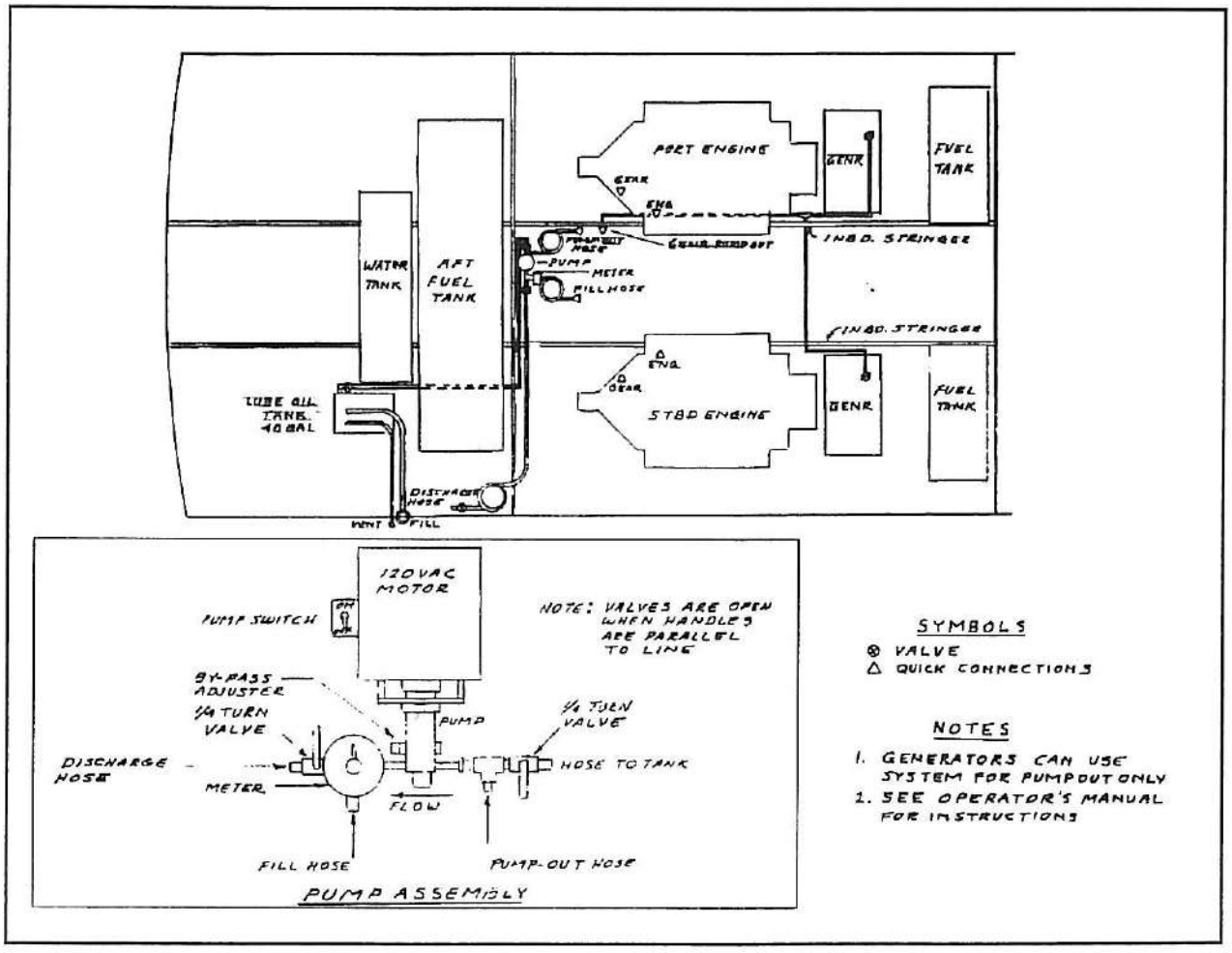


Figure 4-1: Lubrication Oil Transfer System

Engine/Transmission Pump-out Procedure

To pump the used lubricating oil out of the engines or the transmissions:

1) unship the free end of the suction-oil transfer hose;
2) remove the quick-disconnect fitting dust covers from the suction-oil transfer hose and from the engine or transmission sump you want to drain;
3) connect the suction-oil transfer hose to the sump quick-disconnect fitting;
4) arrange for the waste-oil discharge hose free end to empty into a suitable dockside disposal tank or into containers suitable for proper disposal of waste lubricating oil;
5) on the pump:
   a) **CLOSE** the line valve from the lubricating oil tank to the pump (valve handle at right angles to the line);
   b) **OPEN** the valve to the waste-oil discharge hose;
   c) **OPEN** the valve at the free end of the waste-oil discharge hose.
6) switch the pump **ON** to drain the waste oil;
7) when the selected sump is empty, you will hear the pump speed change due to the no-load condition; switch the pump **OFF**;
8) disconnect the suction-oil transfer hose from the sump;
9) replace the dust cover on the sump fitting;
10) repeat steps 2, 3, 6, 7, 8 and 9 for each sump;
11) wipe off the suction-oil transfer hose quick-disconnect fitting and replace the dust cover;
12) restow the suction oil transfer hose in its hanger.
13) wipe off the waste oil discharge hose nozzle;
14) restow the waste oil discharge hose.

Generator Pump-out Procedure

⚠ CAUTION

To avoid generator damage, you MUST CLOSE oil sump drain valves once the used oil is out.

NOTE:
This system both drains and replaces or adds oil to the engines and transmissions and drains used oil from the generators. Do NOT use it to put fresh oil in the generators because:

1) The Diesel engines and the marine transmissions have different lubricating oil requirements than do the generators;

*2) the length of the hose leading to the generators means that a quart or more of oil would always be in this hose. Therefore, Bertram recommends that you use this system only to remove used oil from the a.c. generators. Be sure the generator sump ball valves are **CLOSED** before refilling the generators by hand, and be sure you do not try to drain both ac generator oil sumps at once.*

To pump used lubricating oil out of the generators:

1) unship the free end of the suction-oil transfer hose;
2) remove the quick-disconnect fitting dust cover from the suction-oil transfer hose;
3) remove the quick-disconnect fitting dust cover from the generator waste-oil line (the fitting is on the port side inboard stringer aft of the port engine);

4) connect the suction-oil transfer hose to the generator oil line quick-disconnect fitting;
5) arrange for the free end of the waste-oil discharge hose to empty into a suitable dockside disposal tank or into containers suitable for proper disposal of waste lubricating oil;
7) **OPEN** the sump valve on the generator you want to drain;
8) on the pump:
   a) **CLOSE** the line valve from the lubricating oil tank to the pump (valve handle at right angles to the line);
   b) **OPEN** the line valve on the used-oil discharge hose;
   c) **OPEN** the valve at the free end of the waste-oil discharge hose;
9) switch **ON** the pump;
10) when the generator sump is empty, you will hear the pump speed change due to the no-load condition; switch the pump **OFF**;
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-oil transfer hose from the generator line;
15) wipe off the sump fitting and replace the dust cover;
16) **CLOSE** the line valve on the free end of the suction-oil transfer hose;
17) wipe off the suction-oil transfer hose quick-disconnect fitting and replace the dust cover;

Filling or Refilling the Engines and Transmissions

NOTE:
You should change engine lubrication oil filters with each engine oil change. This requires about one additional gallon of oil per engine.

NOTE:
After running the engine, wait at least 1 hour for the oil to drain back into the sump and then recheck the dipstick level.

NOTE:
After filling the transmission sump, start and idle the engine with gears in neutral. Then shut down engine and check the dip stick level. Continue to fill as required.

To pump fresh lubricating oil into the engines or the transmissions:

1) Unship the discharge-oil transfer hose free end and remove the quick-disconnect fitting dust cover;
2) remove the quick-disconnect fitting dust cover from the sump you want to fill;
3) connect the hose to the sump quick-disconnect fittings;
4) on the pump:
   a) **OPEN** the valve on the line between the oil tank and the pump (valve handle parallel to the line);
   b) **CLOSE** the waste-oil discharge hose valve;
   c) set meter to **0** (turn counterclockwise)
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 cover on the sump fitting;
12) repeat steps 2, 3, and 5 through 11 for each remaining sump;
13) wipe off the discharge-oil transfer hose quick-disconnect fitting and replace the dust cover;
14) restow the discharge oil transfer hose.

Transfer Pump Bypass Adjustment

The lubrication oil transfer system has a built-in bypass control on the side of the transfer pump body. This control is factory preset by Bertram. Under most conditions, no further adjustment is necessary. However, your transfer pump may not work properly in very cold weather. To adjust the by-pass:

1) loosen the lock nut on the bypass;
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 (Bertram Part No. 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 bypass screw counter-clockwise until the pump runs free; then turn the bypass screw clockwise until there is a slight load on the pump (the load will cause a drop in pump rpm);

11b) if the pump runs free, turn the bypass screw clockwise until there is a slight load on the pump (the load will cause a drop in pump rpm);

12) switch **OFF** the pump;
13) tighten the locknut.

Propeller Shaft Alignment

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 an engine has been moved or the shaft line changes because of underwater gear repairs.

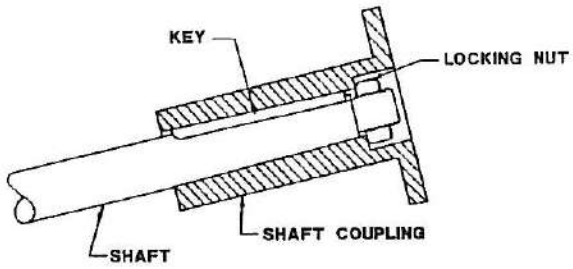
Parallel or Bore Misalignment

The first procedure checks 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 is less than 0.005 inch.

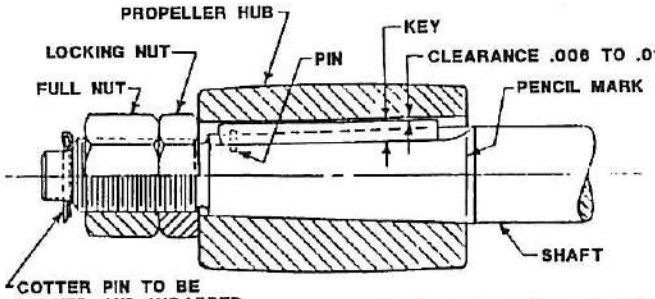
Since the slip fit of the pilot surfaces of these two shafts holds the shafts in alignment, it is most unlikely that this alignment will change unless you replace an engine, move an engine, or seriously damage the underwater gear. To do a parallel or bore alignment procedure requires precision measuring equipment and a competent technician.

Angular or Face Misalignment

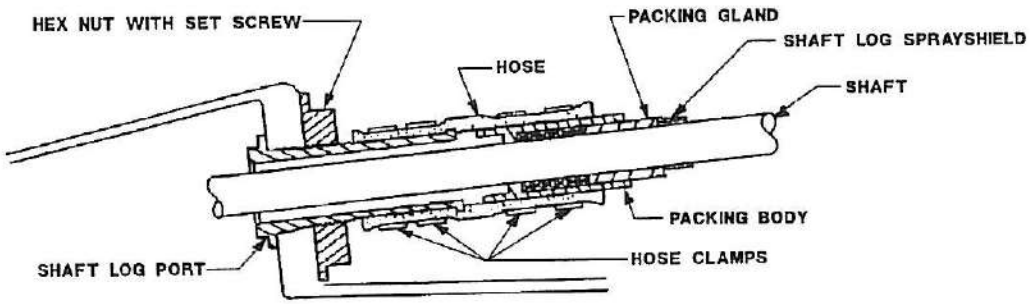
The centerlines of the marine transmission and its mating propeller shaft must be parallel. When the shafts are not, the mating faces of the transmission flange and the mating propeller shaft flange are not parallel.



ENGINE COUPLING ASSEMBLY: DIESEL ENGINES



PROPELLER INSTALLATION



SHAFT LOG ASSEMBLY

DRIVELINE ASSEMBLY

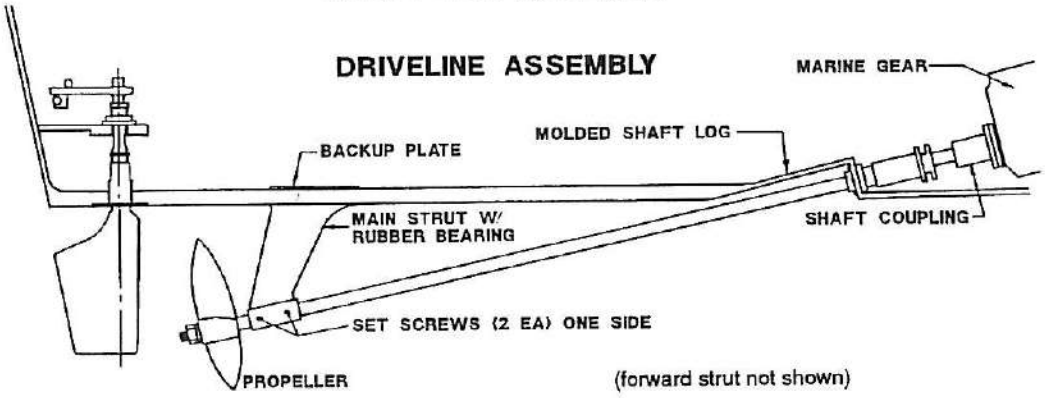


Figure 4-2: Driveline Sketches

The initial alignment check is a part of predelivery preparation. After delivery, alignment is an owner maintenance responsibility.

You should have angular or face misalignment checked periodically to be sure of proper alignment and optimum performance.

Allowable Angular or Face Misalignment

Only a small amount of misalignment is acceptable: 0.0005 inch of angular or face misalignment per inch (of outside diameter) of the propeller shaft companion flange, measured at the mating surface of the flanges.

Here's an example: if we have a 5.0 inch outside diameter companion flange, the allowable misalignment is 0.0025 inch.

Engine alignment is best performed by an experienced mechanic working with the proper tools. Here is the technique used:

1) Open the two couplings before haulout.
2) Check the alignment after launching:
   a) Let the vessel settle in the water for a day or two before making the final alignment adjustments.
   b) Remove all 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 inch or larger feeler gauge between them.
   e) Place another 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. If the alignment is incorrect, the engine must be moved to align the flanges.

NOTE:
At this point gauge thickness is not vital. What is important is that as you bring the flange faces closer together, 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 gauge.

   g) Repeat steps (d) through (f), gradually moving the two flanges closer until they touch.

Propeller Installation

Propeller installation is crucial to maximum shaft and propeller life. If you must replace either the propeller or the shaft, follow these guidelines:

1) Each propeller is keyed to its shaft with a locating pin extending from the key. Check that the key fits snugly in its slot with the pin in its matching hole in the shaft keyway. See Figure 4-2.
2) Check the fit of the propeller on the shaft with the key.
3) If the key does not fit, carefully file the propeller keyway using gentle and even file strokes along the whole keyway.
4) 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.
5) Mark the location of the propeller on the shaft at the forward end of the hub with a sharp pencil. See Figure 4-2.
6) Remove the propeller.

7) Insert the key into the shaft keyway, ensuring that the locating pin is in its hole in the propeller shaft keyway.
8) Reinstall the propeller.
9) Be sure the propeller 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 propeller hub.
11) Remove the propeller.
12) Coat the bore with any *non-graphite* waterproof grease.
13) Reinstall the propeller.
14) Install the plain (full) nut.
15) Torque the nut with a wrench to seat the propeller.
16) Remove the full nut and install a jam (half) nut.
17) Tighten the jam nut slightly more than finger tight.
18) Install the full nut.
19) Lock both nuts together by holding the jam nut while tightening the full nut. The completed installation should match Figure 4-2.
20) Install a cotter pin and bend the legs.

The sequence and method of nut installation described above is in accordance with S.A.E. Specification #J-755.

Propeller Shaft Replacement

CAUTION

When using any type of hammer against metal, wear safety glasses and take all other usual precautions against injury.

NOTE:
Propeller shaft and coupling sets are manufactured to very close tolerances and are matched for proper fit. When replacing a shaft, have a competent machine shop match the new shaft to the coupling.

To replace a propeller shaft, you must unbolt the coupling from the engine and make some space in which to work (Figure 4-2).

1) Loosen and remove the bolts that fasten the coupling to the transmission flange.
2) Push the shaft aft until you have room to work (4 to 6 inches).
3) Follow instructions below for coupling removal.

Coupling Removal

See Figure 4-2.

1) Place the correct size socket wrench in the coupling shaft nut cavity (in the center of the coupling flange) so the nut is secure within the socket.
2) Strike the breaker bar fitted to the socket wrench sharply to loosen the nut (Bertram recommends that you use a small to medium sized lead, lead shot, or other soft faced mallet). 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.

Coupling Installation

See Figure 4-2.

1) Place the new shaft in position.
2) 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.
3) 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.
4) Mark the location of the coupling on the shaft at forward end of the hub with a sharp pencil (similar to that shown on Figure 4-2).
5) Remove the coupling.
6) 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.
7) Reinstall the coupling.
8) Ensure that the coupling is fully seated with the forward end of the hub touching the pencil line you made in Step 4.
9) 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.
10) Remove the coupling.
11) Coat the bore with any *non-graphite*, waterproof grease.
12) Reinstall the key and coupling.
13) Place the nut on the end of the shaft.
14) Use the wrench to tighten as far as possible; take care not to mar or scratch the shaft.
15) Using the lead mallet, strike the ear of the wrench two or three times to tighten the nut.

Shaft Logs And Stuffing Boxes

Shaft Logs

The shaft log recess is the tunnel in which each propeller shaft turns. In your Bertram, the shaft logs are a part of the hull and are the same material as is the hull (Figure 4-2). 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.

Stuffing Boxes

Stuffing boxes keep water from leaking in around the shaft into the boat. The stuffing box contains braided flax packing and the packing gland. A tight packing gland stops excessive stuffing box leakage. However, a slight drip is necessary.

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.

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.

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 within about 1/4 inch of filling the stuffing box (always use tallow flax packing; 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, and reset if necessary;
11) replace the sprayshield.

Shaft Log Sprayshield

Each stuffing box has a sprayshield to prevent water which leaks past the stuffing box from spraying around the engine/generator room.

Rudder Stuffing Boxes

When tightening the packing gland, it is not necessary or desirable to have a rudder stuffing box drip, but you must be sure the rudders turn freely. Otherwise, the rudder stuffing boxes are packed in the same manner and with the same material as are the propeller stuffing boxes.

Rudder Alignment

The twin rudders on your Bertram should *always* be kept parallel. If they are "toed in" or "toed out," your Bertram may not handle properly.

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.

CAUTION

1) Do not overfill battery cells. Excessive liquid will cause acid to spill out the vents when the battery is charging. This causes corrosion at the terminals and the battery cables.
2) NEVER add acid to the battery.

Distilled Water

The first choice for adding liquid to the electrolyte is distilled water. If distilled water is not available, you can use a good grade of potable (drinking) water 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.

Filling Procedure

1) Inspect each cell;
2) fill each cell with distilled water, when required, (the top of the plate separators should never be exposed);
3) fill until the liquid level is about 3/8 of an inch above the top of the separators.

Do not overfill the battery. Excessive liquid will cause acid to spill out the vents when the battery is charging. This causes corrosion at the terminals and the battery cables.

Cleaning Procedure

Be sure battery caps are on tightly, then clean battery top with a stiff, non-metallic brush. Be careful not to scatter corrosion products. Wipe off with a cloth damped with ammonia or baking soda in water. Wipe with a clean cloth dampened with clear water.

Clean the battery terminals and cable terminals to a bright metal finish whenever you remove the cables. Coat the contact surfaces with petroleum jelly before reconnecting the terminals.

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 often a sign that the battery is overcharging. You should check the engine alternators and converter. Never add acid to batteries.

Battery Charging

Use the battery condition meters on the engine room panels to check the Voltage of your battery banks.

Maximum Charge Voltage

12 Volt system: 13.9 Volts

32 Volt system: 37 Volts

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 are turned off;
c) the converters are turned off;
d) you are not wearing rings or metal watchbands or bracelet;
e) you use extreme caution to avoid having tools contact both terminals.

Spilled Battery Acids

If battery acid is spilled, immediate action is required to check or eliminate its damaging effects.

Acid splashed in the eye

1) wash the eye out *immediately and continuously* with plenty of cold, fresh water for at least twenty minutes;
2) if cold, fresh water is not available, use milk or any available fresh-water-based potable liquid to dilute the acid;
3) see a doctor as soon as possible.

Acid splashed on other parts of the body, the clothing, or parts of your vessel:

1) immediately remove acid by washing thoroughly with cold water and
2) neutralize the area with a solution of baking soda or household ammonia in water.

If a considerable amount of acid is spilled from the battery, a battery repairman should replace the battery.

Diesel Fuel

WARNING

Never add commercially marketed diesohol or gasohol to diesel fuel. This mixture creates both explosive and fire hazards.

Use only high quality Diesel fuel that meets the engine manufacturer's specifications. See the engine manufacturer's manual for details.

You may use small amounts of isopropyl alcohol (isopropanol) to prevent fuel line freeze-up in winter months. Add no more than one pint of isopropyl alcohol to each 125 gallons of fuel.

Electrical Repairs

NOTE:
Bertram recommends that a qualified marine electrician perform electrical maintenance.

NOTE:
If electrical 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 in this manual.

WARNING

The 120Vac circuits can deliver a lethal shock. Before opening any 120Vac distribution panel or servicing any 120Vac equipment:
1) disconnect shore power cord;
2) stop the generator.

CAUTION

Do not replace your vessel's circuit breakers or fuses with breakers or fuses of higher amperage ratings than those installed by Bertram. Select breakers or fuses 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.

Bilge Pump Systems

Automatic Bilge Pump Switches

All three bilge pumps, the engine/generator room sump pump, and the shower sump pump, have associated water level sensing switches.

You should check these switches periodically to be sure they are operating properly.

To check a bilge pump float switch, lift the float. The pump should run and the instrument panel **BILGE PUMP** operating lamp should illuminate. Release the float; the switch should shut off the pump and the indicator light should go out.

If the switch does not function, closely monitor the water level in that bilge and have the system repaired as soon as possible.

To check a sump pump switch, lift the switch float; the switch should turn on the pump. Release the float; the switch should shut off the pump.

Cleaning the Pumps

Each submersible pump has a strainer on the bottom of its intake. This intake must be kept clean and free of debris.

The engine/generator room sump pump and the shower sump pump have strainers in their suction lines and at their pick-ups. These strainers must be kept clean and free of debris.

For cleaning, follow the manufacturer's instructions in the data sheets included with your information packet.

Cockpit Hatch Dog Adjustment

The hatch dogs on the cockpit hatches require adjustment to eliminate seepage. Turn the nut on the underside of the hatch dogs to adjust the fitting tightness. You must not overcompress the gaskets, so you should not overtighten the dogs. Where possible, someone should 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 you have adjusted all cockpit hatch dogs, 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.

Overhead Rod Locker Latch Adjustment

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).

CAUTION

Do not mount equipment on top of door. Additional weight may cause inadvertent opening of door.

Inspection and Repair of Hanlon and Wilson Exhaust System Insulation

Inspection

CAUTION

Inspect only when exhaust system is cool.

Frequency of Inspection

1) twice a year;

2) after repair work on the exhaust system;

3) if damage to the insulation is observed or suspected.

How to Inspect

Visually examine the insulation for cracking, splitting, tearing, or a light-colored threadbare appearance. Any of these conditions require repair.

Repair Procedure

The material used to repair the exhaust system insulation is Devcon Wear Resistant Liquid, Stock No. 11220, from Hanlon and Wilson, P.O. Box 641, Jeanette, PA 15644.

NOTE:
Carefully read the instructions and especially the Warnings on the epoxy containers before using this product.

Surface Preparation

The surface of the area being repaired and the surrounding surface area for two inches in all directions must be completely dry and free of all oil, dust, and cleaning agents.

Mixing

Mixing by Volume: Four parts of resin to one part of hardener (4:1).

Mixing by Weight: Nine parts of resin to one part of hardener (9:1).

In a well ventilated area, add the hardener to the resin. Mix thoroughly until a uniform consistency is obtained; this should take about 4 minutes. Be sure to stir in the material from the bottom and sides of the mixing container.

Application

Pour, trowel, or brush a 1/2-inch thick coating of epoxy over the properly prepared sur-

face. Epoxy working time (pot time) is 50 minutes at 75°F.

Cure

A one-half inch (1/2") thick section of epoxy will harden in four hours at 75°F. This same 1/2" 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 cure time, place a heat lamp no closer than 18 inches from the repaired area.

CAUTION

Do not leave a heat lamp unattended.

NOTE:
Epoxy materials will burn. Never expose epoxy to direct flame.

Section 5

Storing Your Bertram

Dry Storage

Indoor storage is the preferred method for storing your Bertram providing there is good ventilation and the location is otherwise safe and dry. For special instructions on a covering for outdoor storage, refer to the Docking Plan, Figure 1-1 in ***Part IV, Section 1***.

Keep Your Bertram Dry

__ 1) **OPEN** all valves and/or seacocks;

__ 2) Flush the 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 generators;
- __ d) all bilges;
- __ e) sewage lines;
- __ f) pumps. If possible, remove the pump and its motor for storage. If the pump must stay aboard for the winter, drain thoroughly and remove the pump inlet and outlet connections.

__ 5) If local weather requires, add a non-alcohol based antifreeze to low position water lines that you cannot drain;

Electric and Electronic Equipment

The best practice is to remove and store your electrical and electronic equipment in a safe, warm, and dry place over the time during which your Bertram will not be used.

Ventilating Your Bertram

__ 1) Open the windows and hatches sufficiently to allow air to circulate.

__ 2) Leave the locker doors and the drawers open.

__ 3) Wash and thoroughly dry the refrigerator and freezer units.

__ 4) If possible, clean and store mattresses and cushions in a dry place. If they must be left aboard, prop up on one side for maximum ventilation.

__ 5) Synthetic nylon and polypropylene 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.

__ 7) After the toilet holding tank, seawater supply, and discharge lines are flushed and drained, apply a light coat of oil to all metal parts.

CAUTION

When preparing the toilet for storage, do not put oil on any rubber or leather parts.

__ 8) To protect chrome, stainless steel, or aluminum deck hardware:

__ a) remove all salt deposits with fresh water;

__ b) clean with a good quality, non-abrasive type metal cleaner;

__ c) coat lightly with grease.

Diesel Engines and AC Generator

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 the governor linkage thoroughly;

__ 4) Lubricate metal ball joints with graphite (do *not* lubricate 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 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;

__ d) engine cylinder blocks.

__ 15) If freezing temperatures are expected, cooling systems should be filled with an antifreeze solution according to specifications in your engine and generator manufacturers' operator's manuals;

__ 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;

__ 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 battery voltage;

__ 22) Drain generator water lift mufflers.

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.

Wet Storage

Follow ***Dry Storage*** instructions, except:

__ 1) Check all seacocks and valves for freedom of movement and then placed in the **CLOSED** position

__ 2) 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 you:

__ 1) Use a zinc "fish", as discussed in ***Part III, Section 1*** under ***Electrolysis***;

__ 2) Keep the bilge pumps in the **AUTO** (automatic) mode;

__ 3) Provide dockside electrical power to keep the batteries charged.

Fitting Out

After an extended layup, you should thoroughly check your vessel and her onboard equipment. Some maintenance will be required. The following list is intended as a guide to the more important items; they are not necessarily in order of importance.

NOTE:
Prelaunch and Postlaunch 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 these checks are made.

Prelaunch

Check to be certain that:

__ 1) All through-hull fittings and their associated strainers are clean and secure;

__ 2) Both propeller shafts turn freely;

__ 3) The propeller nuts, jam nuts, and cotter pins are secured.

__ 4) The rudders fit well in the rudder port;

__ 5) The set screws holding bearing shells on the struts are in place.

Postlaunch

Check to be certain that:

__ 1) If moored, the electric line, water supply line, water discharge line, and sewage discharge line are secured at both ends;

__ 2) All fittings are tight;

__ 3) Both propeller shaft stuffing boxes are properly adjusted;

__ 4) Propeller shaft alignment is checked per the procedure outlined in ***Part III, Section 4*** of this manual;

__ 5) The rudder packing glands are properly adjusted;

__ 6) The bilge pumps are working;

__ 7) The heat removal blowers are working.

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 specific gravity reading of less than 1.220, have them charged.

__ 2) The engine wire looms are:

__ a) in good repair;

__ b) secure;

__ c) away from the exhaust manifolds;

__ 3) All electrical connections are tight.

__ 4. Each piece of standard and optional electrically operated equipment is working properly.

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, thoroughly check your engine and generator systems:

__ 1) Be sure the following (1) are in good repair; (2) are secure; and (3) have all fittings tight:

__ a) fuel lines;

__ b) cooling lines;

__ c) exhaust systems;

__ d) engine mount systems.

the specifications given in ***Part III, Section 4.***

__ 3) Remove all protective wrappings;

__ 4) Wipe the oil off all 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 and be sure:

__ a) they are fully charged;

__ b) proper polarity is observed (ground is negative);

__ 9) Check fuel system for moisture or contamination, and 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 the closed cooling system and top off the anti-freeze mixture;

__ 11) Open sea cocks

__ 12) Turn on fuel and prime the engines and ac generator;

__ 13) Remove all loads and start the engines and ac generator;

NOTE:
Diesel engines and the ac generator 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 ac generator run smoothly. Then apply not more than a 50% load for the first hour; slowly work up to maximum load.

Controls Check

Before putting to sea for the first time after taking your Bertram out of storage, check to be sure that:

__ 1) The clutches are properly adjusted;

__ 2) All clutch fittings are secured;

__ 3) 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) 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 rudders move freely;

__ 11) All gauges and indicators are fully operational (check after starting engines).

Section 6

Care of Fiberglass and Other Materials

These maintenance recommendations will help you keep the fiberglass and other components of your Bertram in factory-new condition.

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.

NOTE:
Some modern paste wax products provide both rubbing and waxing action in one. These products are acceptable.

NOTE:
Fiberglass repairs more extensive than those described here should be made only with the help and advice of your Bertram dealer.

Loss of Gloss

To restore 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 71;* 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***.

Stains

The fiberglass gelcoat surface on your Bertram was chosen to retain its beauty and be highly resistant to most stains. Table 6-1 lists stain removers Bertram recommends. If none of the methods shown in Table 6-1 are successful, it may be necessary to sand down through the gelcoat to remove the stain. This will require refinishing using the techniques described here.

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 whose color matches the color of the area to be repaired. This material should be available from your Bertram dealer.

3) Add two drops of catalyst per cubic inch of gelcoat and mix thoroughly. The mixture will gel (harden) in approximately 15 minutes.

4) Fill the scratch with the mixture before it hardens.

5) Round the patch off to about 1/16 to 1/8 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.

7) Lightly sand the area with 600 grit wet sandpaper.

8) Finish the patch by rubbing and buffing with a commercial buffing compound.

Painting Fiberglass Surfaces

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.

Table 6-1: Recommended Stain Removers for Fiberglass

Stain	Recommended Remover
Common stains	Household detergent, full strength or diluted with water
Crayon, lipstick, & shoe polish	Alcohol
Ink spots	Ajax cleanser
Resistant stains	Ammonia cleaners or a weak solution of hydrochloric acid

5) Apply the marine paint as recommended by the manufacturer.

Bottom Anti-fouling Paint

Bottom anti-fouling paints should only be applied per the manufacturer's instructions. Bertram's usual procedure is to apply anti-fouling paint unless an owner specifically requests something different. Before repainting your vessel's bottom, you should check to be sure the brand and type of paint you've 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.

NOTE:
Do not paint on zinc(s). Use only the manufacturer's recommended paint on depth sounder transducers.

Before Applying Anti-Fouling Paint

Before applying any additional anti-fouling paint, you should be sure the trim tab assemblies are covered (masked off), particularly the hydraulic cylinder piston rods. Take care that the lower portion of the cylinder where the ram comes out of the cylinder has been fully protected.

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.

Cleaning Non-fiberglass Plastics

CAUTION

When cleaning acrylic parts, do not use solvents such as lacquer thinner, acetone, or mineral spirits, and do not use abrasive cleaners. 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* or equivalent product as directed to remove fine scratches.

CAUTION

When cleaning ABS plastic parts, do not use solvents such as lacquer thinner, acetone, or mineral spirits, and do not use abrasive cleaners. 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.

In addition to Fiberglass Reinforced Plastic (FRP), better known as fiberglass, your Bertram has both acrylic and ABS (Acrylonitrile Butadiene Styrene) 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 overtightening and stress-cracking the part.

Acrylic Parts

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 Number 1 Plastic Polish* or a solution of warm water and a mild detergent such as *Formula 407* or *Fantastic* with a soft, all-cotton cloth.

ABS Plastics

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.

Cleaning "Novasuede"

Clean mildewed *Novasuede* surfaces according to the suggestions in Table 6-2.

Table 6-2: Recommendation for Cleaning *Novasuede*

Stain	Cleaner
Coffee, wine, milk, soft drinks, ink, or chocolate	Mild household detergent in warm water
Grease, lipstick	Upholstery solvent

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Part IV: Supplement

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Section 1

Docking Plan

The Docking Plan drawing provides weight information plus hull and superstructure dimensions for your Bertram. These dimensions can be used when lifting your vessel with slings, in designing and constructing a cradle, or in planning for dock or drydock facilities.

Drawing	Number
Docking Plan	7704

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

Section 2

Electrical Systems Supplement

This chapter includes glossaries of Bertram standard electrical abbreviations, plus electrical system and subsystem drawings for your vessel.

The first three drawings show the standard electrical sysmbols used in Bertram electrical drawings. Please note that although these symbols are based on current national standard electrical symbols, in some cases they have been modified for clarity.

Index of Supplementary Electrical Drawings

Electrical Abbreviations

A or AMP
Ampere

AC or ac
Alternating current

A/C
Air conditioning

AH or A.H.
Ampere hour

ALT
Alternator

AM
Ammeter

ANCH
Anchor

BAT or BATT
Battery

BUZ
Buzzer

CAP
Capacity.

CB
Circuit Breaker

CIRC
Circuit

COMP
Compass

COND
Conductor

CR
Control Relay

CT
Current Transformer

DC
Direct Current

DISC
Disconnect

DIST
Distribution

DKHS
Deckhouse

DPDT
Double pole, Double Throw

ENG
Engine

FB or F/B
Flybridge

FU or F
Fuse

FWD
Forward

GEN
Generator

GFCI
Ground Fault Circuit Interrupter

GRD
Ground

HR
Hour

HT
High Tension

HZ
Hertz

INP
Input

INST
Instrument

L_n
Line n (n= any number)

LT or LTS
Light or Lights

MAN
Manual

MOM
Momentary

M/S
Master Stateroom

MTR
Motor

NAV
Navigation

N or NEUT
Neutral

NC or N/C
Normally Closed

OPT
Optional

OVHD
Overhead

P/O
Part of

PAR
Parallel

PRES or PRESS
Pressure

POS
Positive

PWR
Power

REC or RECEPT
Receptacle

RES
Resistor

RM
Room

SDR
Sender

SPDT
Single Pole, Double Throw

SPKR
Speaker

SPST
Single Pole, Single Throw

SOL
Solenoid

STBD
Starboard

STRM or ST/RM
Stateroom

STD
Standard

SW
Switch

T
Transformer

TACH
Tachometer

TB
Terminal Block

TEMP
Temperature

TERM
Terminal

V
Volts

VM
Voltmeter

W
Watts

Wire Codes

Solid Color Wires

BLK or BK
Black

BLU or BU
Blue

BR
Brown

GRN or GN
Green

GRY or GY
Gray

OR or O
Orange

RD or R
Red

V
Violet

WHT, WH or W
White

YEL or Y
Yellow

Striped Wires

WHT/YEL
White Wire with Yellow Stripe

WHT/GRY
White Wire with Gray Stripe

WHT/BLK/RED
White Wire with Black and Red Stripes

Multiple Conductor Wires

10/3
#10 Wire with 3 Conductors

12/5
#12 Wire with 5 Conductors

Section 3

Mechanical Systems Supplement

This section contains mechanical system drawings not referenced elsewhere in the manual. They are included to help you and your staff maintain your vessel.

Index of Supplementary Mechanical Drawings

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REVISIONS				
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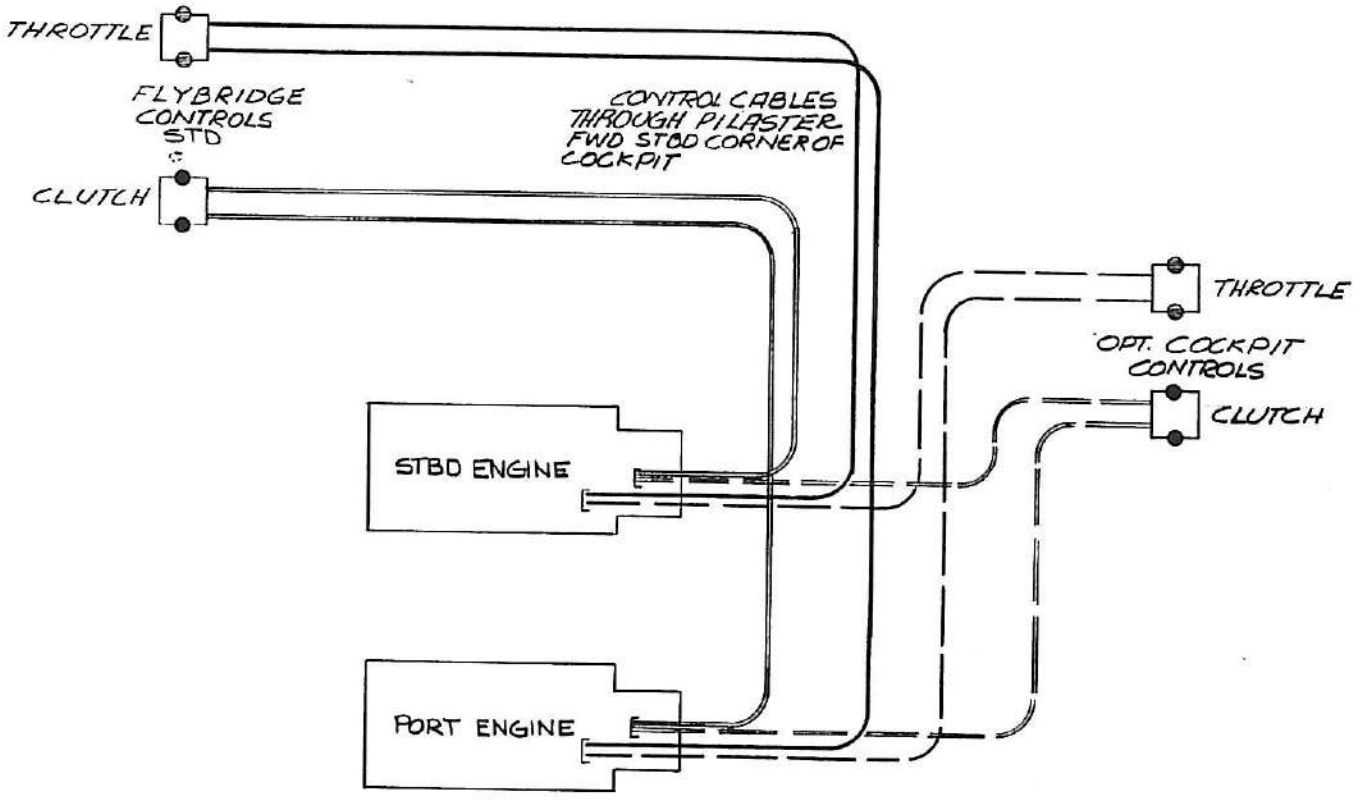


FOR ENGINE AUTOMATIC SYNCHRONIZER
REF DWG# B7708

BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

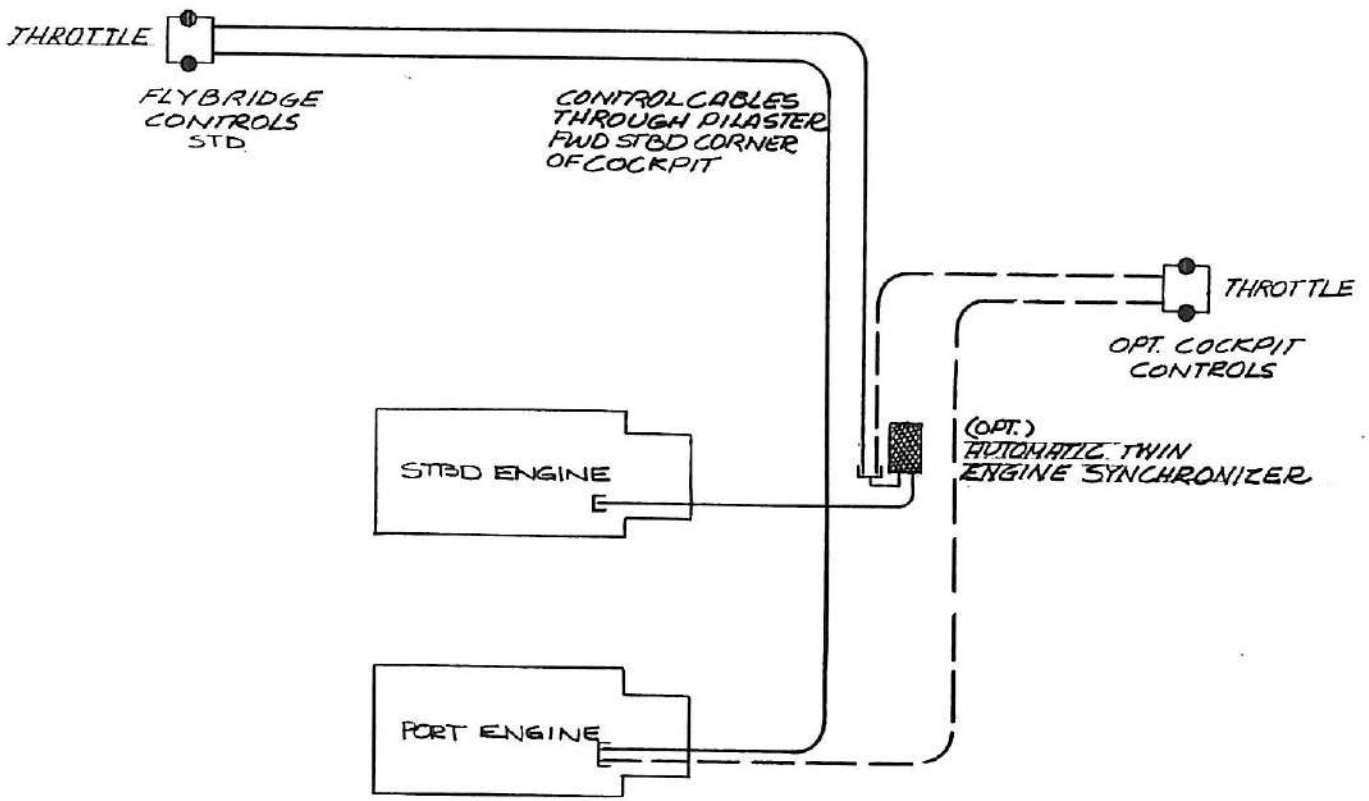
MODEL 545
TITLE CLUTCH & THROTTLE CONTROLS

SCALE NONE		PLAN NO.	REV.
BY VEMA	APPVD RAH	B 7707	
DATE 10-7-81	DATE 11-6-81		
		FILE	

DRAFTRACE 280

AF 14692A

REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.



FOR CLUTCH CONTROLS REF DWG# B7707

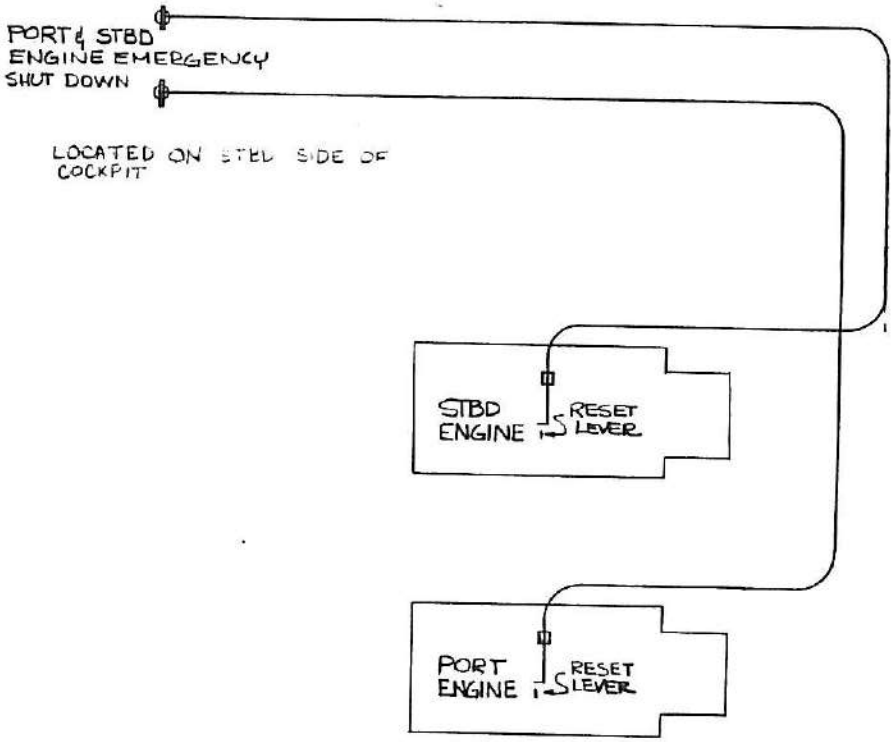
DRAFTRACE 250

BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

MODEL 545			
TITLE THROTTLE CONTROLS WITH SYNCHRONIZER (OPT)			
SCALE NONE		PLAN NO. B 7708	REV.
BY YEITIA	APPVD.		
DATE 10-8-81	DATE 11-2-81		
		FILE	

AF 14692A

REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.
A	CORRECTED P&S CABLES	[illegible]	3/4/84	
B	MOVED ENGINE SHUTDOWNS TO COCKPIT	[illegible]	10/29/87	



BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

MODEL 54
TITLE EMERGENCY ENGINE SHUT DOWN

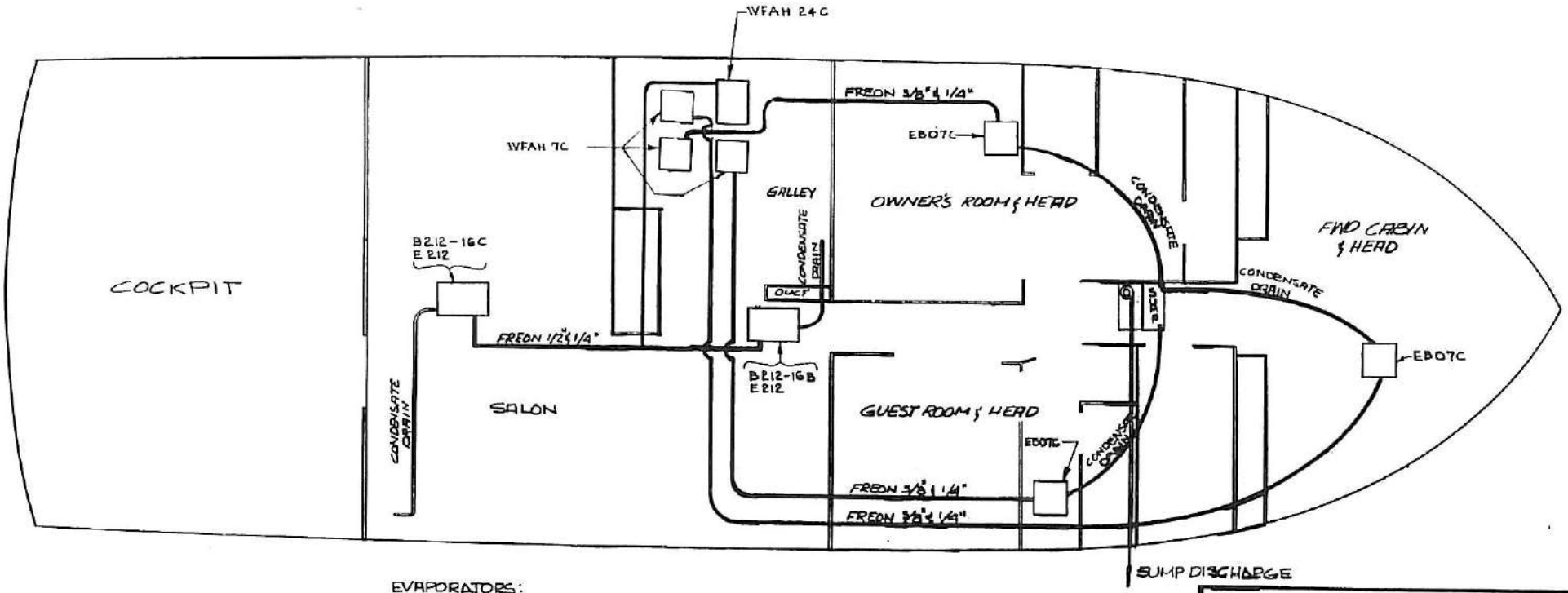
SCALE	NONE		PLAN NO.	REV.
BY	VETTA	APPV'D	B 7709	B
DATE	10-8-81	DATE 11-2-81		
			FILE	

DRAFTRACE 280

AF 14692A

B7713 B

REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.
A	CHGD COMPRESSOR POSITION. OWNER'S SYS WAS 1R EFF. HULL 545-540	LCH	3/19/84	
B	1. CHGD MODEL #'S OF COMPRESSORS AND EVAPORATORS EFF. HULL 545-567 & 560 SUBS.	RLE	1/8/85	



EVAPORATORS:
1- E12FB - FLYBRIDGE MOUNTED (1) SALON & GALLEY
2-EB07C - LOCKER MOUNTED (1) OWNER'S ROOM
3-EB07C - LOCKER MOUNTED (1) GUEST ROOM
4-EB07C - UNDER BERTH STBD (1) FWD STATEROOM

COMPRESSORS:
1-WFAH 7C- OWNERS ROOM (1) REQ
2-WFAH 7C- GUEST ROOM & V/B (2) REQ } MOUNTED IN ENGINE ROOM
3-WFAH 24C-GALLEY & SALON (1) REQ

ALL DRAINS 1/2" HOSE
OWNERS, GUEST, & FWD CABIN DRAIN TO FWD SUMP
SALON & GALLEY DRAIN TO ENG. ROOM BILGE THRU PILASTER & DUCT

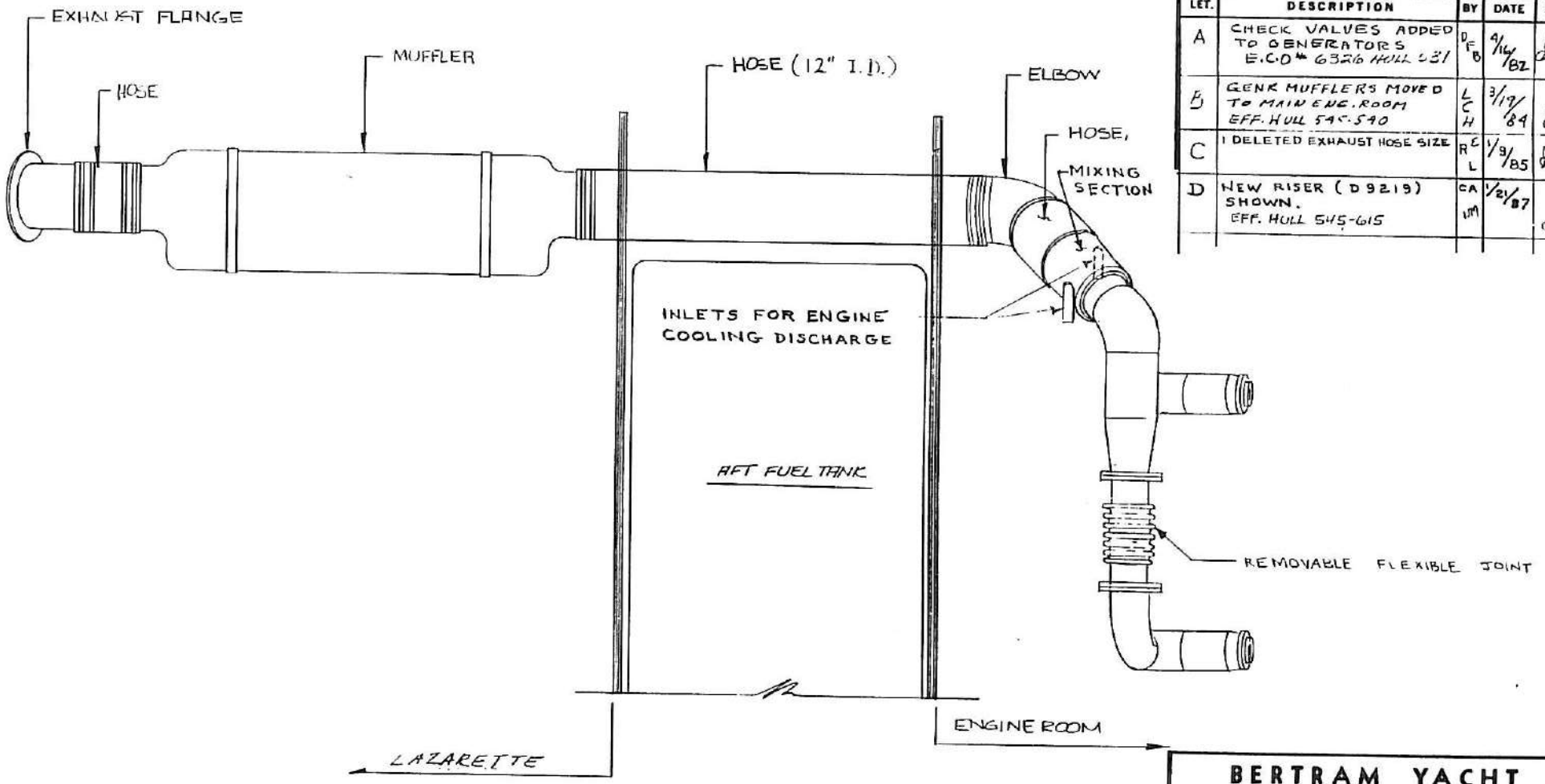
BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

MODEL 54-5
TITLE AIR COND. FREON LINES & CONDENSATE DRAINS
SCALE NONE
PLAN NO. B 7713
REV. B
BY VEIMA
APPVD.
DATE 9-15-81
DATE 12-2-81
FILE

DRAFTRACE 280

AF 14692A

B7718



REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.
A	CHECK VALVES ADDED TO GENERATORS E.C.O.# 6326 HULL 531	DFB	4/14/82	
B	GENR MUFFLERS MOVED TO MAIN ENG. ROOM EFF. HULL 545-590	LCH	3/7/84	
C	I DELETED EXHAUST HOSE SIZE	RCL	1/3/85	
D	NEW RISER (D9219) SHOWN. EFF. HULL 545-615	CA UM	1/21/87	

NOTES

1 PORT ENGINE EXHAUST SHOWN STBD IS SAME, OPPOSITE HAND

2 DRY EXHAUST TO BE INSULATED WITH REMOVABLE BLANKETS.

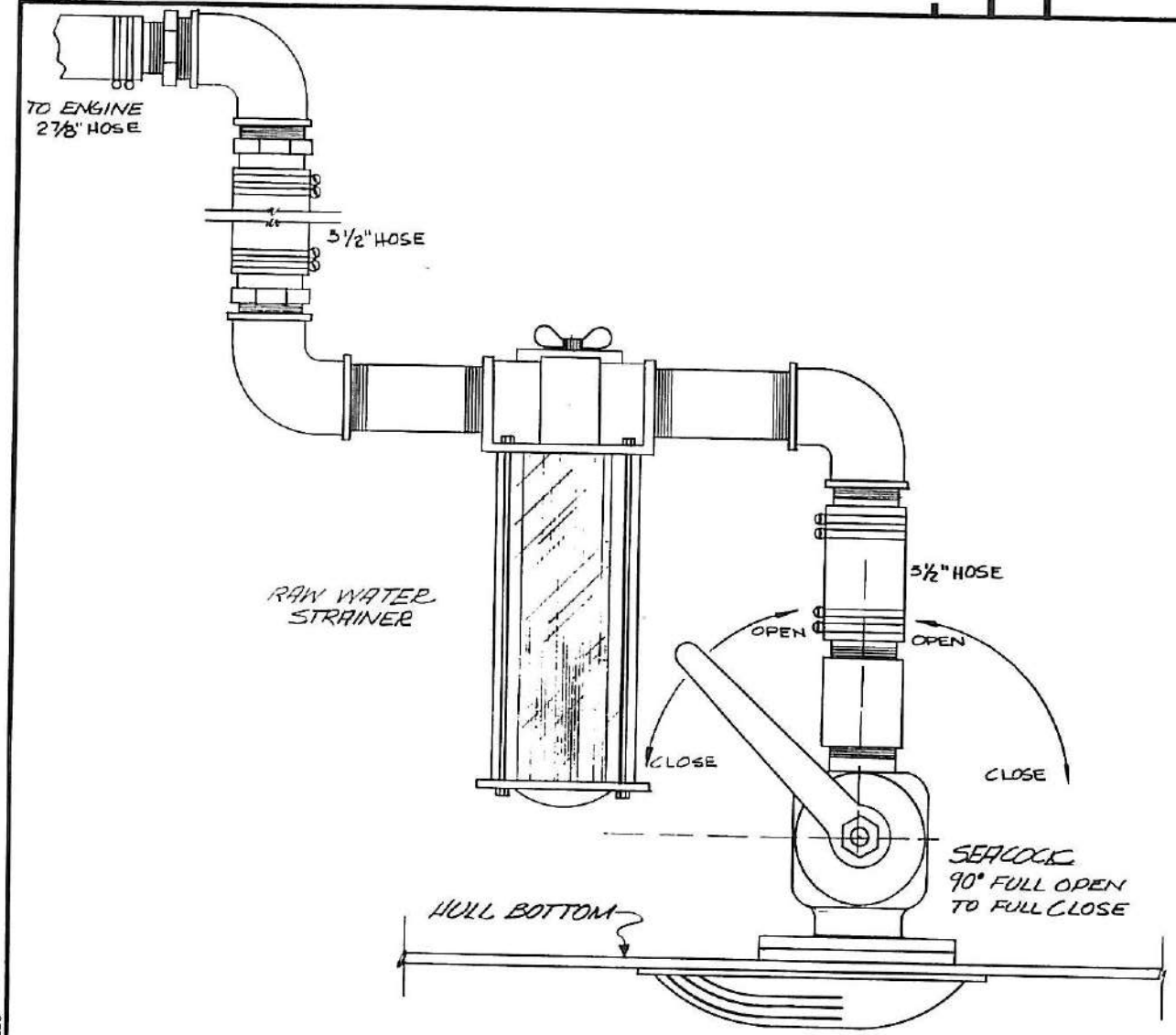
BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

MODEL 545
TITLE EXHAUST SYSTEM, ENG.

SCALE NONE		PLAN NO.	REV.
BY VEITA	APPVD.	B 7718	D
DATE 9-15-81	DATE 11-6-81		
		FILE	

DRAFTRACE 260

AF 14692A



INLET STRAINER

REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.

BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.
A SUBSIDIARY OF WHITTAKER CORPORATION

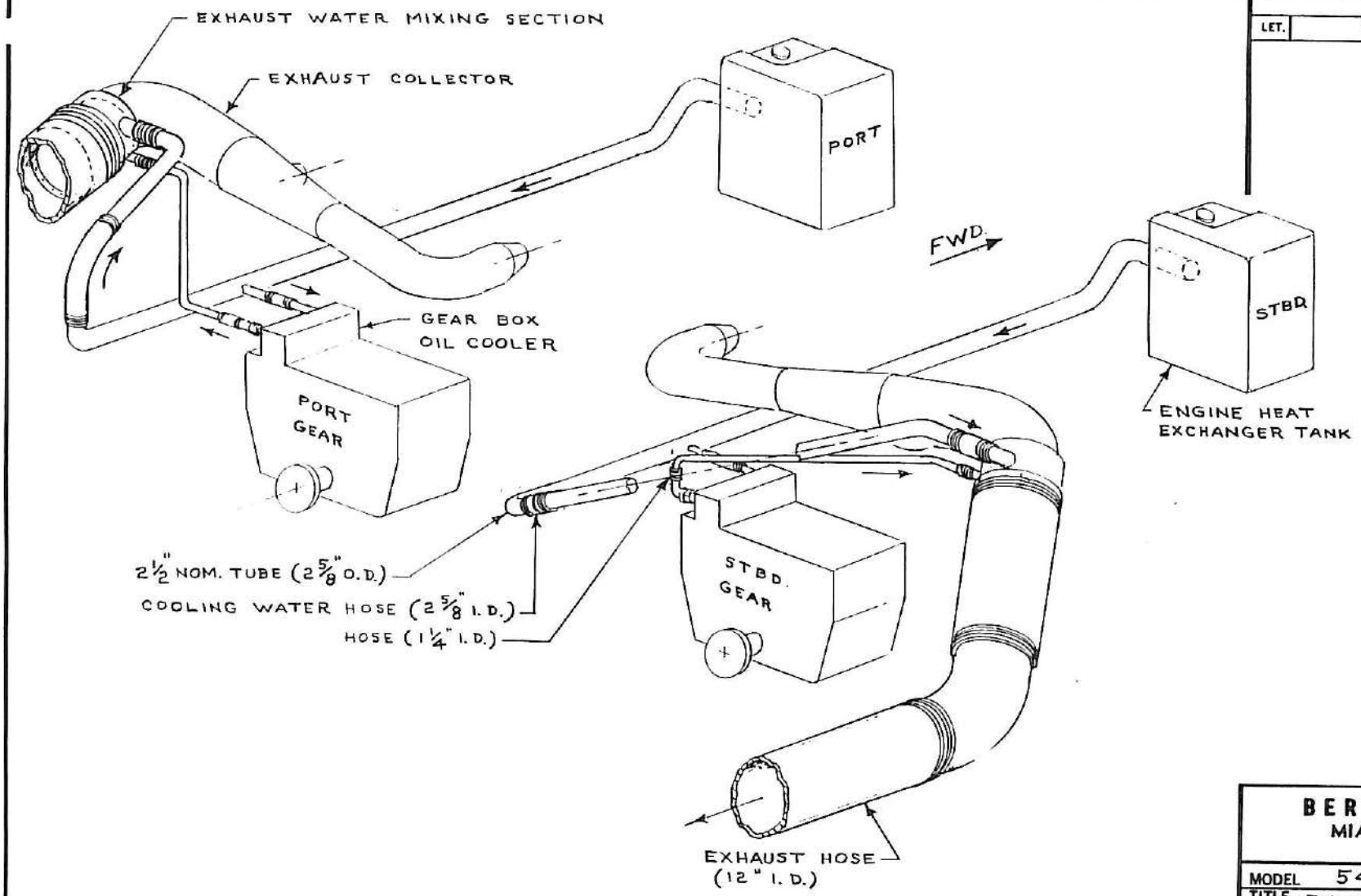
MODEL 545
TITLE ENGINE COOLING SEA WATER INLET

SCALE NONE		PLAN NO.	REV.
BY VEITIA	APPVD.	B 7719	
DATE 10-7-81	DATE 11-6-81		
		FILE	

DRAFTRACE 250

AF 39129A

33B9465



REVISIONS				
LET.	DESCRIPTION	BY	DATE	APPV.

BERTRAM YACHT
MIAMI, FLORIDA, U.S.A.

MODEL 545 EFF. HULL 545-615

TITLE ENGINE COOLING DISCHARGE, 12V92TA WITH ZF195 GEAR

SCALE NONE			PLAN NO.	REV.
BY Chas. A.	APPVD.	33	B 9465	
DATE 2/10/87	DATE 2/16/87			
			FILE	

Section 9

Toilet (Head) System

CAUTION

To avoid damage to your vessel, do not use lye-based clog dissolvers on the fresh water, toilet, and/or bilge pump systems.

CAUTION

Do not flush the toilet 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. Continued flushing could severely damage the toilet system.

NOTE:
Federal law prohibits the discharge of improperly treated sewage into the territorial waters of the United States. Violators are subject to a fine of $5,000 per incident. Some areas may be declared NO DISCHARGE areas.

Marine toilets on vessels operating within U.S. territorial waters must 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 or a non-releasable wire-tie, or have the valve handle removed.

NOTE:
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.

The toilets (heads) in your Bertram are complete Marine Sanitation Devices (MSDs) and comply in all respects with the U.S. Coast Guard regulations and standards. The term MSD means that these are complete marine disposal systems and include the following hardware as shown in Figure 9-1:

- seawater supply seacock and stainer;
- seawater supply valves (one per toilet);
- toilets, toilet pumps and flush timers;
- discharge seacocks (one per toilet);
- holding tank equipped with electric overboard discharge pump;
- holding tank **ALMOST FULL** and **DO NOT FLUSH** alarm;
- deck mounted dockside pump-out fitting;
- associated plumbing;

In this marine toilet system, a timer in each head controls a dual-operation, electric toilet pump. This pump pulls up raw seawater for flushing and simultaneously removes the waste from the toilet. The position of the discharge "Y" mode control valves determines if the

waste is pumped into the holding tank or directly overboard. The "Y" valves are reached through the hatch in the companionway sole.

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.

Inside U.S. Territorial Waters

For your marine toilet systems to operate in U.S. territorial waters in compliance with U.S. regulations, these conditions must be met:

- For any toilet system you plan to use, the toilet pump circuit breaker must be **ON**. These breakers are in the Companionway 32Vdc Distribution Panel (Figure 10B-4). The forward stateroom toilet is on circuit breaker **#3S3 – TOILET FWD**; the starboard toilet is on breaker **#3S2 – TOILET STBD**; and the port toilet is on breaker **#3S – TOILET PORT**.
- The seawater inlet seacock, which supplies seawater to the toilet system manifold, must be **OPEN**. This seacock is below the cabin sole, and is accessible through the hatch in the companionway sole.
- The seawater valve to each marine toilet system must be open. These valves are accessible through the hatch in the companionway sole.
- The discharge seacock control "Y" valves must be set to direct the flow of waste materials into the holding tank.
- The discharge seacock must be **CLOSED** and its handle secured or removed. These seacocks are accessible through the hatch in the companionway sole.

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:

- The toilet pump circuit breaker must be **ON**.
- The seawater inlet seacock, which supplies seawater to the toilet system manifold, must be **OPEN**. This seacock is below the cabin sole, and is accessible through the hatch in the companionway sole.
- The seawater valve to each marine toilet system must be open. These valves are accessible through the hatch in the companionway sole.
- The discharge seacock control "Y" valves must be set to direct the flow of waste materials directly overboard.
- The discharge seacocks must be **OPEN**. These seacocks are accessible through the hatch in the companionway sole.

Flushing

Inside each toilet room (head) is a control panel for flushing the toilet. This control panel has one **ON/EMERGENCY OFF** rocker type switch and one pushbutton type switch. The **ON/EMERGENCY OFF** switch must be in the **ON** position for your marine toilet to operate.

To flush your marine toilet:

1) position the **ON/EMERGENCY OFF** switch in the **ON** position;
2) 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/EMERGENCY OFF** switch in **EMERGENCY 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.

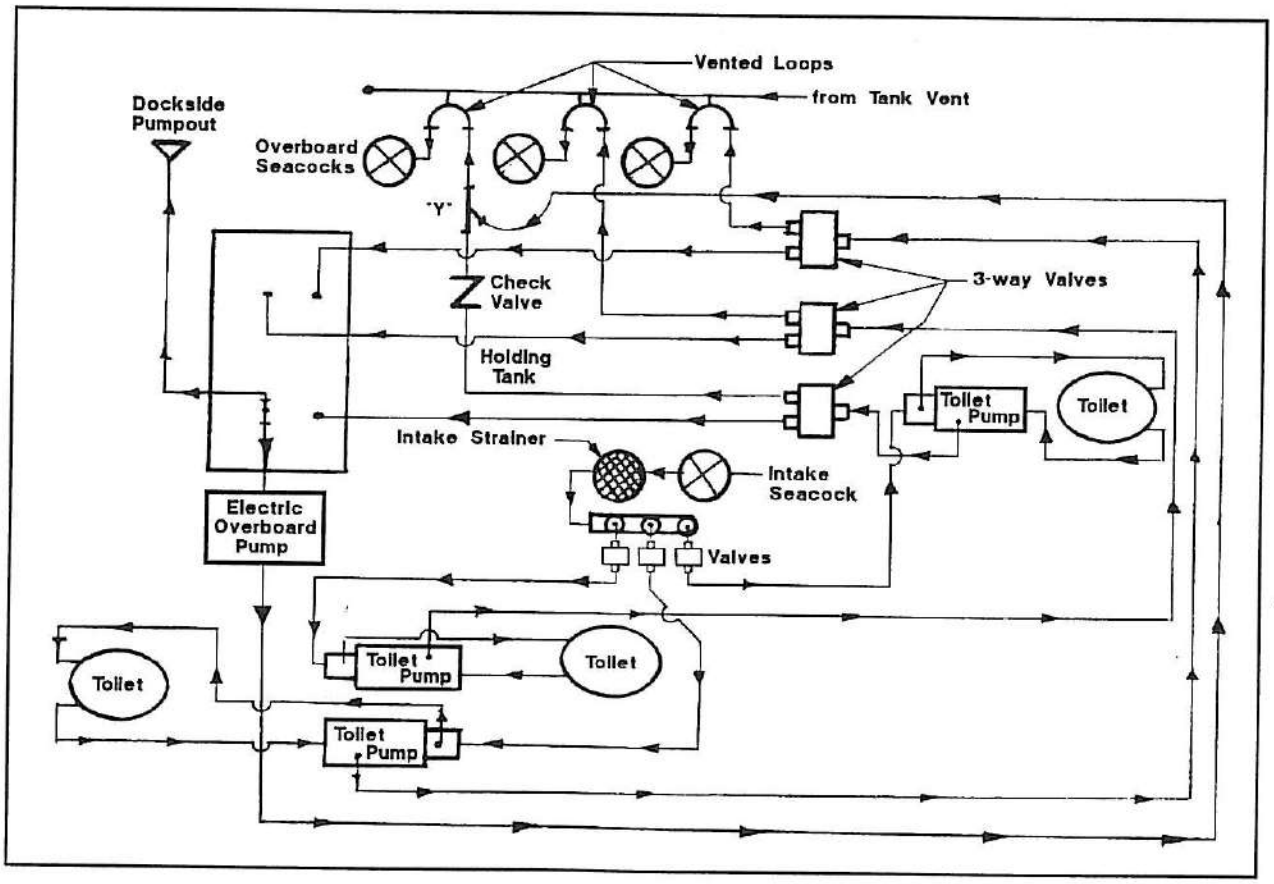


Figure 9-1: Toilet System Schematic

Holding Tank Pump-Out

NOTE:
Federal law prohibits the discharge of improperly treated sewage into the territorial waters of the United States. Violators are subject to a fine of $5,000 per incident. Some areas may be declared NO DISCHARGE areas.

Each head has a **HOLDING TANK MONITOR** panel with amber and red indicator lights. These lights warn 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, 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, this indicates that further flushing could damage your toilet system.

There are two ways to empty your Bertram's holding tank:

1) Use dockside facilities (a suction pump) to pump out the tank through the portside deckplate. Remove the cover of this deckplate to gain direct access to the holding tank.
2) Use the electric overboard pump (only if you are outside U.S. territorial waters):
   a) Be sure circuit breaker **#3S10 – HOLDING TANK OVERBD** on the Companionway 32Vdc Distribution Panel (Figure 10B-4) is **ON**.
   b) Open the discharge seacock. It is accessible through the forward hatch in the companionway sole.
   c) Use the **HOLDING TANK PUMP-OUT** switch to activate the holding tank discharge pump motor. This switch is under the forward cabin sole, adjacent to the holding tank. An amber light illuminates to indicate that this pump is operating.
   d) When the holding tank is empty, and the sound made by the pump changes in tone as it runs with no load, release the switch.
   e) If you will be entering U.S. territorial waters or any other area where waste discharge is restricted:
      1) Turn the cicuit breaker **OFF**.
      2) Close the discharge seacock and secure or remove the handle.

NOTE:
To satisfy U.S. regulations, all outlet seacocks on vessels operating within U.S. territorial waters must be locked shut with a padlock or a non-releasable wire-tie, or have the valve handle removed.

Section 10A

12-Volt DC Electrical System

The 12Vdc (12-Volt direct current) system is a secondary electrical system. It provides electric power for onboard 12Vdc equipment.

The system has three 12Vdc control panels:

- Supply Panel (Figure 10A-1);
- Main Distribution Panel (Figure 10A-2);
- Flybridge Distribution Panel (Figure 10A-3).

Negative Ground System

The 12Vdc system uses negative ground. The negative 12Vdc conductors are connected to ground buses in the 12Vdc panels. The positive 12Vdc conductors are protected by circuit breakers or fuses.

12Vdc Batteries

The 12Vdc system is powered by two banks of 12Vdc lead-acid marine batteries; each bank contains a single battery. The battery banks are independent of each other, but can be used in parallel when starting the Diesel ac generators (Bertram suggests that you parallel the battery banks every time you start a generator).

The 12Vdc battery banks serve two functions:

- they are used to start the ac generators (generator starting procedure is discussed in **Part II, Section 11**);
- they provide power for the Flybridge 12Vdc Distribution Panel (Figure 10A-3).

You can set the **BATTERY SELECTOR** switch on the Engine/Generator Room 12Vdc Main Distribution Panel (Figure 10A-2) to choose either battery bank as the power source.

The 12Vdc battery banks are charged by ac shore power or the onboard ac generators via the 12Vdc converter. The ac generators also have a battery charging circuit to maintain the charge when the batteries are used only to start the generators, but this circuit cannot keep up with battery power used by shipboard systems.

12Vdc Converter

The 12Vdc battery banks are charged through the 12Vdc converter by ac shore power or the onboard ac generators. The converter takes 50Hz or 60Hz ac and converts it to 12Vdc; when both batteries are charged, it maintains them at peak level with a "trickle charge" feature.

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

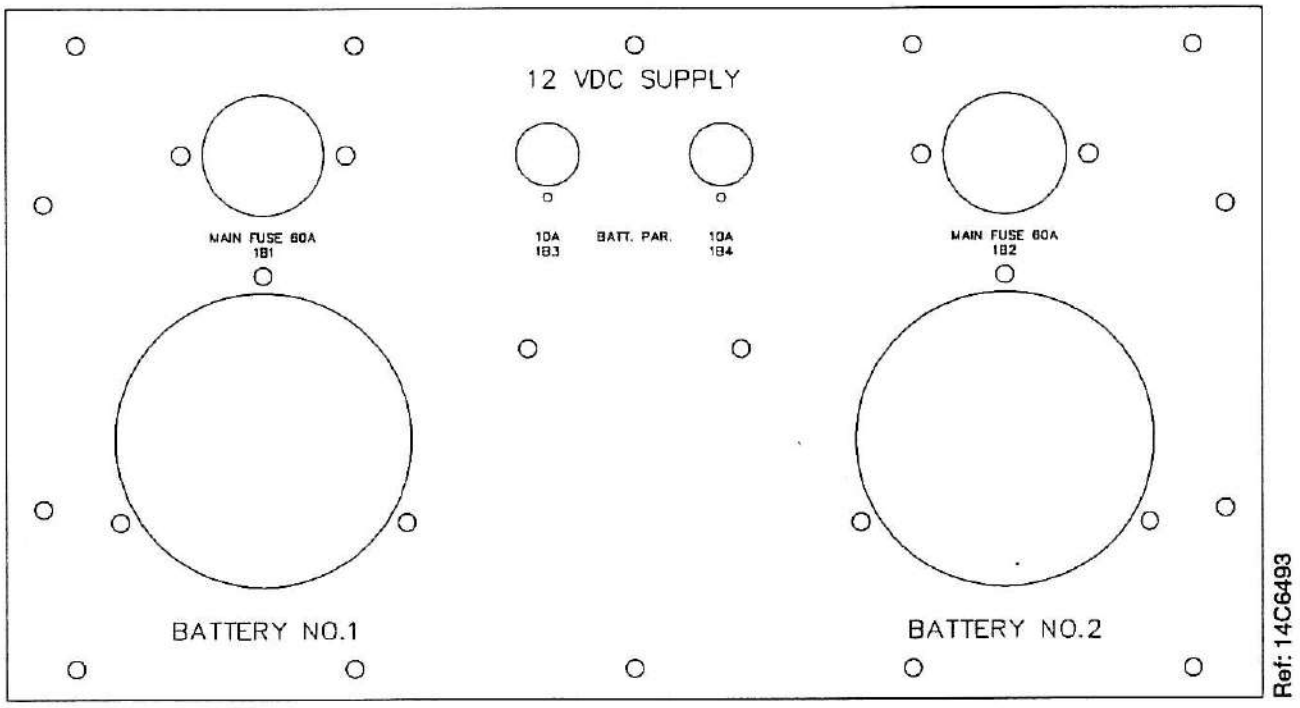


Figure 10A-1: Engine/Generator Room 12Vdc Supply Panel

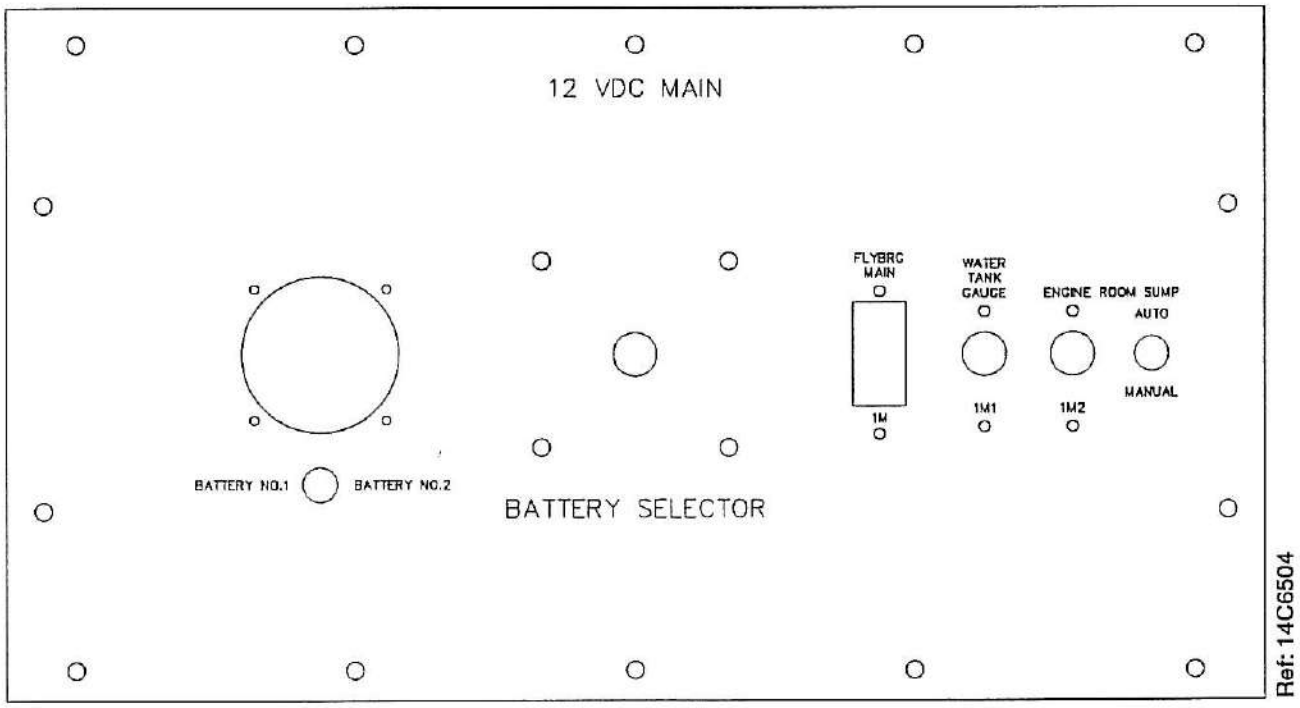


Figure 10A-2: Engine/Gen. Room 12Vdc Main Dist. Panel

The converter is located on the port side of the aft engine/generator room bulkhead (inboard of the two 32Vdc converters).

Bertram recommends that the 12Vdc converter be left on all the time.

12Vdc System Distribution and Control Panels

Each circuit that uses 12Vdc power is protected by its own circuit breaker or fuse. There is space on the Flybridge 12Vdc Distribution Panel so you can provide circuit breaker protection for additional 12Vdc equipment you may wish to add to your Bertram.

Engine/Generator Room 12Vdc Supply Panel

The Engine/Generator Room 12Vdc Supply Panel (Figure 10A-1) is at the forward end of the engine/generator room. This panel contains:

- 12Vdc battery disconnect switches;
- fuses listed in Table 10A-1.

Table 10A-1: Fuses on the Engine/Generator Room 12Vdc Supply Panel

Fuse	Circuit Protected
1B1	Main 12Vdc System
1B2	Main 12Vdc System
1B3	Battery Parallel Circuit
1B4	Battery Parallel Circuit

Table 10A-2: Circuit Breakers on the Engine/Generator Room 12Vdc Main Distribution Panel

Breaker	Circuit Protected
1M	Flybridge Main
1M1	Water Tank Gauge
1M2	Engine Room Sump

12Vdc Battery Disconnect Switches

The 12Vdc Battery Disconnect Switches connect and disconnect the 12Vdc batteries and the 12Vdc circuits and equipment.

The switches are rated at 175 Amperes continuous and 800 Amperes momentary. In case of fire, these switches should be **OFF**.

To activate your vessel's 12Vdc system, the main Battery Disconnect Switches must be **ON**. However, Bertram suggests that these switches should be left in the **OFF** position when your vessel is unattended for long periods.

The Battery Disconnect Switches do not interrupt 12Vdc converter output to the batteries. If the ac shoreline is plugged in and the shoreline input circuit breaker is **ON**, the converter will normally keep the batteries charged during those periods when your vessel's ac generators are not operating.

Fuses

The 12Vdc Supply Panel contains the 12Vdc Main Distribution Panel fuses (60Amp) and the Battery Parallel circuit fuses (10Amp).

NOTE:
*The 12Vdc Supply Panel **MAIN FUSEs** must be in place for circuits on the 12Vdc Main Distribution Panel to be powered. Similarly, the **BATT. PAR.** fuses must be in place for the 12Vdc battery paralleling system to function.*

Engine/Generator Room 12Vdc Main Distribution Panel

The Engine/Generator Room 12Vdc Main Distribution Panel (Figure 10A-2) is at the forward end of the engine/generator room, just above the 12Vdc Supply Panel. The 12Vdc Main Distribution Panel contains:

- dc Voltmeter and its selector switch;
- battery selector switch;
- circuit breakers listed in Table 10A-2;
- sump pump **AUTO/ MANUAL** toggle selector switch.

DC Voltmeter and Switch

The dc Voltmeter enables you to read the Voltage level on either battery bank with a single meter. Use the selector switch to determine which battery is checked.

Battery Selector Switch

The selector switch on this panel allows you to choose which 12Vdc battery bank will supply the power to the flybridge, the water tank gauge, and the 12Vdc engine/generator room sump pump.

Circuit Breakers

This panel contains the flybridge main distribution panel circuit breaker and other circuit breakers listed in Table 10A-2.

NOTE:
*The **FLYBRG MAIN** circuit breaker must be **ON** for circuits on the Flybridge 12Vdc Distribution Panel to be powered.*

Sump Pump Switch

See **Part II, Section 7** for more information on operation of the bilge and sump pump systems.

Flybridge 12Vdc Distribution Panel

The Flybridge 12Vdc Distribution Panel (Figure 10A-3) is above the 32Vdc panel on the flybridge, behind the locker door on the port side. This panel is powered from either of the 12Vdc batteries. The Battery Selector Switch on the Engine/Generator Room 12Vdc Main Distribution Panel determines the battery in use.

The Flybridge 12Vdc Distribution Panel contains:

- circuit breakers;
- dc Voltmeter.

Circuit Breakers

Circuit breakers are listed in Table 10A-3. There is space left on the panel to accommodate circuit breaker protection for additional equipment you may choose to have installed.

DC Voltmeter

The dc Voltmeter reads the Voltage level on the battery bank selected to power the flybridge. The Voltmeter is activated only when the Flybridge 12Vdc Distribution Panel panel is energized.

DC Equipment Protection

A tripped circuit breaker or a blown fuse may indicate either that you have a problem in that circuit or in the equipment that is being protected by that circuit breaker or fuse.

Table 10A-3: Circuit Breakers on the 12Vdc Flybridge Distribution Panel

Breaker	Circuit Protected
1F1	Navigation Lights
1F2	Tachometer
1F3	Hailer
1F4	Flood Lights
1F5	Depth Finder
1F6	Depth Recorder
Breaker	**Circuit Protected**
1F7	Direction Finder
1F8	Fuel Priming Pump
1F9	VHF Radio
1F10	
1F11	Engine Synchronizer
1F12	

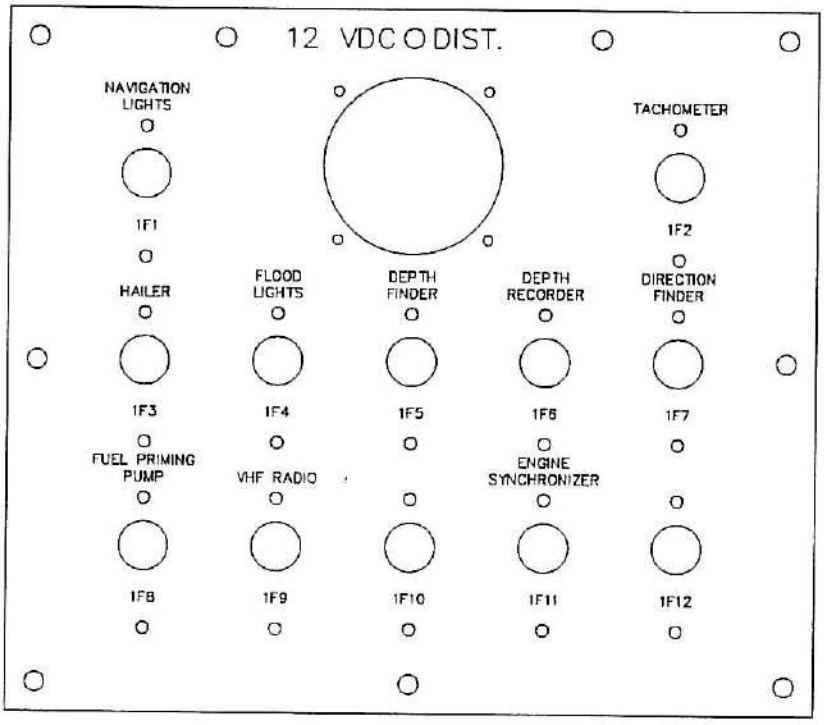
(Fill in when you add equipment.)

CAUTION

Do not replace existing circuit breakers or fuses with circuit breakers or fuses having a higher trip value than the originals. Such modifications could cause equipment and/or circuit failure and/or fires.

If the same circuit breaker trips repeatedly or the same fuse blows repeatedly, the cause of the problem must be found and corrected to avoid possible damage and further complications.

Under no circumstances should any circuit breaker or fuse be replaced with one having a higher trip value than the original.



Ref: 14D9249

Figure 10A-3: Flybridge 12Vdc Distribution Panel

Section 10B

32 Volt DC Electrical System

The 32 Volt direct current (32Vdc) electrical system is your vessel's primary dc electrical system. There are 32Vdc distribution panels in the salon, in the companionway under the stairs, in the engine/generator room, and on the flybridge.

Ungrounded System

Your Bertram has an ungrounded, negative return, 32Vdc electrical system, which means that neither the negative nor the positive sides of the batteries are grounded. This is called an "isolated" or a "floating" system.

NOTE:
It is very important that the isolated condition of the 32Vdc system be maintained. Be sure you advise your boat yard, marina, service technicians, and any other persons who perform electrical or related work on your vessel.

Batteries

The 32 Vdc system is powered by two banks of 8Vdc lead-acid batteries, located in the engine/generator room between the engines. Each bank contains four batteries.

When under way, the 32Vdc batteries are continually charged by the engine alternators. If the generators are running, the batteries are also charged through the two 32Vdc converters. When you are dockside and have shore power available, the batteries are charged by the converters.

The two main battery banks are independent of each other, but can be used in parallel when starting a main engine (Bertram suggests that you parallel the battery banks every time you start a main engine).

Circuit Breakers and Fuses

Each system or piece of equipment that requires 32Vdc power is protected by its own circuit breaker or fuse. On the dc power distribution panels, there is a provision for 32Vdc equipment you may wish to add.

A tripped circuit breaker or a blown fuse may indicate a problem in the circuit or in the equipment protected by the circuit breaker or fuse. If a circuit breaker trips repeatedly, or if a fuse blows repeatedly, you must locate and

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

correct the problem to avoid possible equipment damage.

CAUTION

Do not replace existing circuit breakers or fuses with circuit breakers or fuses having higher trip values than the originals. Such modifications could cause equipment and/or circuit failures and/or fires.

32Vdc Battery Disconnect Panel

CAUTION

Battery switches are designed for use under normal operating conditions. If the switches are used to open the dc circuit while the engine is being cranked, the switch should be replaced as soon as possible to avoid future failure.

The 32Vdc Battery Disconnect Panel (the lower panel in Figure 10B-1) is located on the aft bulkhead of the engine/generator room.

The battery disconnect switches are extra heavy duty units rated at 600 Amps continuous and 1,000 Amps momentary. To activate your vessel's 32Vdc systems, including starting and operating your main engines, one or both 32Vdc Main battery disconnect switches must be in the **ON** position.

Bertram suggests that whenever your vessel is left unattended these switches should be left in the **OFF** position.

For the safety of you and your vessel, the battery disconnect switches do not control power to the fire alarm system, the bilge flood alarm system, the Halon fire system or the bilge pumps. These circuits are protected by fuses and are normally continually energized. Similarly, the battery disconnect switches cannot cut off the output of the two 32Vdc converters.

Table 10B-1: Circuit Breakers: Engine/Generator Room 32Vdc Control Panels

Port Side		Starboard Side	
Breaker	**Circuit Protected**	**Breaker**	**Circuit Protected**
3B1	Mid Bilge Pump	3B2	Monitor Systems
3B3	Aft Bilge Pump	3B4	Forward Bilge Pump
3Z		3D	Deckhouse Main
3R	SSB Radio	3FS	Flybridge Starboard
3FP	Flybridge Port	3X	
3S	Stateroom Main	3Y	

Engine/Generator Room 32Vdc Distribution Panels

The 32Vdc control panels (the upper panels in Figure 10B-1) are on the aft bulkhead of the engine/generator room above the 32Vdc Battery Disconnect Panel. They contain the circuit breakers listed in Table 10B-1.

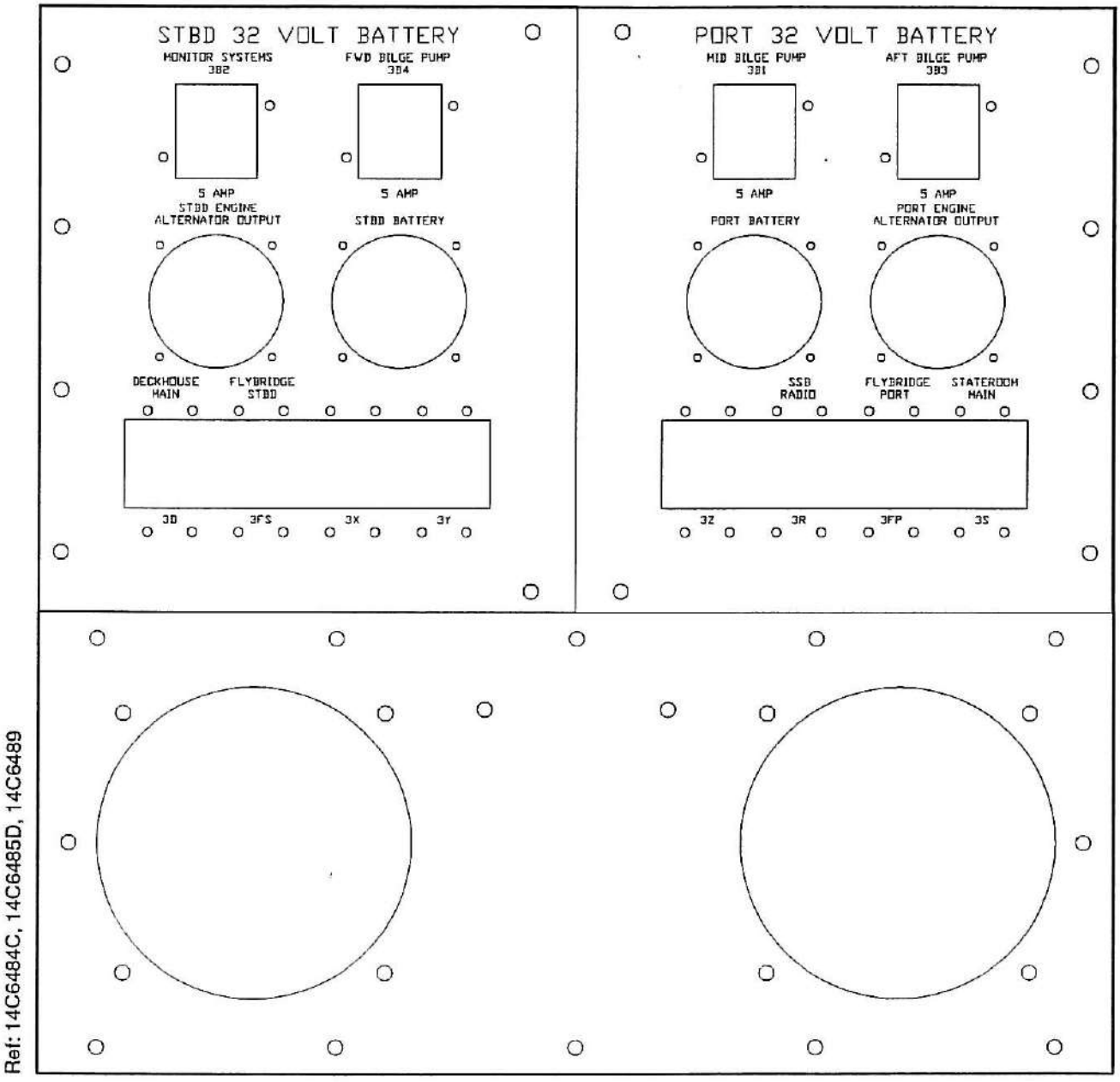


Figure 10B-1: Engine/Generator Room 32Vdc Dist. Panels

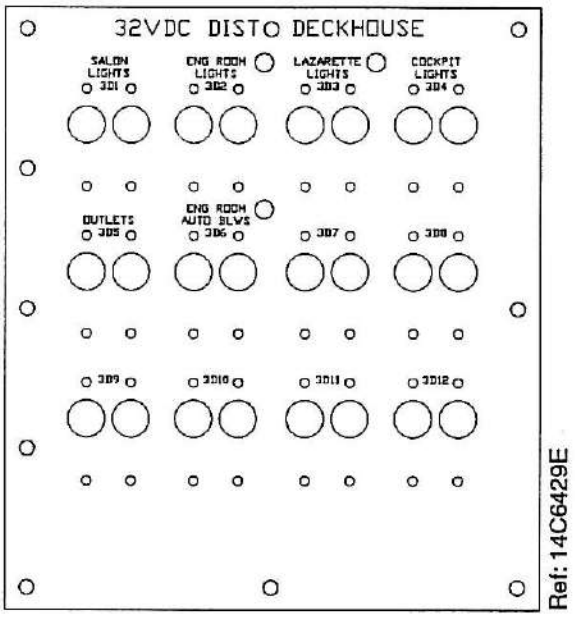


Figure 10B-2: Salon 32Vdc Dist. Panel

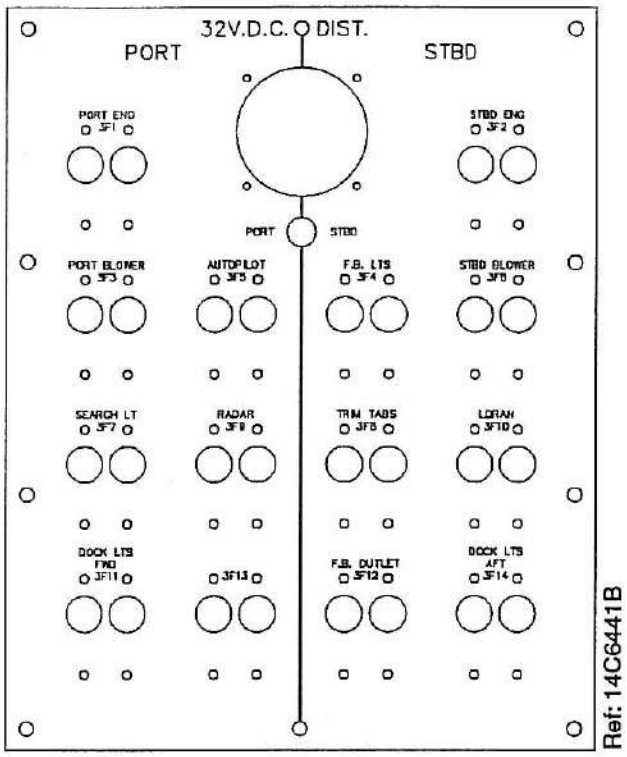


Figure 10B-3: Flybridge 32Vdc Dist. Panel

Table 10B-2: Circuit Breakers: Salon 32Vdc Distribution Panel

Breaker	Circuit Protected
3D1	Salon Lights
3D2	Engine Room Lights
3D3	Lazarette Lights
3D4	Cockpit Lights
3D5	Outlets
3D6	Eng Room Auto Blowers
3D7	
3D8	
3D9	
3D10	
1D11	
3D12	

Table 10B-3: Circuit Breakers: Flybridge 32Vdc Dist. Panel

Breaker	Circuit Protected
3F1	Port Engine
3F2	Starboard Engine
3F3	Port Blower
3F4	Flybridge Lights
3F5	Autopilot
3F6	Starboard Blower
3F7	Search Light
3F8	Trim Tabs
3F9	Radar
3F10	Loran
3F11	Docking Lights Fwd
3F12	Flybridge Outlet
3F13	
3F14	Docking Lights Aft

Salon 32Vdc Distribution Panel

The Salon 32Vdc Distribution Panel (Figure 10B-2) is in the salon, aft on the starboard side, behind a pair of cabinet doors (in the same cabinet as the main 120/240Vac distribution panels). The panel is equipped with 12 branch circuit breakers (Table 10B-2).

Flybridge 32Vdc Distribution Panel

The Flybridge 32Vdc Distribution Panel (Figure 10B-3) is mounted behind the flybridge panel service access door on the port end of the flybridge console.

The panel has spaces for up to 14 branch circuit breakers (Table 10B-3) and a Voltmeter with a **PORT/STBD** selector switch. The Voltmeter reading indicates the condition of the port or starboard 8Vdc battery banks.

Companionway 32Vdc Distribution Panel

The Companionway 32Vdc Distribution Panel (Figure 10B-4) is under the stairs in the companionway from the salon/galley to the staterooms. The panel is equipped with 12 circuit breakers (Table 10B-4).

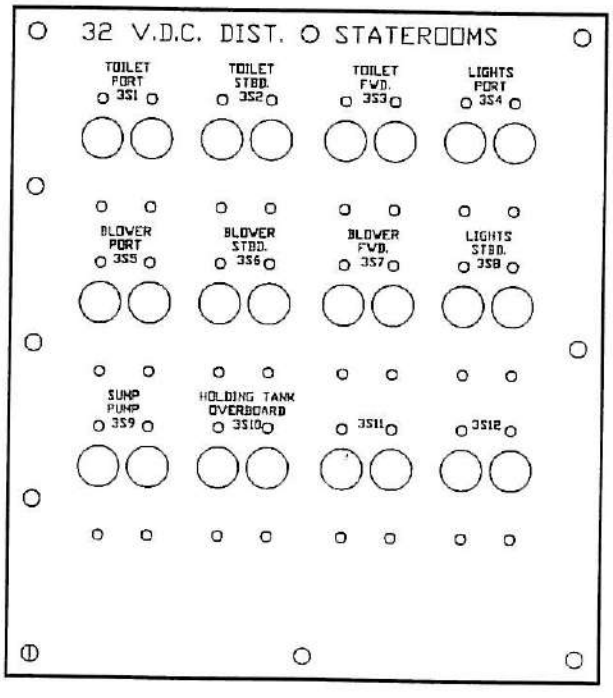


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Figure 10B-4: Companionway 32Vdc Distribution Panel

Table 10B-4: Circuit Breakers: Companionway 32Vdc Distribution Panel

Breaker	Circuit Protected
3S1	Toilet Port
3S2	Toilet Starboard
3S3	Toilet Forward
3S4	Lights Port
3S5	Blower Port
3S6	Blower Starboard
3S7	Blower Forward
3S8	Lights Starboard
3S9	Sump Pump
3S10	Holding Tank Overboard
3S11	
3S12	

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

Converters

The two 32Vdc converters are mounted one above the other on the engine/generator room aft bulkhead. The upper converter charges the port battery bank, and the lower converter charges the starboard battery bank.

The 120Vac power for these converters is supplied through circuit breakers **#104 – STBD CONVERTER** and **#102 – PORT CONVERTER** on the Salon Main 120/240Vac Distribution Panel (Figure 11-1). Each converter has an **ON/OFF** switch with a pilot light. When a battery is fully charged, the converter automatically maintains a "trickle" charge condition and can operate on either a 50Hz or 60Hz ac input current.

Battery Condition Meters

The Flybridge 32Vdc Distribution Panel (Figure 10B-3) and the Engine/Generator Room 32Vdc Distribution Panels (Figure 10B-1) have meters to monitor the voltage levels in the battery banks. A fully charged battery bank should read about 34.0Vdc. When either the ac/dc converters or the engine alternators are running, a reading of 37Vdc to 37.8Vdc indicates a normal charging rate. If either voltmeter reads below 32Vdc, you have little chance to start that engine unless you hold the **BATTERY PARALLEL** switch in its battery paralleling position.

Section 11

120/240 Volt AC Electrical System

The 120/240 Volt alternating current (120/240Vac) electrical system on your Bertram can be powered by shore power, by either or both of your two Diesel 15kW ac motor generators, or by a combination of shore power and generator power.

Each circuit that uses 120Vac or 240Vac power is protected by its own circuit breaker or fuse. There is space on some 120Vac or 240Vac distribution panels so you can add circuit breakers for additional 120Vac or 240Vac equipment you place aboard your Bertram.

120/240Vac Distribution Panels

⚠ CAUTION

Before opening any 120/240Vac distribution panel or servicing any 120/240Vac equipment:
1) disconnect the shore power cords;
2) stop the ac generators.

The Main 120/240Vac Distribution Panel (Figure 11-1) is in the salon. Additional distribution panels (Figures 11-2 and 11-3) are in the galley and under the companionway stairs.

Main 120/240Vac Distribution Panel

⚠ CAUTION

The 120/240Vac Distribution Panel Voltmeters and Ammeters monitor the power source in use. If the Voltage drops below 110Vac, any ac motor in use may be damaged.

The Main 120/240Vac Distribution Panel (Figure 11-1) is in the salon, aft on the starboard side, behind a pair of cabinet doors.

While this panel system looks complex, its operation is simple; just follow the instructions in this section.

The main 120/240Vac distribution panel consists of six subpanels.

120Vac Shore No. 1 Control Panel

The 120Vac Shore No. 1 Control Panel feeds 120Vac to the circuit breakers on the 120Vac Distribution Panel located directly below it.

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

120Vac Distribution Panel

The 120Vac Distribution Panel is equipped with the circuit breakers listed in the left column of Table 11-1. At the bottom of this panel are the main circuit breakers for the Galley No. 1 distribution panel and the Stateroom No. 1 distribution panel.

Generator Control Panels

⚠ 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.

The Generator Control Panels supply power from the 15kW generators to the 120/240Vac system. The remote controls for starting and stopping the generators are also on this panel.

120/240 Vac Shore No. 2 Control Panel

The 120/240 Vac Shore No. 2 Control Panel supplies both 120Vac and 240Vac to the circuits on the 120/240Vac Distribution Panel directly below it.

Table 11-1: Circuit Breakers: Main 120/240Vac Distribution Panel

120Vac

Breaker	Circuit
101	Salon Lights
102	Port 32Vdc Converter
103	Salon Outlets
104	Stbd 32Vdc Converter
105	Cockpit Freezer
106	Washdown Pump
107	Fresh Water Pump
108	12Vdc Converter
110	Galley No.1 Main
130	Stateroom No. 1 Main

Generator No. 1

Breaker	Circuit
300	Generator No. 1 Main

120/240Vac

Breaker	Circuit
151	Windlass
152	Fresh Water Maker
153	Lube Oil Pump
154	Fuel Transfer Pump
155	Washer
156	Air Compressor
201	Water Heater
202	Dryer
160/210	Galley No.2 Main
230	Stateroom No. 2 Main

Generator No. 2

Breaker	Circuit
400	Generator No. 2 Main

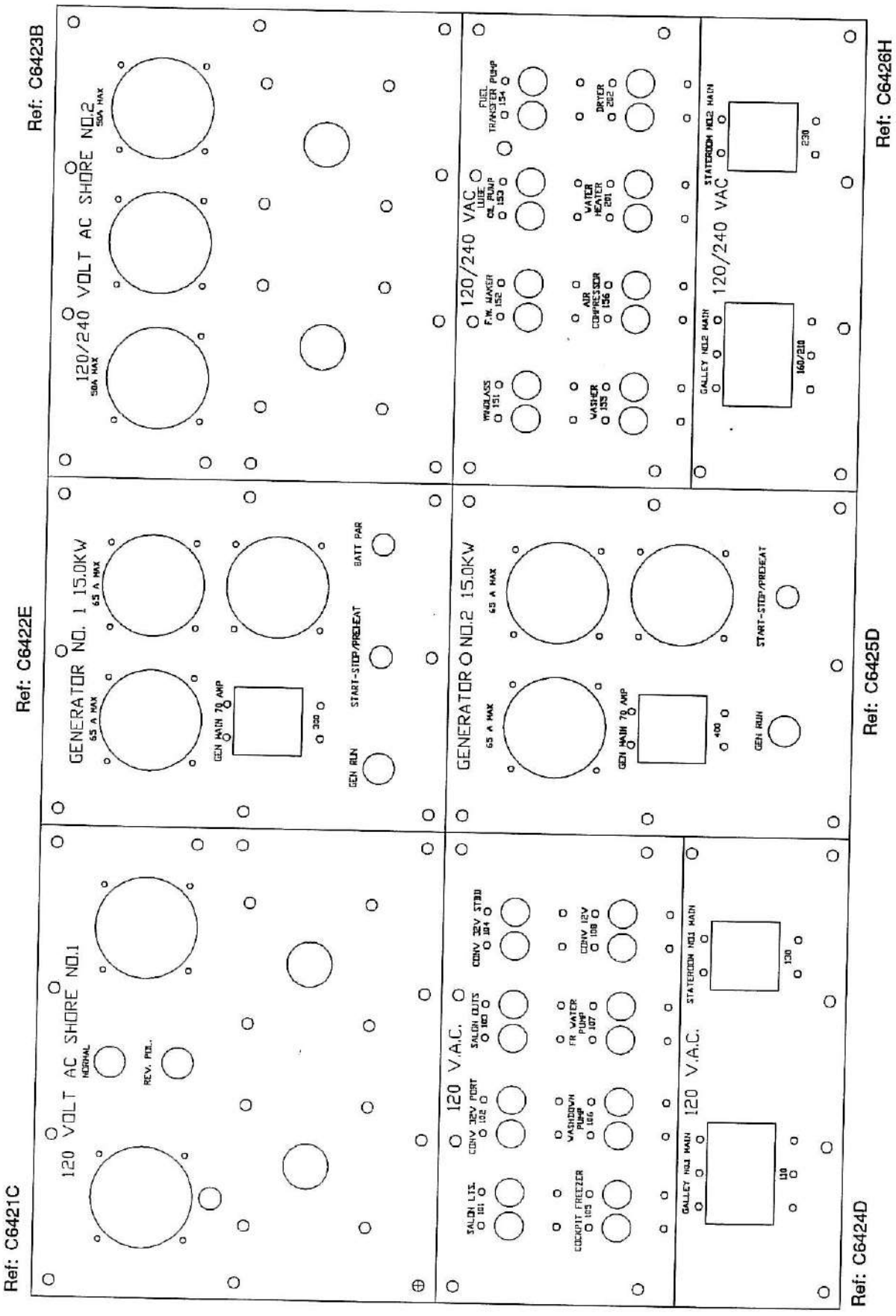

Figure 11-1: Main 120/240Vac Distribution Panel

120/240Vac Distribution Panel

The 120/240Vac Distribution Panel is equipped with the accessory circuit breakers listed in the right column of Table 11-1. At the bottom of this panel are the main circuit breakers for the Galley No. 2 distribution panel and the Stateroom No. 2 distribution panel.

Galley 120/240Vac Distribution Panel

The Galley 120/240Vac Distribution Panel (Figure 11-2) is in a cabinet on the port bulkhead of the galley stairs. It is a secondary distribution panel with no meters, and consists of three subpanels, two for 120Vac circuits, and one for 240Vac circuits.

The Galley No. 1 120Vac subpanel has six circuit breakers that power galley circuits, the salon icemaker and the flybridge refrigerator/icemaker. This subpanel is powered through Salon 120/240Vac Distribution Panel circuit breaker **#110 – Galley No. 1 Main**.

The Galley No. 2 120Vac subpanel and the Galley No. 2 240Vac subpanel are powered through Salon 120/240Vac Distribution Panel circuit breaker **#160/210 – Galley No. 2 Main**.

The upper right subpanel is for the flybridge and engine/generator room outlets, plus the disposal and trash compactor. The lower right subpanel is for 240Vac appliances with dual circuit breakers.

The circuit breakers on the Galley Distribution Panel are listed in Table 11-2.

Companionway 120/240Vac Distribution Panel

This panel is under the stairs in the companionway from the salon to the staterooms. The step in front of the panel is hinged on its left side to allow panel access. As shown in Figure 11-3, this panel is divided into two subpanels.

The 120Vac No. 1 panel is for 120Vac lights and outlets port and starboard, and is powered through Salon 120/240Vac Distribution Panel circuit breaker # 130 – Stateroom No. 1 Main.

The 240Vac No. 2 panel is for the 240Vac air conditioning units for each stateroom, and for the air conditioning cooling water pump. It is powered through Salon 120/240Vac Distribution Panel circuit breaker # 230 – Stateroom No. 2 Main.

The circuit breakers and the fuse on this panel are listed in Table 11-3.

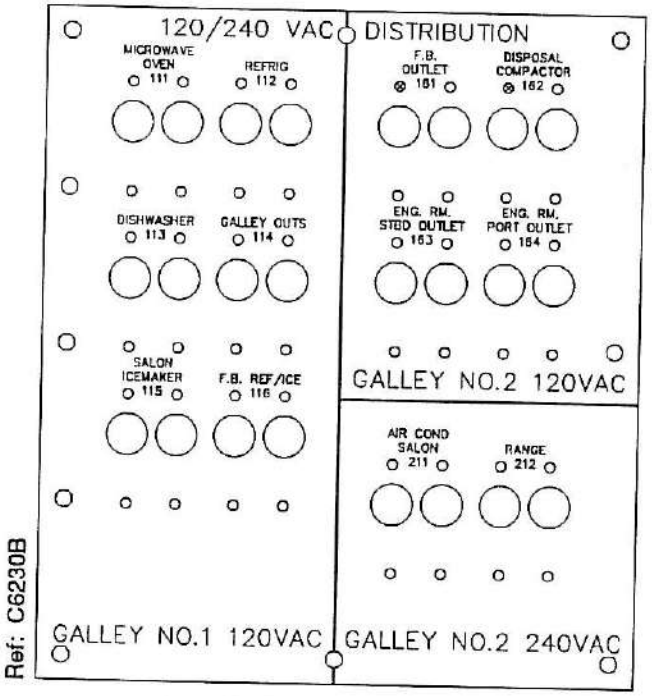

Figure 11-2: Galley 120/240Vac Distribution Panel

Table 11-2: Circuit Breakers: Galley 120/240Vac Distribution Panel

Galley No. 1 – 120Vac

Breaker	Circuit Protected
111	Microwave Oven
112	Refrigerator
113	Dishwasher
114	Galley Outs
115	Salon Icemaker
116	Flybridge Refr./Icemaker

Galley No. 2 – 120Vac

Breaker	Circuit Protected
161	Flybridge Outlet
162	Disposal & Compactor
163	Engine Room Stbd Outlet
164	Engine Room Port Outlet

Galley No. 2 – 240Vac

Breaker	Circuit Protected
211	Air Conditioner – Salon
212	Range

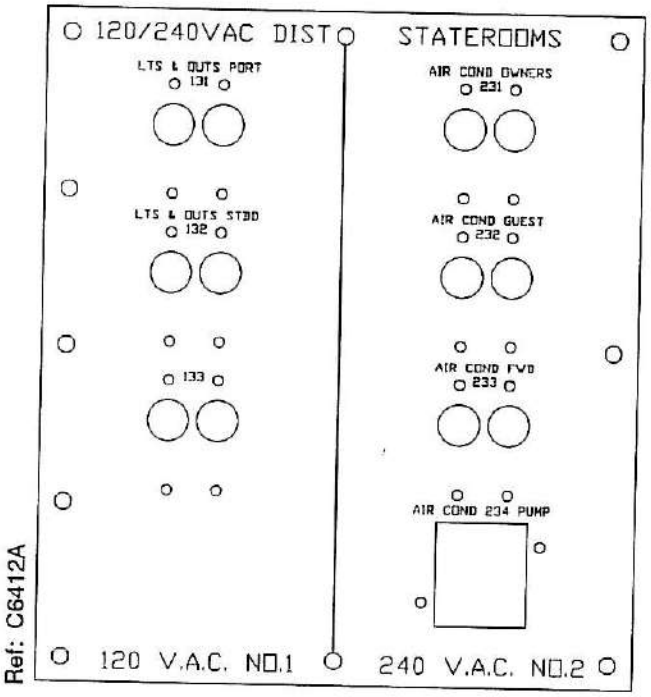

Figure 11-3: Companionway 120/240Vac Distribution Panel

Table 11-3: Circuit Breakers and Fuse: Companionway 120/240Vac Distribution Panel

120Vac No. 1

Breaker	Circuit Protected
131	Lights & Outlets Port
132	Lights & Outlets Stbd
133	

240Vac No. 2

Breaker	Circuit Protected
231	Air Conditioner Owners
232	Air Conditioner Guest
233	Air Conditioner Forward
Fuse	**Circuit Protected**
231	Air Conditioning Pump

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

Shore Power

⚠ WARNING

Do not cut or disconnect the green grounding conductor in the shore line at the dock outlet or the boat inlet. This conductor is needed to provide the same ground potential between shore ground and your vessel's ground and minimizes the shock hazard to persons on the vessel or in the water.

⚠ CAUTION

Before connecting or disconnecting the shore lines, be sure all the main circuit breakers are OFF or that the Power Selector Switches are OFF. This will help prevent connector arcing and fitting damage.

⚠ CAUTION

The shorelines have a twist-to-lock fitting on each end. Be sure these are properly locked in place before switching the shore power circuit breakers ON. This will help to prevent connector arcing and fitting damage.

⚠ WARNING

To minimize shock hazard:
1) Always plug shore power lines into the ***vessel*** **first, and unplug from the *shore*** first (this prevents accidentally dropping a "hot" shore cord into the water).
2) Close the shore power inlet cover tightly.
3) Do not alter the shore power cable connections.

⚠ 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.

NOTE:
*When power is being used, any heavy loads such as the air conditioning or the range should be turned **OFF** at the equipment controls before shifting to another power source.*

Shore Power Inlets

There are two shore power inlets on each side of the cockpit, located behind hinged doors on the outside of the port and starboard pilasters. On each side, one inlet is for 120Vac (Shoreline No. 1) and the other is for 120/240Vac (Shoreline No. 2).

Behind sliding doors on the inside of each pilaster, there is a 50Amp shore connection circuit breaker for each inlet. Below each circuit breaker is a green indicator lamp that illuminates when that circuit is connected and there is ac power to the distribution panels.

One 50-foot, 50Amp rated shore line is supplied for each voltage, since only one 120Vac and one 120/240Vac inlet can be used at any one time. The shore cords are stowed in lockers in the bottoms of the pilasters below the circuit breaker panels.

You can use shore power *and* run one generator (not both) to provide power for loads above the 50Amp shoreline limit.

Using Shore Power

⚠ CAUTION

If your vessel does not have the optional European Shore Power Package, check the polarity lights (on the Salon 120/240Vac Distribution Panel) for the shore circuit in use.
If an amber light is illuminated, the polarity is correct and you may switch **ON** the distribution panel circuit breakers.
If a red light is illuminated, the polarity is reversed and you must make a correction before switching **ON** the 120 Vac circuit breakers.
Disconnect the shore power cord until the problem is corrected.

Your Bertram shore cords and shore connection inlets are wired in accordance with current industry standards, but you may occasionally find some dock outlets that are improperly wired. On vessels with the optional European Shore Power Package, transformers correctly polarize shore power, and you do not need to make any adjustment.

On vessels *without* the European Shore Power Package, two indicator lights are mounted for your protection on the 120Vac Shore No. 1 panel. These lights indicate if the shore wiring has normal or reversed polarity.

When the amber lamp is illuminated, it indicates the 120Vac shore power is connected normally to your vessel.

When the red lamp is illuminated, it indicates 120Vac is connected to a dockside output connection with reversed polarity. You should disconnect the shore power cord until the problem is corrected.

⚠ CAUTION

If both NORMAL and REV POL lamps are illuminated, a ***hazardous condition*** exists: reversed HOT (black) and GROUND (green) wires. Do not use this shore power system until the fault is corrected. Immediately disconnect the shore line at the dock. Check out dock wiring, and then vessel wiring.

NOTE:
These instructions assume your vessel is tied up with the port side to the dock, and that you intend to use the port shore inlet(s). If you wish to use the starboard shore inlet(s) or both port and starboard inlets, set the rotary selector switches to the appropriate positions.

To activate the 120Vac Shore No. 1 control panel:

1) Set the left hand rotary selector switch to **OFF**;
2) Set the right hand rotary selector switch to **PORT NO. 1**;
3) Connect the shore lines to the vessel first, and then to the dock connection;
4) With both shorelines connected to port side inlets, check to be sure both green lights on the port side inlet breaker panel are illuminated;
5) On the 120 Volt AC Shore No. 1 control panel, the Voltmeter on the left hand side (with the toggle switch below it set to **PORT**) should read about 120Vac, indicating that Shore No. 1 power is available for use;
6) Check the polarity lights between the Voltmeter and Ammeter. Only the **NORMAL** light should be illuminated. If the **REV. POL** light is also illuminated, there is a *hazardous condition* that requires your immediate attention. Do not use the shore

power until you have corrected this problem. Unless your vessel has been modified, the problem can usually be found in the dock's power system.

7) If only the **NORMAL** light illuminates, turn the left hand rotary selector switch to **SHORE**. Now all branch circuit breakers on the 120Vac Distribution Panel (including the Galley No. 1 Main and Stateroom No. 1 Main) are powered and may be switched **ON** as desired. The Ammeter at the top of this panel shows the amount of current drawn by Shoreline No. 1.

To activate the 120/240Vac Shore No. 2 control panel:

1) Turn the left hand rotary selector switch to **PORT**. The Voltmeter should read about 240Vac.
2) Turn the right hand rotary selector switch to **SHORE**. Now all branch circuit breakers on the 120/240Vac Distribution Panel (including the Galley No. 2 Main and Stateroom No. 2 Main) are energized and may be switched **ON** as desired.
3) If you want to use only Shoreline No. 2 to power your entire vessel, turn the right hand rotary selector switch on the Shore Power No. 1 Panel to the **SHORE NO. 2** setting.
4) Turn the left hand rotary selector switch to the **SHORE** setting.

AC Generator Systems

⚠ CAUTION

To avoid circuit overloading and tripping the circuit breakers, do not exceed 65Amp current draw when using a generator.

NOTE:
Both generators can be run simultaneously if needed. Generator No. 1 can power the right section of the Salon AC Power Center, and Generator No. 2 can power the left section, or vice versa.

The controls and gauges for starting, stopping, and monitoring your two 240Vac generators are on the Salon Generator No. 1 and Generator No. 2 panels (Figure 11-1). Each panel controls the operation of one generator. These panels each have a 180 to 260Vac Voltmeter and one 0 to 75Amp Ammeter for each leg of the generator output. Each panel has the **START/STOP** switch for its generator and an amber **GEN RUN** (generator running) indicator light. The panel for Generator No. 1 has a battery paralleling switch for the 12Vdc battery banks to make it easier to start the generators' Diesel engines.

NOTE:
Each generator has a main "E" type circuit breaker mounted on it. Since the generators are both oriented the same way for ease of maintenance, on the port generator this circuit breaker is inboard and on the starboard generator this circuit breaker is outboard. Under normal operating conditions, this circuit breaker is always in the ON position.

Before Starting the Generators

1) Be sure the seawater seacock is open.
2) Be sure the seawater strainer is clean and is not leaking.
3) Be sure the heat exchanger expansion tank on top of each generator is full of the proper coolant.
4) Check each generator's lubrication oil level.
5) Select either the aft or forward fuel tank as the Diesel fuel source.
6) On the Engine/Generator Room 12Vdc Battery Disconnect Panel (Figure 10A-1), set both Battery No. 1 and Battery No. 2 battery disconnect switches to **ON**.

Starting the Generators

⚠ CAUTION

If a generator won't start after several tries, its waterlift muffler may fill with water. To keep seawater out of the generators' exhaust manifolds, use the muffler drain plugs to empty the mufflers before moving your vessel.

⚠ CAUTION

When starting your generators: do not exceed 30 seconds of warmup or 30 seconds of cranking. If a generator fails to start, wait 2 to 3 minutes before trying to start it again.

1) The generator control panels are in the salon on the Main 120/240Vac Distribution Panels. The top panel is for Generator No. 1 and has the battery paralleling switch. On this panel, depress and hold the **STOP -- WARM UP** switch for up to 30 seconds, depending on temperature.
2) Depress and hold the **BATT PAR** (Battery Parallel) switch.
3) Depress the **START** switch for 30 seconds or until the generator starts. Do not exceed 30 seconds of continuous cranking.
4 The **GEN RUN** lamp illuminates when a generator is running.
5) Repeat steps 1 through 3 for the other generator if you want both generators on line.
6) 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 from a generator's exhaust port when it is running, to avoid damaging the generator, immediately shut it down until you solve this problem.
7) To use the electric power from one or both generator(s), set the 4-position rotary selector switch(es) on the 120Vac Shore No. 1 panel and/or 120/240Vac Shore No. 2 panel to **GEN NO. 1** or **GEN NO. 2**. Then set the circuit breakers for the desired appliances and equipment to **ON**.

Stopping the Generators

Manual Stop

1) Remove the ac load from the generators at the 120Vac and 120/240Vac Shore Panels.
2) On the 120Vac Shore No. 1 and 120/240Vac Shore No. 2 panels, set the 4-position **OFF – GEN NO. 1 – SHORE – GEN NO. 2** rotary selector switches to **OFF** or **SHORE**.
3) Hold one **START – STOP** switch in the **STOP** position until that generator is fully stopped.
4) Repeat step 3 for the other generator.

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

Automatic Shut-Down

Your generators each have an automatic shut-down system that requires no action from the operator. The system stops the Diesel generator engine before it can be damaged if it detects:

- low oil pressure;
- high exhaust temperature;
- high coolant temperature;
- overspeed.

If the generator shuts down automatically:

1) determine the source of the fault;
2) correct the fault;
3) move the 120Vac 4-position rotary selector switch to **OFF**;
4) perform the ***Before Starting the Generators*** procedure (above);
5) perform the ***Starting the Generators*** procedure (above).

Generator Cooling System

Your generators are fresh water cooled. This means a closed and pressurized mixture of fresh water and a suitable corrosion inhibitor provides cooling for the generator blocks, cylinder heads and exhaust manifolds. This coolant mixture is in turn cooled by passing it through the seawater-cooled heat exchanger.

Fresh Water and Antifreeze Mixture

Your generator coolant provides the medium for heat transfer to control generator internal temperature during operation. In a generator with proper coolant flow, combustion heat moves through the cylinder walls and the cylinder head into the coolant. Without ade-

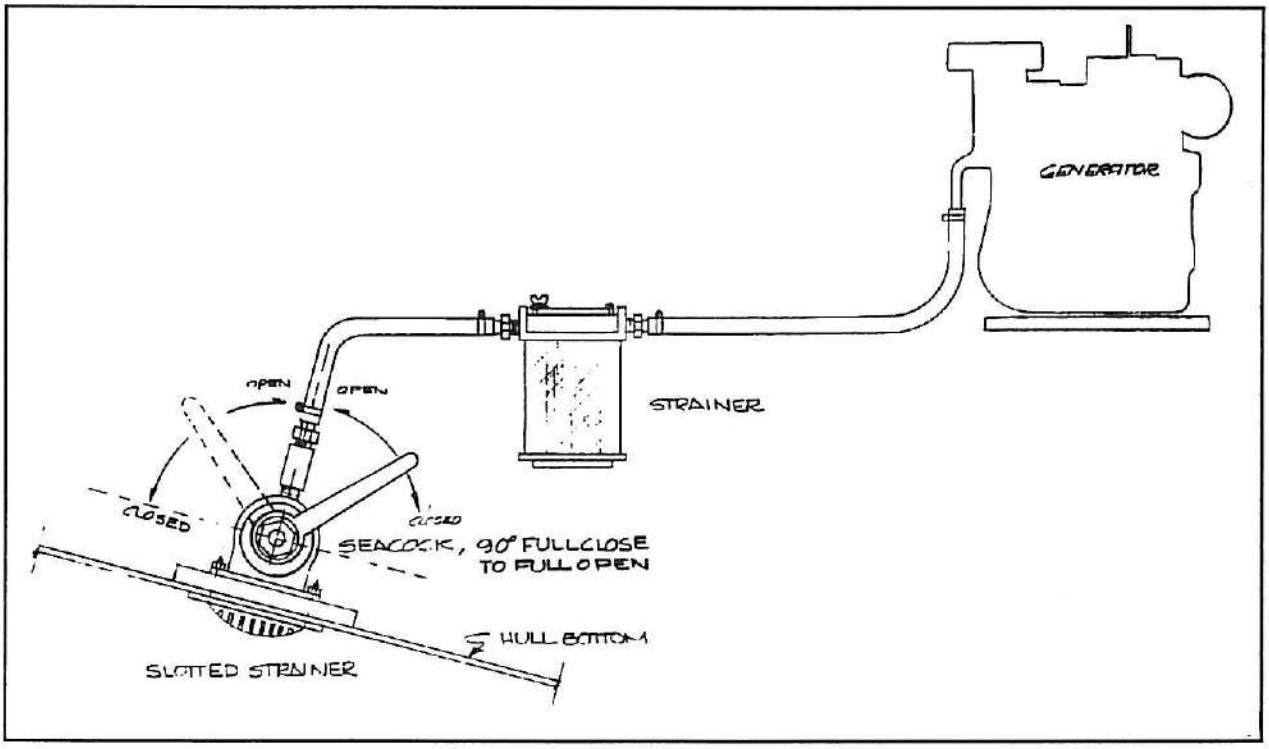

Figure 11-4: Generator Seawater Intake System

quate coolant, normal heat transfer cannot occur and generator temperature will rise rapidly.

The coolant solution in your generators must provide the following functions:

- adequate heat transfer;
- corrosion inhibition;
- protection against the formation of sludge or scale in the system;
- compatibility with the system's hoses and seals;
- adequate freeze protection during cold-weather operation, and boil-over protection during hot weather.

Follow the generator manufacturer's instructions for coolant selection, coolant concentration, and system maintenance. These instructions are in the generator operator's manual included with your supplementary information.

Seawater Inlet System

The seawater cooling system for the generators consists of:

- below-waterline intake ports
- seacocks
- seawater strainers
- seawater piping system
- seawater side of the heat exchangers.

Your Bertram has a seawater heat exchanger system mounted on each generator.

Cooling seawater is taken in through the hull via the slotted strainers, and is drawn through the seacocks and the seawater strainers to the pump (Figure 11-4). The seawater is pumped into the seawater side of the heat exchangers. As it travels through the heat exchangers, heat is transferred from the generator coolant mixture (which is on the fresh water side of the heat exchangers) to the seawater. Then the seawater is piped to the generators' exhaust systems, where it mixes with the exhaust gases and goes overboard with them.

NOTE:
To avoid ac generator overheating, it is very important that the seacocks be completely open and that you keep the seawater strainers clean.

AC Circuit Protection

CAUTION

Do not replace existing circuit breakers or fuses with breakers or fuses that have higher trip values. This change can cause circuit failures and/or fires.

A tripped circuit breaker or fuse may indicate a problem in that circuit or in the equipment protected by that circuit breaker or fuse. If the same circuit breaker trips repeatedly, or the same fuse burns out repeatedly, the cause must be found and corrected to avoid possible equipment damage.

Never replace a circuit breaker or fuse with one having a higher trip value than the one already in the circuit.

NOTE:
Bertram recommends that any added ac equipment be installed in the same manner as the factory installed equipment and that it be installed using the proper-sized circuit breakers and wire.

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

NOTE:
*If your vessel has the optional 120Vac power windlass, keep its circuit breaker (#151) **OFF** except when the windlass is actually being used. Other branch circuit breakers may be **ON** or **OFF** depending on your needs.*

Ground Fault Circuit Interrupters

Circuit breakers and fuses on this vessel protect you and your equipment and circuits against overloads and short circuits. However, circuit breakers and fuses may not protect people from electric shock, particularly from ground fault shock.

Ground fault is a leaking of current to ground, often through the body of a person who accidentally provides 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; in the port, starboard, and forward toilets (heads); on the flybridge; and in the engine/generator room. These areas contain GFCIs because they are most likely to have wet decks, so they are the most likely places for a ground fault accident.

Except for a red **RESET** push-button and a black **TEST** pushbutton located between the two receptacles, GFCI receptacles look similar to common household 120Vac receptacles.

GFCI Outlet Operation

For all practical purposes, each GFCI outlet is a standard double 120Vac outlet, but with a safety feature: if the GFCI outlet senses 6 or more milliAmperes of ground fault current, it will act as a circuit breaker and open the circuit. When the circuit is opened, the **RESET** push-button extends 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 with that part of the 120Vac circuitry – or the appliance used – that requires attention.

Testing a GFCI Outlet

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, *do not use it*. Have the GFCI outlet checked and possibly replaced by a competent marine electrician.

NOTE:
The test circuit requires 120Vac to operate.

Automatic Converters

Three onboard ac/dc converters change 120Vac input into 12Vdc or 32Vdc output to charge the appropriate battery banks. When the batteries are fully charged, the converter(s) hold a trickle charged condition. Bertram recommends that the converters normally be left in the **ON** position with either shore power or the generator supplying the power.

Additional information on the converters can be found in ***Section 10A: 12-Volt DC Electrical System*** and ***Section 10B: 32-Volt DC Electrical System***.

Corrosion Of Underwater Fittings

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 or grounding conductor to:

- all underwater fittings and hardware;
- engine blocks;
- all onboard ac equipment.

Electrolysis

If your vessel will remain idle for extended periods of time, Bertram suggests that you use a zinc "fish". For details of this preventive maintenance procedure, see ***Part III, Maintenance***.

Galvanic Isolator

The galvanic isolator on your Bertram is a solid state device designed to stop 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. It acts as an electrical filter to prevent the flow of dc galvanic corrosion currents through the power system grounding conductor (the green wire) without sacrificing the safety features of the ac grounding system.

A grounding conductor is not normally a current carrying conductor, but under abnormal conditions 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.

To minimize shock hazard when your vessel is connected to shore power, the shore power green grounding conductor is electrically tied to the vessel grounding system. This electrically connects your vessel's underwater metal fittings through the bonding system to the shore ac grounding system and to other vessels which are connected to the shore grounding system. This connection can cause difficulties, in that your expendable zinc anode system may be overloaded.

To stop the overload, the galvanic path must be broken without cutting the green grounding conductor in your shoreline. Your Bertram is equipped with a galvanic isolator to do this. It is installed in series with the (green) shoreline grounding conductor and the ac panel or power selector switches.

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

European Shore Power

If this vessel will be operated in foreign ports that have shore power of 220 to 250Vac and 50Hz, instead of 120/240Vac 60Hz, Bertram's European shore power option should be installed. This system uses built-in isolation transformers that provide shipboard 120Vac and 240Vac when using the shorelines.

The generators remain unchanged with an output of 120/240Vac at 60Hz. The standard ac electrical equipment remains the same since it was selected to be able to operate on 50 or 60Hz (although motor driven equipment will be less efficient when used on 50Hz).

The shorelines are equipped with connectors on the dock end that will mate with connectors used at American marinas. If your vessel is to be used in other ports, you may wish to buy adaptors to match the connectors at your ports of call.

Section 12

Accessories

Entertainment Center

NOTE:
The U.S. Coast Guard is warning boaters that stray electronic impulses from onboard television sets can adversely affect Loran receiver accuracy. The offending signals are harmonics of the horizontal sweep frequency and may be present any time the television set is operating.

For your entertainment, your Bertram is equipped with a multi-media, electronic entertainment system which includes:

- two television monitors;
- a VHS video cassette recorder/player (VCR);
- two am/fm tuner/amplifiers;
- a compact disc (CD) player.

With two televisions and a VCR on board, you and your guests can enjoy two different television programs and record yet another.

Similarly, the audio components interconnect with five pairs of built-in stereo speakers located through your vessel. This allows the five areas of your Bertram to listen to either am/fm receiver or the compact disc player.

The television/VCR system and the stereo system operate independently.

Components

There are two antenna sources, a built-in 22-inch diameter, omni-directional antenna located within the flybridge structure, and the port and starboard cable television (CATV) inputs. A three position selector switch – mounted in the aft side of the galley peninsula – 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; 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. FM signals are sent to a signal splitter. One leg of this splitter is connected to an am/fm stereo receiver in the master stateroom, and the other is connected to a similar system in the salon.

These am/fm receivers are connected to five sets of stereo speakers in:

1) the master stateroom (volume in these speakers is controlled by the master stateroom receiver);
2) the salon (volume in these speakers is controlled by the salon receiver);
3) the port guest stateroom (these speakers have an independent volume control);
4) the flybridge (these speakers have an independent volume control;
5) the cockpit (these speakers have an independent volume control).

The compact disc player, located in the salon, can play through either am/fm receiver.

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

NOTE:
*To use the compact disc player, switch **ON** the am/fm receiver in the salon.*

Telephones

Your Bertram has two standard telephone jacks, one in the salon and the other in the master stateroom. Telephone inlets are on the outsides of the cockpit pilasters with the electrical and CATV connections.

Built-in Vacuum System

⚠ CAUTION

To avoid electric shock, do not use on wet surfaces or pick up water or damp materials.

⚠ CAUTION

FIRE DANGER:
Do not pick up hot ashes, cigarette butts, or flammable powders.
Do not 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," your vessel has a built-in vacuum system in the starboard end of the galley peninsula. Your system's accessories will allow you to reach all the staterooms, the heads, the salon and the galley areas. However, the system is *not* a wet vacuum system. It is not designed or intended for use in the bilges or in the engine/generator room.

Operation

Your vacuum system is powered by 120Vac, through circuit breaker **#103 – SALON OUTLETS**, on the Salon 120/240Vac Distribution Panel (Figure 11-1). It is automatically switched **ON** when you plug the hose into the hose receptacle, and is automatically switched **OFF** when you remove the hose. You can connect or disconnect the system accessories (hose, extension wands, and vacuum heads) with a slight twisting motion.

The vacuum system is manufactured by Wal-Vac Inc., 318 Mart St. SW, Grand Rapids, Michigan 49508. It uses easily replacable dust bags that are available from Bertram or from the manufacturer in packages of five. These carry Bertram part number 181433 and Wal-Vac part number 54062 (Bag, Disposable).

You should wash the secondary filter with a mild detergent as required and replace it when worn or torn. It carries Wal-Vac part number 54230 (Filter, Secondary).

For more specific information on operating your vacuum system, see the separate Wal-Vac operator's manual provided with your vessel's documentation.

Air Compressor

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/generator room aft of the forward fuel tank and port of the lubrication oil tank.

The compressor runs on 120Vac through circuit breaker **#156 – AIR COMPRESSOR** on the Salon 120/240Vac Distribution Panel (Figure 11-1).

WARNING

Do not tamper with the compressor safety valve or the automatic regulator switch mechanism. Tampering with either device could result in severe injury 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, and the other shows air line pressure (both display psi).

Operation

Normally, the circuit breaker for this compressor is in the **ON** position when the engines are operating (when maneuvering signals might be needed). Keep in mind, however, that you need an ac power source to supply 120Vac 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 80psi and is switched **OFF** when the tank pressure reaches 100psi.

Seawater Washdown System (Optional)

WARNING

SEAWATER FAUCET(s) should be clearly labeled to prevent accidental use of seawater for drinking or cooking.

NOTE:
Always switch this system **OFF** *when you leave your vessel unattended.*

The basic seawater washdown system is an optional convenience feature that can be built into your vessel. It is designed to accommodate a fisherman's needs. The seawater washdown system will make cleaning of fish, fish boxes, baitwells, and the cockpit area easier and neater while at sea. You can also use it to aerate the optional live baitwell and wash off the anchor.

As shown on Figure 12-2, this system draws its electrical power from circuit breaker **#106 – WASHDOWN PUMP** on the Main 120Vac Distribution Panel in the salon (Figure 11-1), and consists of:

- through-hull fitting with intake strainer;
- seacock;
- raw water strainer;
- raw water pump;

- shutoff valve;
- pressure relief valve;
- seawater faucet.

In addition to the seawater washdown basic system, there is optional seawater plumbing to a live baitwell in the cockpit preparation center.

System Operation

> **CAUTION**
>
> The seawater washdown system seacock MUST be open before switching the system ON.

The components of this system are aft on the port side of the lazarette.

To operate, circuit breaker **#106 – WASH-DOWN PUMP** on the Salon 120Vac Distribution Panel (Figure 11-1) must be **ON**.

With the deck wash valve (on the lower aft side of the port cockpit pilaster) open, switch the system **ON** using the **DECK WASH** switch in the starboard cockpit locker. Switch the system **OFF** when you are finished.

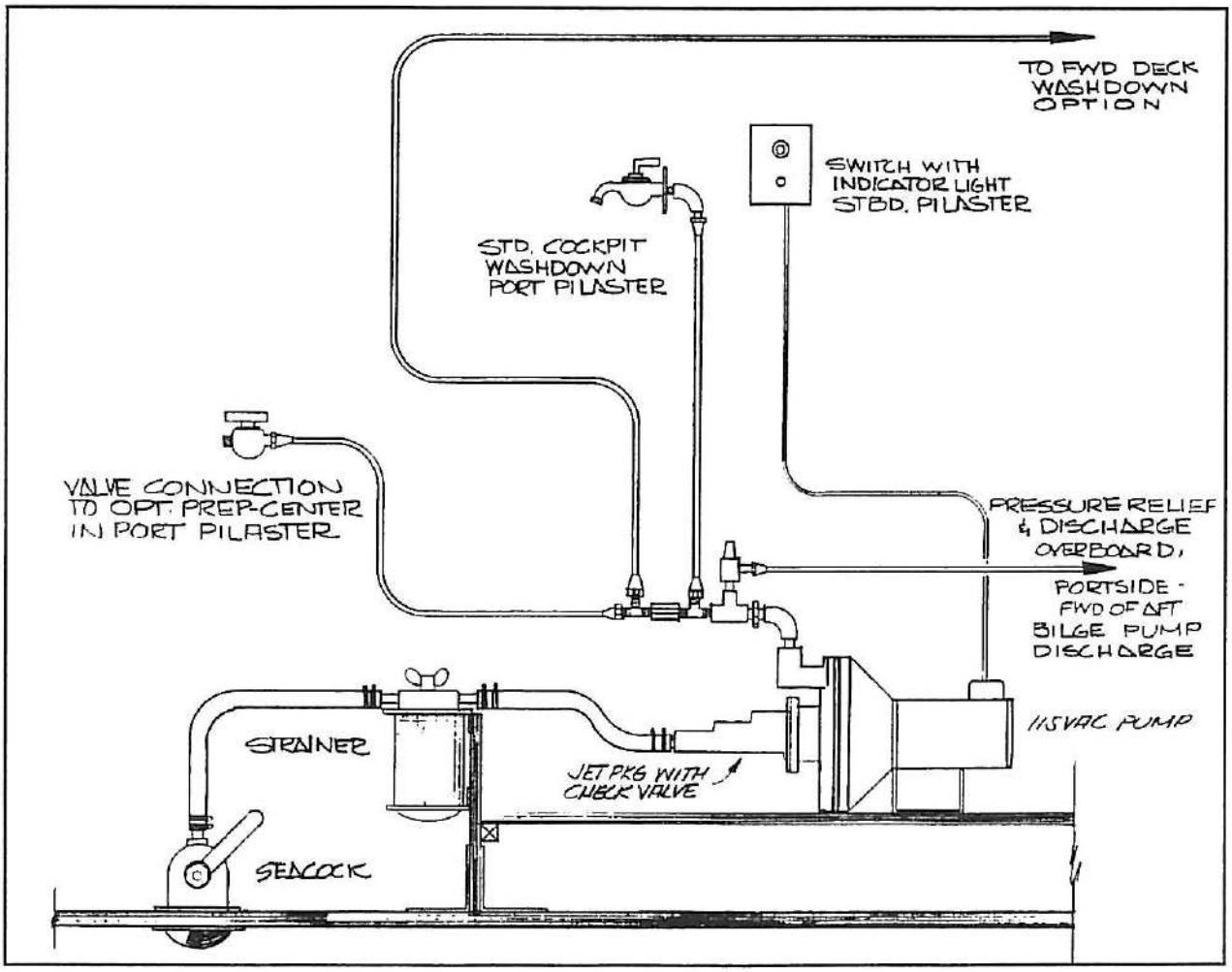

Figure 12-1: Seawater Supply and Washdown System

A relief valve and an overboard discharge through-hull fitting relieve pressure on the system when the faucets are closed.

Bertram recommends that you switch the washdown pump circuit breaker (on the Salon 120Vac Distribution Panel) **OFF** except when you are using the system.

Baitwell (Optional)

If your vessel has the optional baitwell, you can circulate fresh seawater through it. 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.

Windlass (Optional)

⚠ WARNING

Exercise extreme caution when working with a windlass, especially one equipped with a wildcat. This device can inflict severe injury.

⚠ CAUTION

To avoid possible accidental operation, windlass circuit breaker #151 should always be OFF except when the windlass is in use.

A windlass is intended only to lift up your anchor. The windlass is not built as a mooring bitt, nor is it intended as one.

The capstan head is keyed directly to the windlass motor shaft and will revolve whenever the windlass motor is switched **ON**.To raise an anchor line:

1) set circuit breaker **#151 – WINDLASS** on the Salon 120/240Vac Distribution Panel to **ON**;
2) if you have chain at the end of your anchor line, set the chain latch;
3) wrap three to four turns of the anchor line around the capstan in a *clockwise* direction, as viewed from the top;
4) keep a small amount of pressure on the line;
5) step on the foot switch to switch the windlass **ON**.

If the line slips, take another turn or apply more pressure to the tailing line. The wildcat (which is an option on the windlass) is used to pull anchor chain. It is driven by a friction system, and is not keyed to the main shaft.

NOTE:
The windlass should rotate only clockwise as viewed from the top. Do not operate in a counterclockwise direction. The windlass will not function properly and damage will occur.

NOTE:
If your windlass has a wildcat, the fit of the chain links to the wildcat is critical. For safety's sake, the chain must not jam, skip, or jump.

Swimming Platform (Optional)

WARNING

Do not allow anyone to use the swimming platform while the engines are operating. The propellers might injure them.

The swimming platform should be occupied and used only while the vessel is stopped with engines and generator off.

Propellers are dangerous to swimmers and divers. Do not allow anyone to use the platform while the engines are running.

WARNING

CARBON MONOXIDE POISONING DANGER: Do not allow anyone to occupy the swimming platform while engines or generator are operating.

If the engines or generator are running, there is a possibility of carbon monoxide poisoning if anyone is on the platform. For more information on this hazard, see ***Part II, Section 4: Safety Precautions and Emergency Procedures.***

Searchlight (Optional)

CAUTION

FIRE DANGER: Do not operate your searchlight with the cover on.

Do not operate your searchlight with the cover on; it may catch fire.

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Part III: Maintenance

Periodic Maintenance — Section 1

Section 1

Periodic Maintenance

The maintenance required by your Bertram during a boating season -- and throughout the year -- will partially depend on the way you use it and store it. Example: adequate cabin ventilation when the vessel is not in use reduces interior maintenance because it minimizes mildew and odors. Example: a good coat of wax minimizes exterior maintenance.

There are health considerations, too. One prominent threat to avoid is carbon monoxide poisoning. To prevent exhaust gases from leaking and escaping, you should make a thorough, periodic inspection of the engine and ac generator exhaust gas systems. Be especially thorough in checking for faulty hoses and loose hose connections.

This section provides a suggested basic preventive maintenance program for a vessel under "average use" conditions. You'll want to combine this program with the detailed periodic maintenance programs in each of the manufacturer's operating manuals for major onboard components such as engines, ac generator, and other systems.

Onboard Maintenance Supplies

Bertram suggests that you have an onboard tool kit. Here's a basic list:

- a selection of wire and paint brushes
- a selection of files
- a set of open end wrenches
- a set of socket wrenches with 1/4 and 1/2 inch drives
- emery and crocus cloth
- steel and bronze wool
- spray cans of metal primer and engine touch-up paint
- a small (5 inch by 7 inch) inspection mirror
- an assortment of electrical connectors
- a roll of electrical tape
- spray lubricant (*WD-40, CRC, LPS,* etc.).

Assorted hand tools can be very helpful:

- pocket knife (a seaman's knife with marlinspike is best)
- socket wrench set
- combination wrench (open-end and box) set
- hex key (Allen wrench) set
- small, medium, and large straight and Phillips screwdrivers
- ball peen and "soft" hammers
- gas pipe and long-nosed pliers
- small, medium, and large "Vise Grip" and "Channel Lock" type pliers
- electrical crimp-on connector tool
- hand-held Volt-Ohmmeter
- 1/4-inch or 3/8-inch electric drill and assorted bits.

You may also wish to carry some spare parts:

- engine accessory drive belts
- fuel filter elements
- bulbs for all navigation lights
- fuses, including spares for electronic gear
- hoses

- hose clamps
- epoxy mender kit
- plastic tie-wraps
- duct tape.

Daily Maintenance

When Starting Engines and Generator and Before Putting to Sea

__ 1) 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 each bilge pump electronic switch and each alarm float switch and sump pump float switch operation). Return the **BILGE PUMP** switches to **AUTO**.

__ 2) Use the blowers to ventilate the engine/generator room (while you are ventilating, check blower operation).

__ 3) Check engine and generator lubricating oil levels; add oil if necessary.

__ 4) Check transmission oil levels; add oil if necessary.

__ 5) Check engine and generator coolant levels; add coolant if necessary.

__ 6) Drain accumulated water from the fuel oil/water separators.

__ 7) Check the air cleaner indicators; if required, replace the air filters.

__ 8) Check fuel, coolant, and lubricating oil systems on engines and generators for leaks.

__ 9) Check that all engine and generator belts are in good condition and have proper tension.

__ 10) Check that all cooling seawater seacocks are fully **OPEN**. This includes seacocks for:

__ a) starboard engine;

__ b) port engine;

__ c) generators;

__ 11) Check that all other seacocks are fully **OPEN**. This includes seacocks for:

__ a) air conditioning system seawater intake;

__ b) toilet system seawater intake;

__ c) seawater washdown system intake (if installed);

__ d) baitwell overflow discharge (if installed);

__ 12) Visually check all seawater strainers for dirt accumulation. Clean as necessary.

__ 13) Check the water level in the batteries (see ***Part III, Section 4***).

__ 14) Check for a slow drip at the shaft stuffing boxes.

__ 15) Check for proper operation of navigation and anchor lights.

__ 16) Check the steering system reservoir sight glass for the proper hydraulic steering fluid level. (This reservoir is in the lazarette).

__ 17) Check the pressure gauge on top of the steering system reservoir for proper air pressure level.

__ 18) Once each engine is started, check that a water stream is coming from its engine exhaust transom outlet.

__ 19) With the ac generator running, check the generator cooling seawater flow by ob-

serving the generator exhaust. Water should be exhausting from a transom outlet.

__ 20) Check fuel and water levels. Refill as necessary.

After Docking

__ 1) Pump bilges as necessary.

__ 2) Top off (refill) fuel and water tanks.

__ 3) Wash down the boat with fresh water. Be sure to close shore power inlets or see that lines are properly connected.

__ 4) Turn 32Vdc and 12Vdc battery switches **OFF** if you plan to leave your vessel unattended.

__ 5) Turn all unnecessary 120Vac equipment **OFF**. Leave the converters **ON** to keep batteries charged.

Monthly Maintenance

Fire Extinguishing Systems

__ 1) Check the portable (hand held) dry chemical fire extinguishers per instructions in this section under ***Maintenance of Portable Dry Chemical Fire Extinguishers***.

__ 2) Check the Halon 1301 fixed fire extinguisher system per instructions in this section under ***Halon 1301 Fixed Fire Extinguisher System Maintenance***.

Auxiliary Engine Driven Bilge Pump (Optional)

Exercise the pump to keep the rubber impeller from taking a "set":

__ 1) open the valve to the fresh water tank (and be sure the valves to the bilges are closed to avoid the loss of suction);

__ 2) engage the clutch by pulling it toward the vessel's centerline, as shown in Figure 7-2;

__ 3) pump a few gallons of fresh water overboard;

__ 4) disengage the clutch by pushing the lever away from the vessel's centerline;

__ 5) close the manifold valve to the fresh water tank.

Engine Zincs

__ Follow the engine, marine transmission, and generator manufacturers' instructions on maintenance of zinc anodes, as specified in the manufacturer's manuals (these are part of your vessel's documentation).

Every 25 Hours or Twice per Season

NOTE:
You must inspect and clean the fuel filter canisters every 25 hours of operation, or at least twice each season, whichever comes first.
This inspection is mandatory.

__ 1) Inspect and clean the fuel filter/water separator canisters. Remove all sediment and water which may have collected. Inspect the canisters closely for possible deterioration from corrosion. If you you find such signs, replace the canister.

While checking the fuel filter canisters, make a complete inspection of the entire engine fuel system for possible leaks or damage.

__ 2) Check the hatch dogs on forward and cockpit hatches for proper operation and for "snug" fit.

__ 3) Check that the engine mounting bolts and the propeller shaft coupling bolts are tight.

__ 4) Check the emergency shutdown system: with the Diesel 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 (for the correct resetting procedure, see ***Part II, Section 5*** under ***Stopping Detroit Diesel Engines***).

__ 5) Check the engine/generator room and completely inspect the engines and the ac 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 or gaskets, loose wires, loss of electrical ground, and the oxidation of leads and connectors.

Every 100 Hours or 60 Days

Exterior

__ 1) Clean and wax exterior fiberglass finish.

__ 2) Clean hardware, apply protective polish.

__ 3) Tighten loose fittings.

__ 4) Lubricate locks and latches.

__ 5) Inspect varnished areas. Where varnish has begun to deteriorate, sand lightly and apply high quality marine varnish.

__ 6) Clean exterior seat cushions with a mild soap solution or a light household bleach solution. Rinse off with fresh water.

Interior

CAUTION

Do not use a bleach solution or solvents on vinyl headliner or wall coverings. Clean vinyl with mild soap and warm water. Clean *Novasuede* per instructions in Part III, Section 6, Table 6-2.

__ 1) Completely air out the vessel.

__ 2) Clean, dry and air out all life jackets.

__ 3) Use your nose and eyes to check your boat for mildew. If you find mildew:

__ a) Thoroughly wash down any mildewed painted or other hard surfaces with a household bleach solution.

__ b) Wash mildewed vinyl surfaces with commercial cleaners such as *409*, *Fantastic*, or the equivalent.

__ c) Clean mildewed *Novasuede* surfaces using the cleaning agents listed in Table 6-2 in ***Part III, Section 6***.

__ 4) Operate all drawers and doors. Slight adjustments may be necessary on the doors and drawers because they may have expanded from moisture. Drawers will slide easier if you lubricate the runners with wax or other solid lubricant.

__ 5) Check that all hand held fire extinguishers:

__ a) are secure in their mountings;

__ b) are free from rust and corrosion;

__ c) have a full charge.

__ 6) Check first aid kit.

Staterooms

__ 1) Check for proper light operation.

__ 2) Check that there is electrical power to the 120 Vac duplex outlets (requires 120Vac electrical power).

__ 3) Check the bow hatch (forward stateroom only) for smooth operation, secure locking, and watertight fit.

__ 4) Check the air conditioning systems for cooling and heating (requires 120Vac electrical power).

__ 5) Check the entertainment and telephone systems for proper operation.

Companionway

__ Check the forward compartment bilge pump and bilge pump switch for proper operation (refer to ***Part III, Section 4*** under ***Bilge Pump Systems*** for the correct procedures in bilge pump system testing and maintenance).

Heads

__ 1) Check for proper light operation.

__ 2) Check for electrical power to the 120 Vac GFCI duplex outlet (see ***Testing a GFCI Outlet*** in ***Part II, Section 11***).

__ 3) Check lavatory water faucets for proper operation.

__ 4) Check the lavatory sink drain for plugging and leaks.

__ 5) Check the toilets for proper operation.

__ 6) Check 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 the head ventilation blower for proper operation.

__10) Check the head air conditioning duct (requires that the air conditioning system be operating).

__11) Check the deck hatches for smooth operation, secure locking, and watertight fit.

Galley and Salon

__ 1) Check proper light operation.

__ 2) Check for electrical power in both sockets of the 120 Vac GFCI duplex outlet (requires 120 Vac electrical power).

__ 3) Check water faucet for proper operation.

__ 4) Check the galley sink drain for plugging and leaks.

__ 5) Clean and check the stove burners for proper operation (requires 120 Vac power).

__ 6) Clean and check the microwave oven for proper operation (requires 120 Vac electrical power).

__ 7) Check the refrigerator for proper operation; clean it with a solution of baking soda in water (requires 120 Vac power).

__ 8) Check the freezer and the salon icemaker for proper operation; clean them with a solution of baking soda in water (requires 120 Vac electrical power).

Engine/Generator Room

__ 1) Follow the engine, marine transmission, and generator manufacturers' periodic preventive maintenance programs as specified in the manufacturer's manuals (these are part of your vessel's documentation).

__ 2) Check the engine and generator for oil leaks.

__ 3) Check the engine mounting bolts for tightness. If you find they are loose, have the engine and propeller shaft realigned. ***Part III, Section 4*** discusses alignment procedures.

__ 4) Check the generator mounting bolts for tightness.

__ 5) Check all engine and generator hoses and hose clamps.

__ 6) Check all engine and generator fuel lines, flare nuts, and valves for leaks.

__ 7) 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; reinstall the drain plug.

> **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/generator compartment decks or collect in the bilges.**

__ 8) Check the control cable brackets for tightness.

__ 9) Lubricate the threaded cable ends and check the adjustment nuts for tightness.

__ 10) Check the engine/generator room sump pump and its associated sump pump switch for proper operation (refer to ***Part III, Section 4*** under ***Bilge Pump Systems*** for the correct procedures in bilge pump system testing and maintenance).

__ 11) Check that the engine/generator room sump pump screen and strainer are clean.

__ 12) Check the engine/generator room bilge pump and its associated bilge pump switch for proper operation (refer to ***Part III, Section 4*** under ***Bilge Pump Systems*** for the correct procedures in bilge pump system testing and maintenance).

__ 13) Manually test the bilge flood alarm float switch for proper operation. Lift the float to test the alarm light and bell.

__ 14) Check all electrical connections for corrosion, and clean or replace as necessary.

__ 15) Check the exhaust blowers for proper operation.

__ 16) Check the exhaust hoses and hose clamps for leaks.

__ 17) Check that wires are not rubbing against sharp edges and that the insulation has not been worn off.

__ 18) Check the gauge senders and alarm system connections.

__ 19) Check raw water seacocks; lubricate with petroleum jelly.

__ 20) Check the seawater strainers and be sure they are 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; remove the strainer basket for cleaning;
- __ d) replace the basket;
- __ e) resecure the top;
- __ f) reopen the seacock;
- __ g) check for leaks.

__ 21) Check the seawater system lines and fittings for leaks.

__ 22) Check the stuffing boxes. A slight drip is desirable, as seawater lubricates the packing. However, if the stuffing box is leaking excessively, follow the procedure discussed in ***Part III, Section 4.***

__ 23) If the optional seawater washdown system is installed, check lines and fittings for leaks.

__ 24) Check the seawater pump and relief valve for proper operation and for leaks (requires 120Vac electrical power).

__ 25) Check the air compressor and lines for proper operation and for leaks (requires 120Vac electrical power).

__ 26) Check the following items on the air conditioning:

NOTE:
*This is a **sealed system.***
Do not loosen flare nut fittings on any air conditioning line.

__ a) check the condensing units for rust and loose fittings;

__ b) check the seawater hose clamps for loose fittings;

__ c) clean the seawater strainer;

__ d) check for proper pump operation (requires 120Vac electrical power);

__ e) check for corrosion-free and tight electrical connections.

Batteries

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, and this corrodes the battery terminals and cables.
2) *Never* add acid to a battery cell.

NOTE:
Always turn off all dc power and the converters prior to cleaning or working on battery terminal connections.

__ 1) Check each 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:

__ a) Remove the **NEGATIVE** battery cable terminal first and then the **POSITIVE** cable 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 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** under **Spilled Battery Acid.***

Lazarette

__ 1) Clean the screen on the bilge pump.

__ 2) Check the bilge pump and the pump float switch for proper operation.

__ 3) Manually check the bilge flood alarm float switches for proper operation. Lift the float to test the alarm light and bell.

__ 4) Check the trim tab hydraulic fluid level; for service see ***Part III, Section 3*** under ***Trim Tab System Troubleshooting***.

__ 5) Check each trim tab motor, pump, and cylinder for proper operation.

__ 6) Inspect both rudder ports for leaks. The rudders use a packing gland similar to the propeller shaft stuffing box. Follow the procedure described in ***Part III, Section 4*** for packing the propeller shaft stuffing boxes to stop excessive rudder post leaking.

__ 7) Check the following steering system components for tightness, fluid level, and for smooth, proper operation:

__ a) hydraulic fluid reservoir (the fluid level indicator that should show the fluid level to be about two inches from the top);

__ b) clevis bolts;

__ c) rudder arms;

__ d) lock nuts; and,

__ e) lock bolts.

__ 8) Add grease to the both tie rod end fittings and to both rudder upper bearing fittings.

__ 9) Check for fresh water system line and fitting leaks.

__10) Check the fresh water pump for proper operation and for leaks.

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.

As Required

Clean the Bottom

Haul your vessel out of the water, scrub the bottom, and if necessary repaint with anti- fouling paint. See ***Part III, Section 6*** for information on ***Bottom Anti-Fouling Paint***.

NOTE:
Never paint transducers or zincs.

Change Engine Oil and Filters

Change the lubricating oil in the engines and in the generator at least as often as required in the manufacturer's operator's manuals.

Change the lubricating oil filters each time you change the lubricating oil.

Change Turbocharger Silencer Air Filters (Diesel Engines)

Check the air filter indicators on the engine turbocharger silencers each time you check the engine oil. You can check the indicators with engines stopped.

There is one indicator on each filter. The indicator is located on the end of the air filter, and holds the filter onto its support shaft. The indicator should have a small green dot showing when the filter is operating properly. When filter replacement is necessary, the green dot disappears, and the entire indicator area is red. Replace the filter as soon as possible. Reset the indicator by applying suction to the indicator window.

Clean the Bilges

Check the bilges for debris; clear any debris to keep it from clogging the bilge pump.

Check the limber holes along the keel and clear them of any debris.

Drain and Clean the Engine and Generator Cooling Systems

Follow manufacturers' recommendations for draining and cleaning the fresh water cooling systems in both engines and both generators.

NOTE:
Coolant specifications for Detroit Diesel engines are not the same as those for your generators. Follow the engine and generator manufacturer's recommendations for coolant mixtures.

For recommendations on engine cooling system maintenance, see Detroit Diesel publication 7SE298, *Coolant For Detroit Diesel Engines*. A copy is included with this manual.

For recommendations on generator cooling system maintenance, see your generator manufacturer's operator's manual. A copy is included with your vessel's supplementary information.

Crevice Corrosion

When your vessel is in wet storage, rotate both propeller shafts about once a week to prevent crevice corrosion, which may occur in the area of the struts and shaft logs if the shafts stay in the water in the same position over a long period.

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, you should replace it, as it will no longer be effective. You can purchase zinc "fish" from a marine supply store, or make them if desired. Remove the zinc from the water before making any attempt to move the boat under power. Replace standard transom zincs as required.

Maintenance of Portable Dry Chemical Fire Extinguishers

Examine the portable (hand held) fire extinguishers at least monthly that:

__ 1) they are properly secured in their intended mounts;

__ 2) they have not suffered rust, corrosion, or mechanical damage;

__ 3) they are fully charged.
Extinguishers that have pressure gauges or indicators should show that the pressure is within the prescribed limits.
Fire extinguishers without pressure gauges or indicators should all be periodically weighed and the exact weight should be noted on the tag attached to the extinguisher);

__ 4) the tamper-resistant seal proves the extinguisher has not been operated;

__ 5) the nozzle orifice is unobstructed and the extinguisher hose is in good condition.

Portable Fire Extinguisher Service

Have a qualified fire extinguisher service facility make an annual full check of all portable fire extinguishers according to the maintenance instructions on the extinguisher nameplate. This firm should attach a tag to each extinguisher showing the date of the maintenance check.

After Using a Fire Extinguisher

After any use, a qualified fire extinguishing service facility should recharge or replace portable fire extinguishers.

Halon 1301 Fixed Fire Extinguisher System Maintenance

WARNING

Never attempt to disassemble any part or portion of your fixed fire extinguisher system. The system's contents are under high pressure. Serious injury could result.

You are not required to empty and hydrotest this system at regular intervals. However, the manufacturer specifies that the system must be examined once a month for accidental damage, and to be sure no equipment has blocked the system's operation.

The Halon tank (without the brackets) should be removed and carefully weighed on an accurate (certified) scale at least once a month. The exact weight for each unit should

be noted on the tag provided for this purpose attached to the unit.

Follow the system manufacturer's instructions (found in the system operator's manual) for acceptable weight loss from the weight shown on each unit's nameplate. When either unit has reached the maximum weight loss, that unit must immediately be replaced with a serviceable unit.

Section 2

Engine Troubleshooting

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. It 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.

⚠ CAUTION

Loud noise can damage your hearing. To prevent possible hearing loss, before you enter the engine/generator room 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.

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.

⚠ WARNING

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.

Troubleshooting Detroit Diesel Engines

Table 2-1: Troubleshooting Detroit Diesel Engines

Problem	Cause	Solution
1) Engine doesn't turn over when **START** switch is pressed.	Main 32Vdcbattery disconnect switch is set to **OFF**.	Set the main 32Vdc battery disconnect switches to **ON**.
	32Vdc main circuit breakers set to **OFF**.	Set the main circuit breakers on the engine/generator room 32Vdc distribution panels to **ON**.
	32Vdc engine circuit breakers set to **OFF**.	Set circuit breakers **3F1** and **3F2** on the flybridge 32Vdc distribution panel to **ON**.
	Battery terminals corroded.	Clean battery terminals.
	Battery cable(s) loose.	Tighten battery cable connections.
	Battery cell or bank low or dead.	Use **BATTERY PARALLEL** switch. Charge or replace dead battery.
	Starter motor cable connection(s) corroded.	Clean and tighten all cable connections. Replace badly corroded starter cable(s).

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
2) Nonoperating or chattering starter solenoid.	Battery terminals corroded.	Clean battery terminals.
	Battery cable(s) loose.	Tighten battery cable connections.
	Battery cell or bank low or dead.	Use **BATTERY PARALLEL** switch. Check battery voltages. Charge or replace dead battery.
	Starter motor cable connection(s) corroded.	Clean and tighten all cable connections. Replace badly corroded starter cable(s).
	Bad starter solenoid.	Replace starter solenoid.

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
3) Engine starts, runs rough, stalls.	Fuel filters clogged.	Clean or replace fuel filters.
	Fuel tank and/or selector valves not fully open.	Reset fuel tank and selector valves.
	Contaminated or spoiled Diesel fuel.	Switch tanks. Replace fuel.
	Fuel lines or fittings leaking (resulting in inadequate flow or aerated fuel).	Check system for fuel leaks.
	Fuel control linkages binding.	Inspect, clean, and adjust linkages.
	Insufficient air intake.	Inspect intakes for dirty or obstructed air silencer(s); check filter indicators. Replace filters if necessary and follow instructions on indicators to reset them.
	Turbocharger failure.	Shut down engine and contact engine manufacturer's service department.

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
4) Engine over speeds, slows down, or runs on.	When a Diesel's rpm increase or decrease at a given throttle setting, you may have an internal malfunction: a stuck injector, a faulty governor, and/or a ruptured lubricating oil seal.	If a Diesel runs normally at cruising speeds, but does not slow down when the throttle is backed off, do not put the clutch in neutral until you are sure you have lost engine control. Keeping the engine in gear may prevent engine or gear damage. To Shut Down A Diesel Engine (take these steps in the order shown): 1) Set the **ON/STOP** switch to **STOP.** 2) If the engine does not stop, use the **EMERGENCY SHUTDOWN** system. 3) If the engine still does not stop, shut off fuel supply.
	Fault in mechanical throttle control cable system.	Check the throttle linkages. Readjust system to stop "creep."
5) Engine lubricating oil pressure too high.	Wrong grade of lubricating oil.	Watch oil pressure gauge closely. If the oil pressure exceeds the manufacturer's specified upper limit, stop engine. Change lubricating oil.
	Clogged oil filter and bypass relief valve stuck.	Change oil filter and contact engine manufacturer's service department.

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
6) Engine lubricating oil pressure too low.	Faulty oil pressure alarm.	Check engine oil level. Watch engine temperature gauge. Low oil pressure and high operating temperature usually go together.
	Low oil level.	Add oil.
	Wrong grade of oil.	Change oil.
	Water or fuel diluting oil.	Stop engine. Do not run engine until leak is found; change oil before running.
	Faulty oil pump.	Replace pump.
7) Excessive engine lubricating oil consumption.	External oil leaks.	Check all lubricating oil lines and connections. Tighten loose fittings, add oil, and watch closely. If problem persists, stop engine.
	Damaged engine parts.	Stop engine.
	Worn engine parts.	Add oil and watch oil level closely. If problem persists, stop engine.
8) Engine surges.	Air in fuel system.	Stop engine. Bleed air from fuel system. Check fuel lines for leaks.
	Clogged fuel filters.	Change fuel filters.

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
9) Transmission fails to engage.	Loss of transmission lubricating oil.	Stop engine. Check for oil leaks. Add oil to transmission.
	Transmission oil strainer/filter clogged.	Clean strainer, replace filter.
	Loose, broken, or maladjusted gear shift linkage.	Check linkage. Clean and adjust linkage as necessary. Contact engine manufacturer's service department for repairs.
10) Unusual noise in engine or transmission.	Loss of lubricating oil.	Stop engine. Check oil levels. Refill and resume operation at reduced speeds. Stop engine if noise persists.
	Worn gears.	Have transmission overhauled.
11) Loss of transmission oil pressure.	Faulty transmission low oil pressure alarm circuit.	Check transmission oil. Refill if needed and watch closely.
	Loss of transmission oil.	Check all high pressure oil lines for leaks. Repair if possible or shut down engine.

Table 2-1: Troubleshooting Detroit Diesel Engines (Continued)

Problem	Cause	Solution
12) Engine coolant temperature too high.	Engine cooling water seacocks completely or partly closed.	Open seacocks.
	Engine cooling water seacock strainers clogged.	Stop engine. Clean seacock strainers.
	Engine cooling water intake clogged from outside.	Stop engine. Remove obstruction from intake.
	Leaking cooling water hoses.	Tighten hose clamps. Check for and replace leaking hose(s). Add coolant.
13) Hot water in bilge.	Engine coolant or seawater leaking.	Check all cooling system hoses and clamps. Replace leaking hoses, tighten all clamps.
14) Engine oil level rises. Oil looks and feels gummy.	Engine coolant or cooling seawater leaking into engine crankcase.	Do not run engine until leak is found and repaired.
15) Engine oil level rises. Oil looks and feels very thin.	Diesel fuel oil leaking into engine crankcase.	Do not run engine until leak is found and repaired. Replace oil filter(s) and change lubricating oil before operating.
16) Excessive smoke.		Refer to Diesel engine manufacturer's operator's manual.

Section 3

On-Board Systems Troubleshooting

Troubleshooting 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:

Engine Oil Pressure

If the engine alarm horn sounds and either engine **OIL PRES** light illuminates, there is a low engine oil pressure condition. See your engine manufacturer's operator's manual for the specific minimum oil pressure. Check:

__ 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.

See ***Part III, Section 2*** for additional information.

Coolant Temperature

WARNING

At operating temperature, coolant is hot and under pressure. Steam can cause burns and alkalai in coolant can damage eyes.
Check the coolant level ONLY when engine is stopped and the filler cap is cool enough to touch with your bare hand. Remove the filler cap SLOWLY to relieve pressure.

If the alarm sounds and the engine **WATER TEMP** alarm light illuminates, there is an engine overheat problem. Check for:

__ 1) Inaccurate engine temperature gauge (verify the high temperature condition).

__ 2) Loose expansion tank cap.

__ 3) Low coolant in the heat exchanger. Check the coolant level in the expansion tanks *after* you have shut down the engines and allowed them to cool. Carefully remove the caps from the heat exchangers (use a rag over the cap to protect yourself, and open the cap slowly). Check the water level. If it is necessary to add water, start the engine and add water with the engine running.

> **CAUTION**
>
> **Do not add cold water to a hot engine unless the engine is running. If the engine is not running, you may crack the engine block.**

If the unit will not hold water, check for a blown hose. Before replacing the hose, make sure the nipple and the inside of the hose are free of paint.

__ 4) Restricted seawater strainer (the **EXHAUST TEMP** alarm light may also illuminate).

__ 5) Closed or partially closed seacock (the **EXHAUST TEMP** alarm light may also illuminate).

__ 6) Loose engine belt; see the engine operator's manual for tightening technique.

__ 7) Defective water pump(s); check inside the heat exchanger for water flow. This will tell you whether the pump is working.

__ 8) Defective thermostat.

> **CAUTION**
>
> **DO NOT remove the thermostat and run the engine without it.**

__ 9) Defective alarm circuit or switch.

__10) Collapsed water suction hose (check for this problem with the engine running at moderate speed and with no load, but after the engine has cooled down).

Gear Oil Temperature

If the alarm sounds and the **GEAR TEMP** alarm light illuminates, there is a gear box overheat problem. Check:

__ 1) Low transmission fluid.

__ 2) Fault in transmission cooling system.

__ 3) Clutch slipping (check control cable adjustment).

__ 4) Defective alarm circuit or switch.

See ***Part III, Section 2*** for additional information.

Exhaust Temperature

If the alarm sounds and the **EXHAUST TEMP** light illuminates, there is an exhaust system overheat problem. Check:

__ 1) Absence of water flow 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 (located on the engine exhaust riser) or sensor alarm circuit.

Fresh Water System

Table 3-1 includes a list of potential onboard fresh water system problems, their possible causes, and some suggested solutions.

Water Pump

Your automatic water pump responds to a demand for hot or cold fresh water.

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 120Vac Distribution Panel at circuit breaker **#201** (see Figure 11-1 in ***Part II, Section 11***). Only qualified, trained technicians should work on or attempt to adjust this unit. The manufacturer's documentation includes instructions for cleaning/descaling or replacing the heating element.

Table 3-1: Fresh Water System Troubleshooting

Problem	Cause	Solution
1. Pump cycles, no apparent water usage.	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 minimum use of water (an ounce or less).	Deflated or leaking tank bladder.	Return to boat dealer for repair or replacement.
4. Water leaks from pump seal.	Defective seal.	Replace seal.
5. Pump runs, won't reach cut off pressure level.	Worn pump stator.	Replace worn stator.
	Leak in system.	Repair leak.

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 shower water and air conditioning condensate overboard. You should regularly inspect and clean the filter screen between the pump and the float switch.

Hydraulic Steering System Maintenance

Figure 3-1 shows the hydraulic steering system, which is designed and built specifically for marine use. Its primary components are:

1) axial piston steering pump;
2) relief valve with filters;
3) double-action slave (steering) cylinder;
4) reservoir with sight glass, system fill location and system pressure gauge.

When you turn the helm (steering wheel), the axial piston steering pump sends hydraulic fluid into either side of the single action steering cylinder attached to the starboard rudder arm. The piston pushes or pulls the starboard rudder away from amidships. The port rudder moves at the same time because a tie rod connects it to the starboard rudder.

From the steering cylinder, the hydraulic fluid is piped to the relief valve, which is equipped with 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.

The steering system is designed specifically to prevent outside air from entering the reservoir. If needed, you can recharge the steering system's air pressure 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.

Table 3-2 includes a list of potential onboard hydraulic steering system problems, their possible causes, and some suggested solutions.

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: Texaco #15, Exxon Univis J-13, Castrol AWH-15, Castrol Aero-585-B, or Shell Tellus 15. You may use heavier oils such as automatic transmission oil Type A or Dextron II, if necessary, but they will cause harder steering.

Adding Hydraulic Steering Fluid.

__ 1) Locate the two screws with 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 counter-clockwise 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.

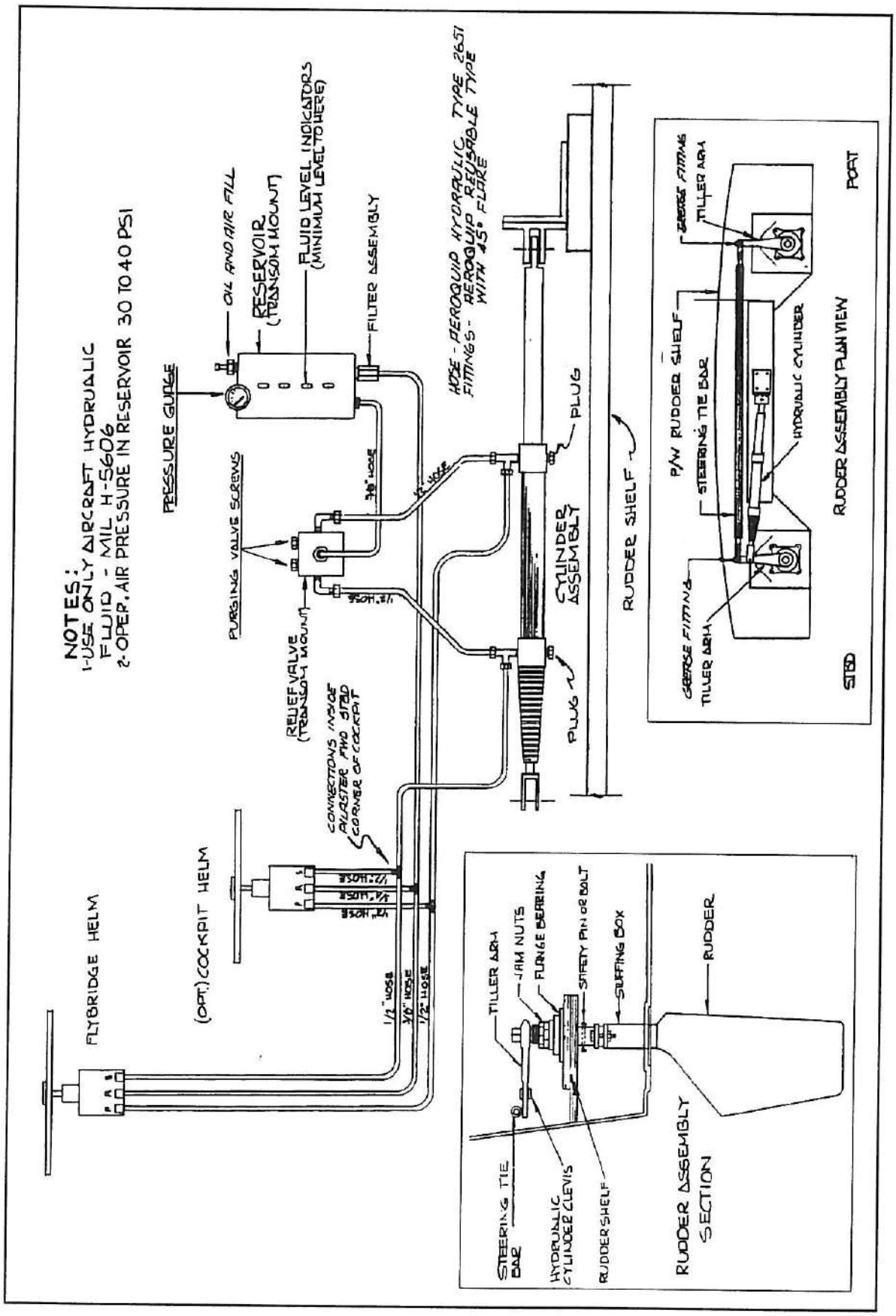


Figure 3-1: Steering System

Ref: B7710A

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 will flow into the system. Stop pressurizing 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.

__ 10) Carefully close the relief valve screws. Do not apply excessive force.

⚠ CAUTION

Be careful when tightening relief valve screws. Loss of steering will occur if the screws are not securely closed, but excessive force will result in damage to screw and relief valve.

Complete Refill and Systems Purging

If it is necessary to completely drain and refill your steering system, first follow the procedure for adding hydraulic steering fluid. Then:

__ 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.

__ 4) Disconnect the cylinder rod from the rudder.

__ 5) Open the fitting connections on the cylinder just enough to let the trapped air escape.

__ 6) Keep the fitting open until hydraulic fluid appears.

__ 7) Tighten the fitting connections.

__ 8) Verify that the reservoir is at least 3/4 full. If not, follow the procedure for adding hydraulic fluid.

__ 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.

__ 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 clockwise.

__ 16) Use a wrench to carefully snug down the relief valve screws. Do not apply excessive 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) Open the fitting at the end of the cylinder with the rod extending from it.

Table 3-2: Hydraulic Steering System Troubleshooting

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 equivalent.
	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 proper clearance.
	Cylinder out of alignment.	Remount cylinder per manufacturer's installation information.
	Fittings in cylinder over-tightened.	Remove & inspect fitting. A circular mark is reason to replace.
	Rudder stuffing box(es) too tight.	Loosen packing & jam nuts on stuffing box(es). For instruction, see **Part III, Section 4.**
	Damaged or bent rudder post(s).	Replace rudder.
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.
3. Helm pumps in only one direction.	Dirt in makeup check valve.	Return unit to factory for overhaul.
	Air in system.	Re-purge system per instructions.

Table 3-2: Hydraulic Steering System Troubleshooting (continued)

Problem	Cause	Solution
4. Helm has no stop in either direction.	Relief valve screws have been left open.	Close and tighten the relief valve screws.
	Excessive air in the system.	Purge system per instructions.
5. Helm takes excessive turns from hardover to hardover.	Excessive air in the system	Purge system per instructions.
6. System seems to always need to be purged.	Air saturated hydraulic fluid.	Purge system per instructions.
	Hydraulic fluid foaming.	Purge system per instructions.
7. Rudders drift excessively.	Relief valve screws have been left open.	Close and tighten the relief valve screws.
	Internal leakage in relief valve.	Return unit to factory for repair.
	Cylinder internal seals worn & leaking.	Return unit to factory for repair.
8. Loss of fluid & pressure in reservoir.	System fluid leak.	Check all components and fittings, repair or replace as needed.
9. Loss of system pressure but no loss of fluid.	Air leak in upper reservoir.	Repressurize. If problem continues, check for leaks. Repair & repressurize per instructions..
10. Fluid leak from tubing.	Damaged hydraulic tubing.	Replace or splice tubing.

Open it just enough to let the trapped air escape

__ 21) Keep the fitting open 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 feel **HARDOVER** again.

__ 25) Repeat steps 18 through 22.

__ 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 meanyou should repeat steps 18 through 27.

__ 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.

Table 3-3: Onboard Toilet System Troubleshooting

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 does not operate.	Tripped circuit breaker.	Reset circuit breaker.
	Blown solenoid fuse.	Replace fuse.
	Obstruction in suction housing from hopper bowl.	Remove obstruction.

__ 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 clockwise.

__ 37) Snug down carefully with a wrench; do not force.

__ 38) Verify:

__ a) 6.5 turns lock-to-lock

__ b) Reservoir level 1/2 to 2/3 full.

__ c) Reservoir pressure 20 to 30 psig.

Toilet System Troubleshooting

Table 3-3 includes a list of potential on-board toilet system problems, their possible causes, and some suggested solutions.

Trim Tab System Troubleshooting

To determine the cause of a problem in the trim tab system:

__ 1) use a flashlight or work light to check the hydraulic fluid level in the trim tab motor/pump;

__ 2) if fluid is needed, use a Phillips screwdriver to remove the motor/pump cover retaining screw;

__ 3) remove the plug from the starboard forward corner of the motor/pump;

__ 4) add the correct hydraulic fluid per the manufacturer's operator's manual;

__ 5) replace the plug, the motor/pump cover, and the cover retaining screw;

__ 6) check each trim tab motor, pump, and cylinder operation.

The Fresh Water Gauge

The fresh water tank gauge is in the galley on a small panel inside the port cupboard. It reads in quarters of a tank, and is normally **OFF**. To activate the gauge, lift up on the **READ GAUGE** toggle switch next to it.

A description of the fresh water system and instructions for operating it are in ***Part II, Section 6***.

Voltmeters and Ammeters

Your Bertram has nine Voltmeters and nine ammeters. These are discussed in ***Part II, Section 10A, Part II, Section 10B*** and ***Part II, Section 11.***

Main Engine Hour Meters

The two engine hour meters are located on a panel mounted in the engine/generator room on the port side of the walkway overhead at the webframe step.

Each instrument is energized by the ignition switch and tracks the total hours its engine has been operating. Engine running time is accumulated regardless of engine speed (rpm).

Generator Hour Meter

Mounted on each generator (on the control panel) is a non-resettable hour meter. These meters accumulate the generators' running time and are intended to help you schedule preventive maintenance.

Important Notes on Operating your Bertram

Slow Speed Maneuvering

For maximum maneuverability your twin-engine Bertram has counter-rotating propellers. These propellers rotate in opposite directions and give your Bertram exceptional maneuverability at low speeds where many boats are difficult to handle.

For example, to turn your Bertram in its own length in a confined area, set the throttles at or near idle (but below the 1,000 rpm shift maximum), and set one engine in forward and the other in reverse, with the rudders amidships.

You can make this turn in either direction. Running the port engine forward and the starboard engine in reverse turns you clockwise. Running the starboard engine in forward and the port engine in reverse turns you counter-clockwise. You can turn faster by applying rudder in the direction of the turn.

Single Engine Operation

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

Docking

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 should bring your stern smoothly alongside the dock without a jolt.

With some practice, you should be able to accomplish this type of docking with minimum fuss and noise, using the clutches alone, without steering or using the throttle.

Course Changes

At any speed above idle, your Bertram will settle smoothly into a turn due to the forces of the water on your deep "V" hull. Once your rudders bite, your vessel pivots around a point forward of amidships. The pivot point moves as speeds and hull attitudes vary. The bow pivots around a circle that is smaller than that of her stern with her bow initially just inside the intended turning track and her stern just outside.

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.

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, decreasing speed and fuel efficiency.

Water in the Bilge

The bilge should be pumped dry to minimize excess weight and sloshing. The added weight of bilge water makes your vessel ride lower, increasing water resistance and drag, and reducing speed and fuel efficiency.

The bilge is kept dry by a sump pump and by three bilge pumps equipped with sensor switches (see ***Part II, Section 7***). The galley and lavatory sinks have their own drains directly overboard. The shower has a sump with a pump that discharges overboard.

Atmospheric Conditions

While operating your Bertram, there are some operational considerations to keep in mind:

- 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.
- engine performance will be affected to a slight degree by local atmospheric conditions; among other things, you will find that the engines may develop less power in warm air temperatures.
- similarly, dry air reduces power, as will high altitudes; if you are cruising regularly in

Table 2-1: 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

___14) _____

___15) _____

___16) _____

___17) _____

___18) _____

___19) _____

___20) _____

___21) _____

___22) _____

___23) _____

___24) _____

___25) _____

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.

Preparing for a Trip

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 2-1 should be part of this list. There are blank spaces left so you may add other items to your personal list.

Of course, all gear and equipment on board should be properly stored while cruising.

Adding Weight Means Reduced Performance, Higher Fuel Consumption

You should be aware that adding passengers, personal equipment, provisions and accessories will add weight and decrease your vessel's speed.

Remember to take the effect of this added weight into consideration when calculating your vessel's performance, and particularly when calculating fuel consumption.

Calling at Ports Away From Home

Shore Current

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 50 or 60 Hz single phase alternating current (ac).

Diesel Fuel

When cruising abroad, try to purchase fuel equal to American standards. For your engines' requirements, see under ***Fuel System*** in ***Part II, Section 5***, and in your engine Operator's Manual. Carry extra fuel filters with you, since replacement may be necessary.

Drinking Water

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

Leaving Your Bertram

Follow these procedures when leaving your boat overnight or for a short time:

1) Switch **OFF** all ignition or engine circuits.
2) Lock all doors, windows, and hatches.
3) Set fenders and spring lines.
4) Make sure mooring lines are well secured with adequate allowance for tides.
5) Leave the automatic bilge pump on the **AUTO** position. If your vessel is taking on water, check the batteries' voltage frequently.
6) Disconnect dockside fresh water line.

Section 3

Fire Alarms and Fire Safety

Boating safety studies show that the best way to fight shipboard fires is to prevent them. Most shipboard fires are preventable if you:

- do not allow fuel spillage to accumulate in the bilge;
- properly store paint and other combustibles;
- take appropriate care when cooking, especially frying;
- take appropriate care with smoking materials;
- do not exceed the safety factor built into electric wiring.

Unfortunately, some on-board fires are unpreventable. Boating safety statistics[1] show that of those pleasure craft that burn, 80% are destroyed unless the fire is put out in the first 5 to 10 minutes. These same sources show that more than 80% of the fires on pleasure craft start in the engine room.

To give you fire warning and fire fighting capabilities, your Bertram's factory-installed equipment includes:

- engine/generator room fire alarm system;
- fixed Halon engine/generator room fire extinguisher system with fire extinguisher discharged audio/visual alarm system;
- four portable fire extinguishers;
- salon smoke detector.

Engine/Generator Room Fire Alarm System

NOTE:
You can disable the fire alarm system only by removing the panel fuse or disconnecting the batteries.

The engine/generator room fire detection system uses heat sensing switches, located on the overhead, which activate the alarm system at approximately 200°F. These switches automatically reset after the temperature drops below the critical point.

The fire alarm bell and indicator lights on the control console instrument panel (Figure 2-2) warn if the heat sensing switches have detected an overtemperature condition. There is also an alarm panel in the salon (Figure 3-1), located on the galley side of the rod locker. This panel warns of both fire and bilge flooding conditions.

The fire detection system is limited solely to detecting fires in the engine/generator room.

NOTE:
The engine/generator room fire detection alarm system is completely separate from the onboard fixed fire extinguishing system's own audio/visual alarms.

1 U.S. Department of Transportation, U.S.C.G. COMDTINST M16754.1G, *Boating Statistics*, June, 1986.

Testing the Fire Alarm Lamp and Bell

Along the lower edge of the instrument panel are the **FIRE SYSTEM MONITOR** push-button switches. You can test the fire alarm lights and bell on the flybridge instrument panel by pressing the push-button switch labeled **TEST**.

Overriding the Fire Alarm Bell

You can override the fire alarm lights and bell on the flybridge instrument panel (Figure 2-2) by pressing the **FIRE SYSTEM MONITOR** push-button switch labeled **OVERRIDE**. This switch is located along the lower edge of the instrument panel.

Fixed Fire Extinguisher System

> **CAUTION**
>
> Your fixed fire extinguishing systems will only fight engine/generator room fires. Fires outside of this compartment are fought with hand-held extinguishers.

Your Bertram has two fixed fire extinguisher systems that protect the engine/generator room. Each independent fixed fire extinguisher system consists of a Halon 1301 gas bottle with its controls and indicators.

There are two systems in case a reignition occurs, or if the first Halon discharge fails to completely put out a fire.

Both bottles are in the engine/generator room and both discharge only into that compartment. Each bottle has sufficient Halon for more than the necessary 5% concentration needed to extinguish engine/generator room fires.

Halon System #1 is automatically discharged when a rapid rise in engine/generator room temperature is detected by rate-of-rise detectors. You can also discharge the system manually.

Halon System #2 is intended solely as a backup system, so you must discharge it manually.

Halon 1301

Halon 1301 was selected as a fire extinguishing agent for several reasons:

- It is safe and clean (it leaves no water, foam, powder, or other residue behind).

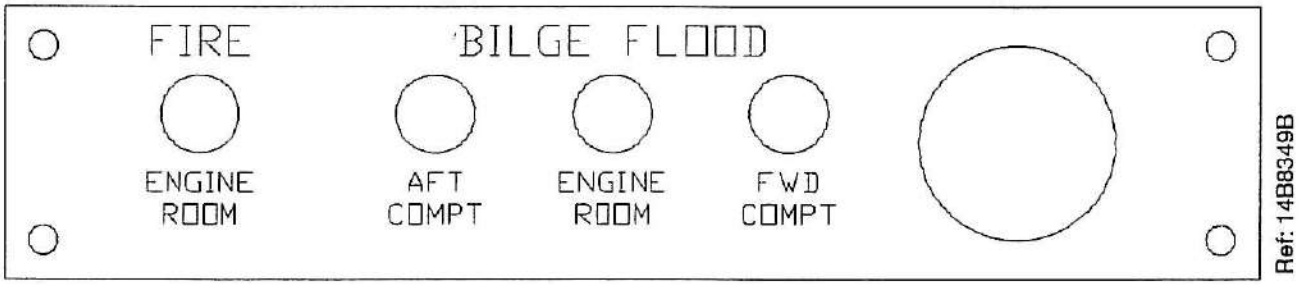
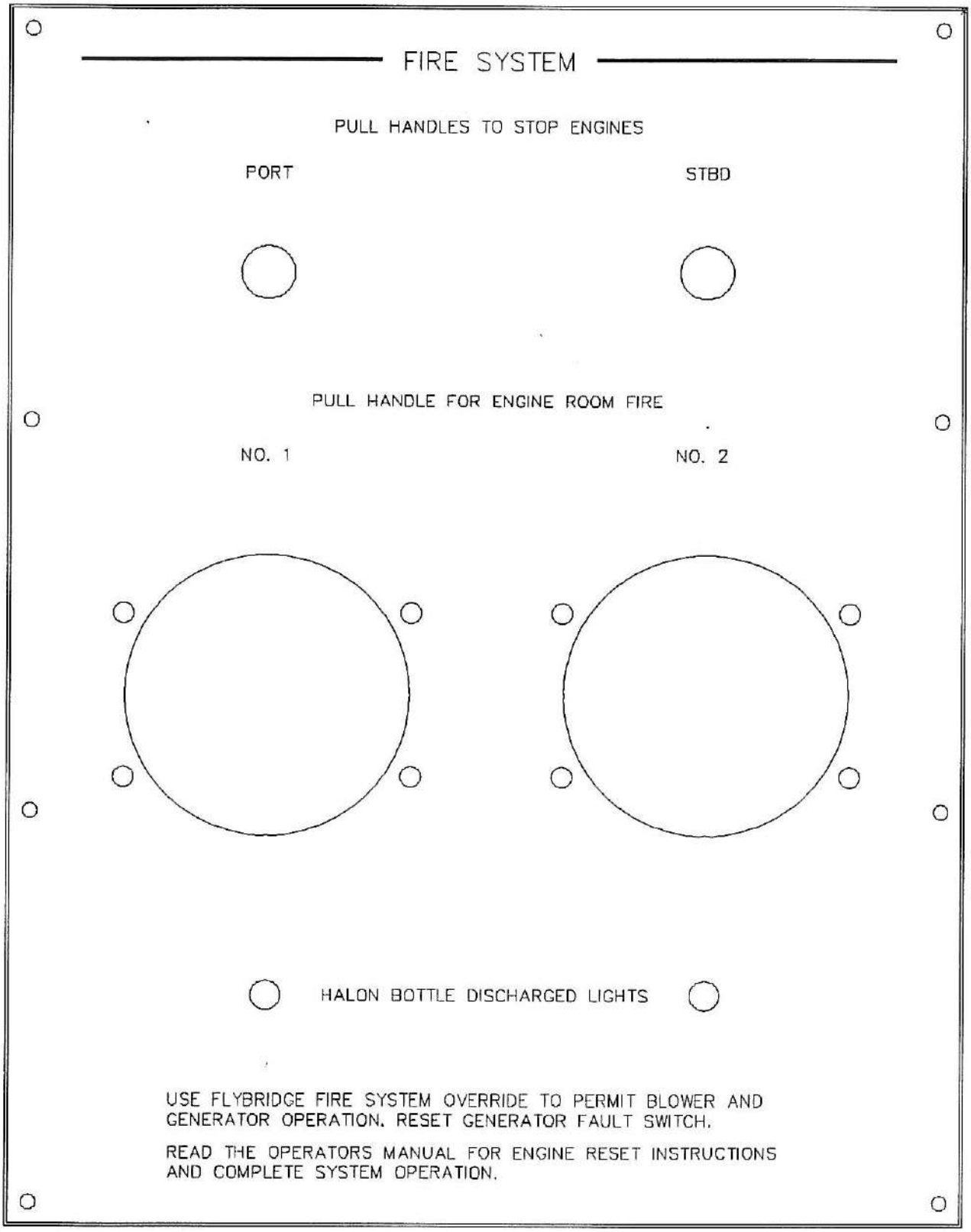


Figure 3-1: Salon Alarm Panel



Ref: D9819

Figure 3-2: Fire System Panel

- Halon 1301 works chemically to stop a fire. It breaks the chain reaction by which the fire propagates itself from one fuel molecule to another.
- With a minimum Halon 1301 concentration of at least 5%, it will prevent reignition and flashback.

⚠ WARNING

Although unburned Halon is relatively safe, *burned* halon can be TOXIC. Do not breath the fumes, the smoke from the fire, or the engine exhaust.

System Operation

The first warnings of an overtemperature condition will usually be the fire alarm bell and the fire alarm light, which signal the detection of an overtemperature condition in the engine/generator room. But when the temperature rises rapidly due to a fire, there may be only a brief time span between the alarm and the discharge of Halon System #1.

NOTE:
The time between the fire warning system alarm and the HALON DISCHARGED alarm may be too short for you to act upon them as separate events.

⚠ WARNING

Most fire fighting agents stop engines by oxygen depletion, but Halon 1301 may not stop Diesels. If you do not quickly stop your Diesel engines in the event of fire in the engine/ generator room, the Halon gas concentration will be rapidly lowered and may no longer be effective as a fire fighter.

NOTE:
In the event of a fire in the engine/generator room, you must keep the engine/generator room hatches closed. This keeps the Halon concentration as high as possible, and gives the Halon the chance to put out the fire.

Halon System #1

When either Halon system is discharged -- automatically or manually -- the system:

- shuts down the forced ventilation system;
- shuts down the ac generators;
- releases Halon gas into the engine/generator room;
- sounds the Halon discharged alarm bell.

NOTE:
For Halon to be fully effective as a fire extinguisher in your engine/generator room, the engines must be shut down as soon as possible after Halon system #1 automatically discharges, or before you manually discharge either system (the ac generators and the blowers are automatically shut down when either Halon bottle is discharged).

NOTE:
To keep Halon bottles from exploding due to pressures created by overheating, they have relief devices that release the Halon if the engine/generator room temperature reaches a preset level.

Halon System #2

The fire extinguisher system controls are in the starboard cockpit pilaster. Halon System #2 is intended as a backup for Halon System #1 and has only a manual discharge mode. This system is discharged by removing the safety pin and pulling the system release "T" handle.

After the Discharge of Either Fixed Fire Extinguisher System

WARNING

Do not open the engine/generator room hatches or try to enter this compartment for at least 15 minutes after a Halon discharge. Allowing oxygen to enter this compartment before hot metals or fuels are cool 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 fifteen minutes for any heated metal or fuel to cool off before opening the engine/generator room hatches.

If you hear the **EXTINGUISHER DISCHARGED** bell, Halon System #1 has discharged. Take these steps immediately:

1) Unless other dangers make maneuvering power necessary, immediately shut down the engines if the Halon has not already done so. The engine **STOP** switches are on the flybridge control console instrument panel (Figure 2-2).

   There is one **ON/STOP** switch for each engine. The standard method for stopping a Diesel engine is to move its **ON/STOP** switch into the **STOP** position. Your Bertram also has an emergency engine shutdown system. If an immediate Diesel engine shutdown is necessary, and if the engines do not shut down when you hold the **ON/STOP** switch in the **STOP** position, you should use the Emergency Stop system (it is discussed in detail in ***Part II, Section 5***). This system consists of two Emergency Stop "T" handles on the Fire System panel (Figure 3-2) on the starboard cockpit pilaster. To use this system, you pull each emergency stop "T" handle out as far as it will go.

NOTE:
If you choose to manually discharge this system, you should always attempt to manually discharge Halon System #1 first.

2) Shut down all electrical power except for the bilge pumps, navigation lights (if after dark), and the emergency radio.
3) Extinguish all open flames, including galley stoves, smoking materials, etc.
4) Do not open the engine/generator room hatches for at least 15 minutes. Then carefully check to be sure that the fire is totally out. Verify by feeling around the hatches and bulkheads to ensure these surfaces are cool before opening the hatches. If you have reason to believe the fire is not out, discharge Halon System #2.
5) Stand by with portable fire extinguishers in case the fire spreads past the engine/generator room bulkheads.

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

Inspecting and Restarting Boat Systems

⚠ WARNING

Halon 1301 itself is safe to breath, but, after it has burned, its combustion products are TOXIC. Do not breath the fumes, the smoke from the fire, or the engine exhaust.

After determining the fire is out:

1) Use the **FIRE SYSTEM MONITOR OVERRIDE** switch to allow switching **ON** the blowers and generator;
2) Ventilate the engine/generator room to remove any burned Halon, which is ***TOXIC***;
3) Have the proper type of United States Coast Guard-approved hand-held fire extinguishers ready when you cautiously open the engine/generator room hatches;
4) Carefully examine the engine/generator room for damage and determine the cause of the fire.
5) Make the necessary emergency repairs.
6) Reset the fault resets on the ac generator control panels (mounted on the generators);
7) Restart your ac generator;
8) Restart your engines.

NOTE:
The engines and the ac generators may be hard to start due to residual Halon in the engine/generator room.

8) Turn **ON** only those electrical circuits necessary to safely maneuver your vessel.
9) Return to port.
10) Have the Halon fixed fire extinguisher system(s) and any hand held fire extinguishers that were used checked and serviced as soon as possible.

Using Portable Fire Extinguishers

⚠ CAUTION

Do not use water-based extinguishing agents on electrical fires. There is 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/generator room fires, Bertram supplies four dry chemical, portable (hand held) fire extinguishers, USCG approved Type BC1. These are mounted:

- on the flybridge, in a recess on the port side of the control console;
- in the cockpit portside locker;
- in the galley cabinet under the sink;
- in the companionway, on the forward bulkhead of the washer/dryer locker.

Figure 3-3: Portable Fire Extinguisher Location Label

There is a label (Figure 3-3) on the surface of the cabinet, locker or recess in which each portable extinguisher is located.

NOTE:
If you hold down the trigger on a hand-held fire extinguisher, it will be empty in 8 to 20 seconds, and some fires can reignite. Use only the amount of chemical necessary to suppress the fire -- don't waste the resource you may need soon.

Classes of Fires

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

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. It is important to use it as soon as possible. Drench the fire, open the material to expose all burning embers and redrench, or throw the smoldering material overboard.

Class "B" Fires.

Class "B" fires are fueled by flammable liquids such as gasoline, oils, paint, and cooking fats (galley grease). Carbon dioxide, dry chemical, and Halon fire extinguishers are suitable against Class "B" fires. Aim the extinguishing spray 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.

Galley grease fires may be fought with dry chemical extinguishers, by smothering the fire (covering with a pot lid), or with baking soda.

You should *never* fight galley grease fires with water, which splatters hot grease, possibly spreading the fire and causing injuries.

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.

You should *never* fight Class "C" fires with water because water could cause short circuits and more fires or could endanger your life by electrocution.

Salon Smoke Alarm

The salon smoke alarm is located on the overhead (ceiling) of the salon near the cockpit door.

If the salon smoke alarm sounds, unless the smoke is from the galley and the fire is easily extinguished, you should follow the procedures you have developed according to the discussion at the end of this section under ***Fire Fighting Plan***. If necessary, you should follow the ***Emergency Evacuation Plan*** you have developed according to the material discussed in ***Part II, Section 4***.

Fire Fighting Plan

After an active fire prevention program, a well thought out and well rehearsed vessel fire fighting plan is probably the next most important step. This helps organize the fire fighting

efforts of vessel operator, crew members and guests.

Organization is vital -- studies of fires at sea show that quick reaction time is critical in putting out a shipboard fire.

Therefore, the vessel operator, crew members and other designated persons on board should know:

- the location of controls and the operation of both fixed Halon fire extinguishing systems;
- the location of the switches to shut down the:
  a) engines;
  b) ac generators;
  c) 12Vdc and 32Vdc power supplies;
  d) forced air ventilation blower system;
- the location and operation of every hand-held portable fire extinguisher on board;
- what type of fire extinguisher to use in fighting different types of fires.

We suggest you assign specific duties and have at least one "dry run" fire-fighting practice session each time you go to sea. This helps prevent panic in case there is an actual fire, and builds your confidence that operator, crew and guests understand what to do.

In dry runs, you should not discharge the fire extinguishers.

Section 4

Safety Precautions and Emergency Procedures

Carbon Monoxide Gas

⚠ WARNING

Gasoline and Diesel internal combustion engines use petrofuels and emit carbon monoxide gas. This gas is colorless, tasteless, odorless, and *lethal* if breathed in sufficient quantities.

Gasoline and Diesel internal combustion engines use petroleum-based fuels. These engines emit carbon monoxide (CO) gas, which is colorless, tasteless, odorless, and ***lethal*** if breathed in sufficient quantities.

You should always observe certain precautions to be sure of safe and pleasant power boating. These precautions are essential to the continued good health of you, your crew, and your passengers.

Be sure you open sufficient windows, hatches, and vents to maintain adequate ventilation, even with the air conditioner operating. Be especially careful when operating auxiliary equipment such as the ac generator.

When you are tied up to a dock, or are rafting with other vessels, or are immediately alongside other vessels, a lethal concentration of carbon monoxide may be drawn into your ventilation system from engine or generator exhaust fumes of nearby vessels.

Remember that carbon monoxide poisoning is one of boating's most treacherous hazards. Carbon monoxide poisoning first attacks the brain's judgment center; early symptoms (headache and nausea) are easily confused with seasickness.

Carbon monoxide is lethal, and its effects are cumulative. As carbon monoxide 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, odorless and tasteless.

Don't take chances with your life and health. Learn these symptoms of carbon monoxide poisoning:

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.

If you even *think* you smell excessive exhaust odor, or if you think you or anyone on your vessel might possibly have one or more of these symptoms of carbon monoxide poisoning, you should immediately:

a) move everyone out on deck into fresh air;
b) open all hatches, windows, and vents;
c) shut down the engines and the ac generators until you have located the source of the carbon monoxide.

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

If the carbon monoxide comes from your vessel, make all the necessary corrections and repairs before getting underway again.

Once again, be very aware that you can get Carbon monoxide poisoning from the exhaust fumes of vessels nearby.

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" footwear.

Certain aspects of being on any moving vessel can be dangerous. However, you can reduce these dangers if you exercise caution where required.

For instance, moving forward on deck or moving about the foredeck when your vessel is underway should always be done cautiously, and the transom door should be kept shut when underway.

Prudent Speeds

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. You should reduce speed as required by adverse sea conditions in the interest of your comfort. This also reduces needless strain on the engines and vessel structure.

Navigation Lights

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:
a) to be sure that if the vessel superstructure is modified (i.e., you add a fishing tower, radar or other electronic equipment), the required areas of visibility for each of these lights is not obstructed;
b) to be sure the vessel complies with any future changes to the existing 72 COLREGS.

From both the safety and legal aspects, your navigation or anchor lights must be illuminated between dusk and dawn, unless you are dockside or at anchor in a marked anchorage.

Your Bertram is delivered to you with a complete set of approved 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 and in U.S. navigable waters where the Inland Navigational Rules apply. However, you must refer to the Great Lakes and Western Rivers Rules when in U.S. navigable waters where these rules apply.

For a vessel the size of your Bertram, the required navigation lights consists of a 112.5° red sidelight (for port) and a 112.5° green sidelight (for starboard), a white 135° stern running light, a white 225° masthead light, and if you are not docked or anchored in a recognized anchorage, a white 360° anchor light.

To comply with USCG and international regulations, you must use the correct bulbs in your navigation lights. A table in Part I, Section 1 lists the correct replacement bulb part numbers for your navigation lights.

NOTE:
Keep the transom door closed while underway at night to avoid obscuring the stern light. (For safety's sake, you should keep this door shut when underway to minimize the possibility that someone might fall overboard).

Sound Signals

The length of this vessel falls within the Coast Guard category that requires it to carry both a bell and a whistle or a horn. Bertram has equipped this vessel with a suitable (unmounted) bell that satisfies the Federal Requirement of a bell for use in fog, and a dual horn suitable for the sound signals required by the Rules of the Road, under Fog and Other Signaling. The horn push button switch is on the bottom edge of the flybridge control console instrument panel at the far starboard side of the row of switches.

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 ready availability for each adult and each child on board (this device is commonly referred to as a life preserver or life jacket). If the vessel is not used commercially, PFDs may be Type I, II, or III. If the vessel is used commercially and carries 6 or fewer passengers for hire (charter boat operation), the PFDs must be Type I.

NOTE:
For purposes of satisfying the requirements of its regulations, 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.

For this vessel, Bertram furnishes six adult size Type II buoyant vests. 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, comply with all 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 four sizes: adult (90 pounds and heavier); child medium (50 to 90 pounds); child small (30 to 50 pounds); and infant (less than 30 pounds).

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. If you plan to carry passengers who require smaller PFDs, you must obtain them yourself.

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

Donning PFDs

Don this type of PFD by placing it over the head with the collar behind the neck. Then connect the waist strap and adjust to prevent the PFD from riding up.

Everyone should know where the PFDs are stowed. Each person should practice putting on a PFD and should know how to properly put one on, even in the dark (in this case, it helps to practice donning a PFD while blindfolded).

If time and conditions permit – for instance during a swim – all hands should practice water entry while wearing a PFD, and swimming while wearing one.

The recommended technique for water entry while wearing a PFD is to wrap both arms as tightly as possible around the 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. Tuck the head down into the pocket made by the folded arms.

As soon as each wearer is in the water, they should join others for mutual help and warmth.

Storing PFDs

Storage of PFDs is important. If PFDs are put away wet or stored in a damp locker, they may mildew, which hastens their deterioration. They should first be thoroughly rinsed off in fresh water, dried, and stored in a cool dry place out of direct sunlight. They should be kept away from oil, paint, and greasy substances.

Ring Buoy

In addition to life jackets (PFDs) mentioned in the previous paragraphs, federal regulations require at least one U.S. Coast Guard approved throwable Type IV (buoyant cushion or life ring) aboard. 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 three mounting brackets. Mount this buoy in a suitable location. Bertram recommends that you attach about 60 feet of light line to the ring buoy.

You may add to the one on-board "throwable" or replace the ring buoy with any other approved Type IV device if you choose.

Radios as Emergency Equipment

Bertram recommends that you install a quality marine radio on your vessel for use in obtaining help in the event of an onboard emergency. Reliable radio communications can measurably add to the safety of your vessel and to the comfort of your crew and passengers.

Visual Distress Signals

A Federal regulation requires your Bertram to carry U.S. Coast Guard approved visual day and night distress signals.

You must always carry visual distress signals on board when 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 on the approval label.

Bertram does not supply such equipment. You should study the latest issue of the Coast Guard pamphlet *Visual Distress Signals for Recreational Boats*. You can get a copy from the U.S. Coast Guard.

⚠ WARNING

Do not use automotive road flares as your required night signals. The "slag" from road flares can cause serious injury and start fires.

Cockpit Engine Control Station (Optional)

For vessel owners heavily involved in deep sea fishing, a Cockpit Engine Control Station is available.

⚠ CAUTION

The Cockpit Engine Control Station has little or no forward visibility and no steering capability.
Use the Engine Control Station only when:
1) a lookout is on the flybridge;
2) the vessel is in safe, open waters;
3) you need limited maneuvering with engines only to aid in boating a large fish.

You should use this optional engine control station only under these conditions:

1) you must have a **qualified** lookout on duty on the flybridge. This lookout must be prepared to take over control of the vessel if necessary;
2) you must be operating the vessel in open seas well clear of obstructions or dangers;
3) you must restrict maneuvering to limited, low speed maneuvers performed to help boat 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.** It is not intended for use in navigating your vessel.

Although it does have dual throttle controls and dual transmission controls, it is not equipped with a steering wheel (helm), engine performance gauges, or alarm monitors.

Preparing for Heavy Weather

⚠ CAUTION

Keep deck hatches dogged and secured while underway to prevent lazarette flooding.

One of the compelling reasons you operate a Bertram may be its long tradition of exceptional strength and seaworthiness. Even so, there is no vessel, regardless of its size and strength, that is completely immune to the dangers of heavy weather.

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

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

Table 4-1: 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) _____

Table 4-1 provides a checklist of things you should do to prepare for rain, fog, high winds, 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 must slow to a "Moderate Speed" to comply 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 one-half (1/2) the existing visibility.
2. **Post at least one lookout** (in addition to the helmsman) whose sole responsibility is to watch for vessels and other hazards to navigation.

Fishing Tower – Heavy Weather Warning

WARNING

No one should occupy the fishing tower under adverse sea or wind conditions.

The height and weight of a fishing tower (also called a tuna or marlin tower), and the weight of any occupant(s), significantly raise your vessel's 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 or weather conditions, do not allow anyone to occupy this tower.

The Beaufort Scale Of Wind Force

To more accurately and quickly transmit wind and wave information, the British Royal Meteorological Office developed a table (with comparison photographs) of each of wind forces called the Beaufort scale (Table 4-2).

Some of these photographs can be seen in Chapman's basic textbook for boaters: *Piloting -- Seamanship and Small Boat Handling*, available from Motor Boating & Sailing Books (New York, NY) and some yacht supply stores.

Emergency Evacuation Plan (the Abandon Ship Plan)

You should plan for the possibility of an uncontrollable fire or other emergency at sea requiring that all hands leave your vessel. As an important part of your emergency preparedness plan, you, along with the crew and regular guests, should develop and practice an emergency evacuation plan (Abandon Ship Drill). As a minimum, this plan should cover:

- location of the PFDs (life vests) and how to don them;
- location and operation of any other emergency flotation equipment such as life ring, life raft, dinghy, etc.;
- speedy operation of the forward hatch;
- when and how to quickly summon help by:
  a) using the hailing/emergency channel for the onboard VHF (in inland or coastal

Table 4-2: 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

waters) or the single side band radio (past the continental limits);
b) using flares or daylight visual distress signals;
c) using the orange and black distress flag;
d) using the Emergency Position Indicating Radio Beacon (EPIRB).

Draft

To avoid going aground or damaging your underwater gear in shallow waters, it is absolutely vital you know your vessel's draft. Draft is the distance from the surface of the water to the lowest external part of the boat. Be aware that any vessel's draft varies depending on her load.

You should determine draft fully equipped and at or near the maximum load you expect to be carrying. Any vessel will draw slightly less in saltwater than when equally loaded in fresh water. To determine 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.
3) record this dimension where it will be readily available. An excellent place is on your compass deviation card.

Height

In addition to knowing your vessel's draft, it is also vital you know her height, including any optional equipment such as fishing towers 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 where it will be readily available, as on your compass deviation card.

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 the clutch/transmission system.

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 or hit a piece of floating debris (flotsam).

If you run aground, take these steps to protect your vessel and to minimize the damage:

1. Resist the natural impulse to "throw" the transmission into reverse and, instead, pull both throttles back to idle.
2. Shift both transmissions into neutral.
3. Stop both engines and follow the instructions below.

Refloating Your Vessel

Most vessels run aground at the bow. Unless your vessel has received hull damage that requires repair before refloating, the most important things are:

- to avoid damaging your propulsion system, holing your vessel, or allowing it to be driven farther ashore;
- to prevent possible vessel damage from pounding or broaching.

Pounding

Pounding occurs when successive waves raise a grounded vessel's hull and drop it repeatedly against the sea bed. Bottom damage from pounding can range from cracked fiberglass to open holes in the hull. As each wave strikes the vessel, continuing wave action tends to drive the vessel harder aground.

Broaching

Broaching is the most serious problem a grounded vessel may face. It occurs when the vessel is thrown or turned broadside to the shore or the shoal by wave action.

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 the vessel's hull fore and aft, and pile it up amidships and to leeward of the vessel. This action eventually leaves the hull supported only amidships, and can break the vessel's back.

Refloating Techniques

1) Determine the location and extent of any hull damage. Bertram hulls are among the strongest made, but running any vessel onto a sharp coral reef or pointed rock can damage it.

2) Establish or restore your watertight integrity. If necessary, make a patch using one or more hull patch kits containing two-part emergency fast-setting epoxy. These kits are readily available at marine hardware stores. You can apply the material 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 reduce the influx of water.

3) If you can remain afloat, and are better off afloat than grounded, break out your "ground tackle." This should include a heavy duty service anchor and a light duty "lunch hook." Prepare to set them as "kedges" off your stern as quickly as possible to prevent being driven farther aground.

Ideally, kedge anchor(s) can be carried into place by your vessel's dinghy or by an inflatable raft, if available. For best effect, set the kedges as far behind your vessel as available line permits, with an offset to the port or starboard to compensate for wind or current, whichever is stronger.

Make the bitter end of your anchor line fast to your stern cleats. 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 personal flotation devices (PFDs) and towed into place by one or more swimmers. This technique is an emergency procedure. Each swimmer should wear a PFD and should be attached to your vessel with a light life line.

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 starboard quarter.

4) By using your vessel's winch or all hands, and by pulling first on one line and then on the other, the two-kedge arrangement may make it possible to "walk" your vessel off. In any case, always keep tension on the kedge line.

5) 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.

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:

- go out on the swim platform;
- enter or leave the water;
- board or disembark from your vessel by climbing out of or down into a dinghy.

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.

Damaged Underwater Equipment

⚠ CAUTION

Only under emergency conditions should you operate at cruising speed with a vibration caused by damaged propellers or running gear. Get a tow, or, if necessary, proceed with extreme caution at idle speed.

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

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

A significant loss of speed and excessive vibration can -- and usually does -- result from damaged propellers, shafts, struts, or misaligned rudders and engines.

The rudders on your Bertram always should be kept parallel, neither "toed in" nor "toed out." You should have propeller shaft alignment checked periodically.

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.

WARNING

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

Although towing is a common courtesy among pleasure vessel skippers, it 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's manual CG 484 (1977), *Auxiliary Towing Guide*, states that most marine accidents occurring during towing fall into one of three categories:

1) Most recreational boats do not have suitable deck fittings for towing other vessels, and many do not have suitable deck fittings to be towed.
2) The boating public in general has both limited knowledge and limited experience in the practice of good seamanship.
3) Boating personnel sometimes fail to conform to good seamanship practices through inexperience or acting out of expediency.

Safety First in Towing

We strongly recommend against towing. If you choose to do so despite the risks involved, please understand that in all towing operations the primary objective is to be sure of the safety of the people on both vessels. Thus your first goal must always be to save lives and to avoid inflicting personal injury. Saving property is only secondary and must never take precedence over personal safety.

Section 5

Propulsion System

WARNING

If you come into contact with moving machinery, you can be seriously injured.

CAUTION

Operating engines and generators may produce high noise levels in the engine/ generator room. To protect your hearing, obtain and wear hearing protection equipment that meets recommendations of the U.S. Occupational Safety & Health Administration (OSHA).

Carbon Monoxide Hazard

WARNING

Diesel internal combustion engines use petrofuels and emit carbon monoxide gas. This gas is colorless, odorless, and lethal if breathed in sufficient quantities.

Carbon monoxide poisoning is one of boating's most treacherous hazards. *Please read very carefully* the information in ***Part II, Section 4*** under ***Carbon Monoxide Gas***.

Propulsion System Care

CAUTION

1) check engine oil level, transmission oil level, coolant level, and air cleaner indicators before you start the engines; 2) monitor the propulsion system performance gauges, especially for the first several minutes after engine startup.

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

To maintain its rugged reliability and ensure long life for all the components, your system demands your careful attention, gentle

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

treatment and a consistent program of preventive maintenance.

Part III of this manual contains information on maintaining your vessel; ***Part III, Section 1*** covers ***Periodic Maintenance***. You should also follow the instructions in the engine and transmission operator's manuals provided by the manufacturers for:

- selection of fuel and lubricants;
- monitoring performance instruments;
- scheduled preventive maintenance.

You can find these manuals in the supplementary information delivered with your Bertram.

Part III, Section 2 of this manual covers engine troubleshooting procedures.

Engine Performance Alarm Systems (one per engine)

An independent alarm system protects the engines and transmissions. This alarm system consists of an alarm horn and two sets of alarm indicator lights (one per engine/transmission) mounted on the flybridge control console instrument panel (Figure 2-2).

System Operation

The alarm systems warn you audibly and visibly in case any of the following possibly damaging conditions exist:

a) engine coolant operating temperature exceeds a set upper limit in one of the engines;
b) lubricating oil pressure has dropped below a preset level in one of the engines;
c) oil temperature exceeds a set upper limit in one of the transmissions;
d) exhaust temperature exceeds a set upper limit in one of the engines.

If any of these occurs, the alarm horn will sound and the related port or starboard alarm lamp will illuminate. ***Part II, Section 1*** covers the settings at which the alarm systems sound.

⚠ CAUTION

If the engine alarm horn sounds and ANY engine alarm light illuminates indicating an engine or transmission problem, you should immediately:
1. throttle the engine back to idle;
2. shift the transmission into neutral;
3. shut down the engine.

Troubleshooting Engine Performance 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 begin troubleshooting using the engine alarm lights. This procedure is discussed in ***Part III, Section 3*** of this manual.

NOTE:
*An illuminated alarm light is intended to make you aware of a possible emergency, but it may indicate a problem with the alarm circuit. You should treat **all** alarms as emergencies, and then begin troubleshooting to determine the source of the problem.*

Detroit Diesel Engine Operations

CAUTION

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

NOTE:
*Additional information on operating your Detroit Diesel engines and ZF transmissions is included in **Part II, Section 5(S)**. This chapter contains information from Florida Detroit Diesel Allison Inc., developers of the engine/transmission systems powering your Bertram.*

Your engine Operator's Manuals contain technical information, operating instructions and maintenance data. These manuals are part of your vessel's documentation package.

You should carefully read the sections on operating instructions, lubrication requirements, and preventive maintenance before you try to start or operate your engines.

If you wish to learn more about your Detroit Diesel engines, Florida Detroit Diesel Allison presents three-day marine Diesel seminars for boat owners and captains. These engine seminars include theory of operation, preventive maintenance, and troubleshooting.

For more information, see the registration form in ***Part II, Section 5(S)*** of this manual. You may wish to contact the Director of Training, Florida Detroit Diesel Allison Inc., 2295 NW 14th Street, Miami, Florida, 33125; call (305) 633-5028.

Starting Detroit Diesel Engines

WARNING

Before starting your engines, be sure the clutch controls are set in the neutral position to prevent accidental boat movement.

CAUTION

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

NOTE:
If your vessel is docked in a climate where the ambient temperature falls below 60°F, you should use the block heaters supplied with your engines. Plug them into the special ground fault-protected circuits on the aft bulkhead of your engine/generator room, and leave them in operation for at least 12 hours prior to starting the engines.

NOTE:
Be sure that:
a) engine cooling seawater intake seacocks are fully open;
b) the engine cooling seawater strainers are not clogged;
c) you have set the fuel tank selector valves in the compartment under the steps between the cockpit and the salon to draw from either forward or aft tanks.

On the engine/generator room 12Vdc Supply Panel (Figure 10A-1):

Set both 12Vdc battery disconnect switches to **ON**. These battery disconnect switches feed 12Vdc battery power to the vessel 12Vdc system.

On the engine/generator room 12Vdc Main Distribution Panel (Figure 10A-2):

Set the **FLYBRG MAIN #1M** circuit breaker to **ON**. This feeds 12Vdc power to the flybridge 12Vdc distribution panel.

On the engine/generator room 32Vdc Battery Disconnect Panel (Figure 10B-1):

Set both 32Vdc battery disconnect switches to **ON**. These switches feed 32Vdc power to the vessel 32Vdc system.

On the flybridge 12Vdc distribution panel (Figure 10A-3):

Set the **TACHOMETER #1F2** circuit breaker and others necessary for vessel operation to **ON**.

On the flybridge 32Vdc distribution panel (Figure 10B-3):

1) Set the **PORT ENG #3F2** and the **STBD ENG #3F3** circuit breakers to **ON**.
2) Position the **TRIM TAB #3F8** circuit breaker and others necessary for vessel operation to **ON**.

On the flybridge control console (Figure 2-1):

1) Position the clutch controls in the **NEUTRAL** position.
2) Advance the throttle levers to slightly forward of **IDLE**.

On the flybridge control station switches (Figure 2-4):

1) Set either **ON/STOP** switch to **ON**. (The engine alarm bell should sound and the engine lubricating **OIL PRES** alarm light should illuminate.) If the **GEAR TEMP**, **EXHAUST TEMP**, or **WATER TEMP** alarm lights are now illuminated (with the engine still cold), there is a problem in one or more 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**. (We recommend you use the **PARALLEL** mode whenever you start an engine.) Release this switch as soon as the engine starts.

NOTE:
Use of the COLD START position allows a Detroit Diesel engine to turn over for several seconds with no fuel injected into the cylinders. This allows:
a) the cylinder wall temperatures to rise;
b) lube oil to circulate throughout the engine, especially the cylinder walls;
c) elxhausting of condensed water vapor or collected fuel.

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

NOTE:
*You can do no harm by using the **COLD START** feature whether the engine is cold, warm, or even hot. Bertram recommends that you use **COLD START** each time you start an engine.*

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 re-engage the starter.

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.

6) Hold this switch in **START** for a maximum of seven seconds or until the engine starts, whichever comes first.
7) When the engine starts, release the **START** switch (the engine alarm horn should stop and all engine alarm lights should have gone out).
8) Repeat steps 1 through 7 for the other engine.

After Starting Detroit Diesel Engines

> **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 its transom exhaust outlet. This stream of mixed water and exhaust gases indicates the seawater cooling system is operating. If the stream is not there, shut that engine down immediately to avoid engine damage, and do not restart it until you determine why no water is flowing.

Check the readings on the engine performance gauges. The engine oil pressure gauges will indicate pressures slightly higher than 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:
Be sure the engine performance gauges are reading correctly.

The manufacturer recommends that you not idle your Detroit Diesel engines under no-load conditions for an extended period (more than five minutes), at any time.

Stopping Detroit Diesel Engines

Normal Stop

The Detroit 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 **STOP**.
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.

Emergency Stop

> **CAUTION**
>
> Do not use the emergency stop system to shut down your engines except in emergencies. Shutting off the air supply to the engines could damage them. Read the manufacturer's manual on the system.

Because Diesel engines are self-igniting, they have no ignition systems. Once started, Diesel engines will operate as long as they have fuel and air. Some Diesel engines have electrically controlled fuel shutoffs and thus may be difficult to shut down if there is an electrical failure or fire in the engine **STOP** circuitry.

Your Bertram has a mechanical emergency shutdown system for use with the fixed fire extinguishing system. Use this system to shut down your engines only in an emergency.

NOTE:
Under normal operating conditions, you should stop your engines by idling them and simply holding the ON/STOP rocker switches in STOP until both Diesel engines have completely shut down.

In case of an engine/generator room fire or an electrical **STOP** circuit failure, your emergency stop system is located in the starboard cockpit pilaster on the **FIRE SYSTEM** panel (Figure 3-2) (***Part II, Section 3*** discusses the fire extinguisher system and its operation).

There are two "T" handles (one per engine) on the **FIRE SYSTEM** panel. Cables connect these "T" handles to shutdown levers on each engine.

If it becomes necessary to bring your engine(s) to an emergency stop, first place and hold the two **ENGINE ON/STOP** rocker switches in the **STOP** position.

If this fails to shut down the engine(s), pull the "T" handles out as far as they will go (about 3/4 inch). This will trip the catches and allow spring loaded flappers to snap closed and cut off the air supply to the engine.

Resetting the Emergency Stop System

After using one or both emergency engine shutdown systems, before you attempt a restart, you must:

1) Push the "T" handles on the **FIRE SYSTEM** panel (Figure 3-2) back to their original positions.

2) Go into the engine/generator room to the engine and reset the flapper catches on the engines. Refer to your *Detroit Diesel Series 92 Operators Guide*.

Fuel System

Your fuel system (Figure 5-1) consists of:
- four fuel tanks;
- fuel lines;
- fuel selection valves;
- manual shutoff valves;
- fuel filters.

Fuel Tanks and Shutoff Valves

There are four separate fuel tanks, each with a manual shutof valve.

Forward Fuel Tanks

The aluminum forward tanks are in the engine/generator room, forward of the generators. The manual shutoff valves are at the bottom of the tanks.

Aft Fuel Tank

The aft tank, made of reinforced molded fiberglass with fire retardant resin, is beneath the cockpit. The manual shutoff valve is located at the top of the tank. A small cockpit hatch provides access to the fuel supply fittings. The tank fill and vent plate assembly are inspected from the engine/generator room.

Reserve Tank

The stainless steel reserve tank is beneath the cockpit, aft of the fresh water tank. The manual shutoff valve is located at the bottom of the tank.

The reserve tank cannot feed fuel directly to the selector valves. It feeds fuel only to the aft tank via an inline electric fuel pump. This pump is powered through circuit breaker **#154 – FUEL TRANSFER PUMP**, on the Main 120/240Vac Distribution Panel in the salon. This circuit breaker acts as the **ON-OFF** switch

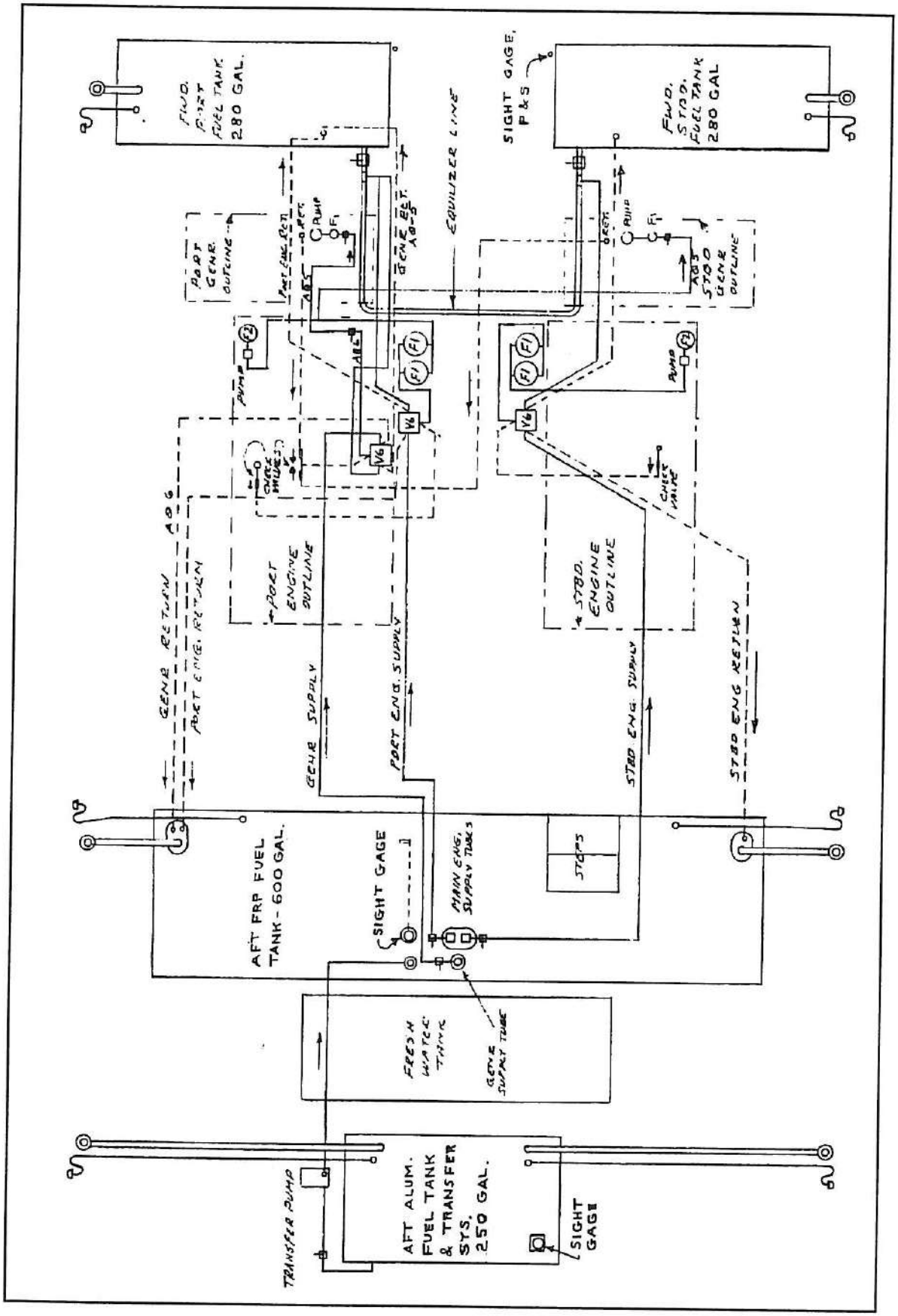


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Figure 5-1: Fuel System

for the fuel transfer operation. An amber light next to the breaker is illuminated when the transfer pump is in operation.

NOTE:
*Be sure the aft tank is less than half full before you transfer fuel from the reserve tank. If there is insufficient space in the aft tank, excess fuel delivered by the transfer pump is vented overboard. In U.S. Territorial waters, pumping Diesel fuel overboard is a violation of federal law. Bertram recommends that the manual shutoff valve on the reserve tank be left in the **CLOSED** position unless you are transferring fuel.*

Fuel Tank Selection

Fuel supply lines lead directly from the forward and aft tank manual shutoff valves to the fuel selector valves in the walkway between the engines.

Mounted in the engine/generator room walkway inboard of the engines are the engine and generator fuel tank selector valves. One valve is for each main engine, and there is a third valve for the generators.

The valves permit you to select the tank from which each engine and the generators draw fuel. The valves connect directly to the fuel tank suction heads.

Diesel engines do not use all the fuel drawn into them, so they have fuel return lines which automatically return all unused fuel to the tank from which it was drawn. The Diesel fuel return lines connect through the tank selection valves, and have no shutoff valves.

NOTE:
*Under normal operating conditions, most operators leave the generator tank selection valve on the **AFT** tank.*

Fuel Filtering

The fuel travels from each selector valve to a combination fuel filter – fuel/water separator. A filter service valve is located on the fuel line at each engine so you can replace the fuel filter without having the fuel lines drain 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.

Each separator assembly has a drain plug at the bottom to allow removal of collected water. You should visually inspect these separators regularly, depending on climatic conditions, and remove the water when required.

Part II, Section 1 lists the make and part numbers for main engine and generator filters. This information is also in the manufacturers' manuals.

Fuel System Priming

Engine Priming – Forward Tanks

Fuel is drawn from the bottom of the forward fuel tanks. Since the fuel level is normally above the main engine and generator fuel filters, the forward tanks need no priming pump system.

The fuel tank selector valves let you use the forward tanks for priming and then switch to the aft tank for running.

To prime either main engine from the forward fuel tanks, you must bleed the air from the system:

1) Loosen the fuel line connection at the engine side of the Racor fuel filter.
2) Use gravity to fill the filter from the forward tanks.
3) When fuel comes out of the loosened connection, tighten it.

NOTE:
Limit cranking to seven seconds; wait two minutes before cranking again.

4) Crank the engine to fill the engine-mounted fuel filter. The engine should start.

Engine Priming – Aft Tank

You must use a manual or electric suction pump to prime the engine from the aft tank, or to prime from the forward tanks if their fuel level is too low to use gravity priming:

1) Disconnect the fuel line from the engine fuel pump to the Racor fuel filter at the filter.
2) Connect the suction pump to the Racor filter.
3) Operate the pump to draw fuel up into the Racor filter until fuel starts to flow from the pump.
4) Disconnect the suction pump and replace the fuel line.
5) Crank the engine until the secondary fuel filter on the engine is full. The engine should start.

Generator Priming

The generator has a manual fuel pump with a priming lever extending from the bottom. This system lets you manually prime the generators from either tank. However, you must bleed air from the system for the priming process to work. To prime a generator, follow the instructions provided in the generator operator's manual.

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 three pairs of fuel fill ports. Each port is a flush-mounted deckplate with a captive, screw-on cover.

The forward tank fuel fill ports are amidships, one on each side. (There is an equalizer tube connecting the two forward fuel tanks, so you can fill both tanks from either port.)

The aft tank fuel fill ports are just aft of the salon superstructure, one on each side.

The reserve tank fuel fill ports are just forward of the transom on each side.

Fuel Gallonage

The fuel tanks fit athwartships inside your Bertram's hull. The shapes of these fuel tanks follow your hull's deep V interior shape. To make the best use of the space available, the tanks are necessarily larger at the top than they are at the bottom.

The result of this design is that there is space for more fuel in the top half of the tanks than there is in the lower half. The fuel gauges can only show the approximate *level* of fuel remaining in the tanks, not the quantity.

Keep this in mind to avoid running too low on fuel and to reduce the chance of running out

of fuel at sea. Table 1-2 in ***Part II, Section 1*** shows an approximate relationship between fuel gauge readings and actual fuel remaining.

Fuel Quality

⚠ WARNING

Never add commercially marketed Diesohol or gasohol to Diesel fuel. Mixing these blends with Diesel fuel creates both an explosion hazard 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

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

You may choose to use very small amounts of isopropyl alcohol (isopropanol) to prevent fuel line freeze-up in winter months. Add no more than one pint of isopropyl alcohol to each 125 gallons of Diesel fuel.

Refer to your engine manufacturers' operator's manual for information on the specific grades of fuel suitable for use in your engines.

Spoiled Diesel Fuel

Diesel fuel kept in your vessel's tanks for long periods deteriorates. Spoiled Diesel fuel can damage your engines. Therefore, on shorter trips, alternate fuel tanks. On longer trips, where you expect to use both tanks, we suggest that you use the forward tank first. This reduces the weight forward as fuel is drawn, making it easier for you to trim your Bertram to the slightly bow-up attitude best for both the smoothest ride and maximum fuel efficiency.

Bertram and Detroit Diesel recommend that, when possible, you refill your fuel tanks at the end of each day's running to prevent condensation from contaminating the fuel.

Engine Air System

In two-cycle Diesels, a charge of blower-compressed intake air pushes exhaust gases out through the exhaust valve ports and fills the cylinders with fresh air. The input air also helps to cool the internal engine parts, particularly the exhaust valves.

A blower on each engine cylinder block supplies the compressed input air for scavenging and combustion. The blower consists of a housing with two 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 equipped with washable, dry-foam air cleaners on the air intake silencers attached to the input end of each turbocharger.

The air filter element in the silencer is polyurethane foam. It normally requires no maintenance.

Engine Lubrication System

As with any internal combustion engine, proper lubrication is critical to engine life and performance. A full-flow oil filter mounted on each engine removes the larger foreign particles from the engine lubricating oil without restricting oil flow. As it circulates through the system, all the oil is eventually filtered.

The full-flow filter has a bypass valve in its base. This valve opens at a set pressure differential across the filter. When the valve opens, it allows unfiltered oil to circulate, but it ensures engine lubrication in case the filter becomes clogged.

Unfiltered oil can cause excessive engine wear.To reduce the likelihood of filter clogging, and thus to prevent unfiltered oil from circulating, replace the filter element each time you change engine oil. See ***Part III: Maintenance*** for the replacement procedure.

For more information on the requirements of your engine lubricating systems, see Detroit Diesel publication 7SE270, *Lubricating Oil, Fuel Oil and Filter Recommendations.* A copy is included with this manual.

Engine Cooling

Your engines are fresh water cooled. This means a closed and pressurized mixture of fresh water and a suitable corrosion inhibitor provides cooling for the engine blocks, cylinder heads, exhaust manifolds and turbochargers. This coolant mixture is in turn cooled by passing it through the seawater-cooled heat exchanger.

Fresh Water and Antifreeze Mixture

Your engine coolant provides the medium for heat transfer to control engine internal temperature during operation. In an engine with 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 and engine temperature will rise rapidly.

The coolant solution in your engines must provide the following functions:

- adequate heat transfer;
- corrosion inhibition;
- protection against the formation of sludge or scale in the system;
- compatibility with system hoses and seals;
- adequate freeze protection during cold-weather operation, and boil-over protection during hot weather.

Diesel Engines in Warm Areas

For Diesel engines in waters above 70°F, do not use antifreeze in the coolant mixture. Antifreeze does not transfer heat through the heat exchanger as efficiently as a mixture of fresh water and *Nalcool 2000* (one pint of *Nalcool 2000* to four gallons of water).

Diesel Engines in Cold Areas

For Detroit Diesel engines operating in climates requiring antifreeze, Detroit Diesel recommends ethylene glycol antifreeze, and recommends against methyl alcohol antifreeze.

Use of antifreeze in your Diesel coolant presents another problem. Over the years, antifreeze manufacturers changed their products to include increased amounts of silicates to protect aluminum engine components from corrosion. Today, most antifreezes have three to eight times as much silicate as they did several years ago. This includes antifreezes used in heavy-duty Diesel coolants.

If a high silicate Diesel antifreeze is overconcentrated by evaporation, or by use of unnecessarily large amounts of corrosion inhibitor supplements, excess silicate "drops out" of the coolant. This results in a buildup of silica gel in the cooling system's cool, low-flow zones, especially the oil cooler core, the heat exchanger, and the aftercooler.

The silica gel buildup restricts coolant flow and causes overheating, which can result in serious engine damage. In its wet state, silica gel looks like antifreeze. When dried, silicate is a white powdery deposit. The gel is non-abrasive, but it can pick up particles in the coolant and become a gritty, abrasive deposit that can cause excessive wear in water pump seals.

For more information on the requirements of your engine cooling systems, see Detroit Diesel publication 7SE298, *Coolant For Detroit Diesel Engines*. A copy is included with this manual.

CAUTION

To prevent engine damage to Detroit Diesel engines 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.

Seawater Inlet System

The seawater cooling system for the engines consists of:

- below-waterline intake ports
- seacocks
- seawater strainers
- seawater piping system
- seawater side of the heat exchangers.

Your Bertram has a seawater heat exchanger system mounted on each engine (a similar but smaller system is mounted on each ac generator).

Cooling seawater is taken in through the hull via the slotted strainers, and is drawn through the seacocks and the seawater strainers to the pump. The seawater is pumped into the seawater side of the heat exchangers. As it travels through the heat exchangers, heat is transferred from the engine coolant mixture (which is on the fresh water side of the heat exchangers) to the seawater.

Then the seawater is piped to the engine exhaust riser mixing sections, called "mixing elbows"). To keep the seawater from getting back into the exhaust manifold, the cooling seawater is injected into the exhaust flow at a point several inches beyond the highest point of the riser.

The seawater is mixed with the exhaust gases and cools them, and the mixture is expelled overboard after passing through the exhaust silencers (mufflers).

NOTE:
To avoid engine (or ac generator) overheating, it is very important that the seacocks be completely open and that you keep the seawater strainers clean.

Wet Exhaust System

Exhaust systems are called "wet" exhaust systems when the entire system or any portion of it is cooled by water. Your Bertram has a wet exhaust system.

Exhaust gases go from the exhaust manifold to an exhaust riser. This area is dry (not cooled by seawater) and will get *very hot*. You should treat it with great respect.

Special heat-resistant insulation covers your exhaust risers to protect anyone working near them and to reduce the chance of an engine/generator room fire caused by contact between the risers and an inflammable material. These covers should be inspected and repaired if necessary according to the information in ***Part III, Section 4***.

Cooling seawater is injected into and mixed with the exhaust gases just below each exhaust riser. This seawater cools the remainder of the exhaust system.

CAUTION

Be careful when working near the exhaust risers. They are not cooled by seawater; when the engines are operating, they get *very* hot and can burn you.

Marine Gears

The heavy-duty marine hydraulic transmission attached to each of your engines consists of the forward and reverse gears and one or more clutches. Twin levers mounted on the flybridge control station console (Figure 2-1) control the transmissions.

Operation

Operating information and maintenance procedures for your marine gears can be found in the transmission manufacturer's Operator's Manual included with your vessel's documentation.

Propeller Shafts

Technical data on the propeller shafts can be found in ***Part II, Section 1.***

Propeller Shaft Alignment

See ***Part III: Maintenance***.

Shaft Logs and Stuffing Boxes

See ***Part III: Maintenance***.

Propellers

Propeller Installation

To provide maximum shaft and propeller life, the propeller must be properly fitted to the shaft. If you replace the propeller or the shaft, follow the guidelines in ***Part III, Section 4.***

Changing Propeller Size or Style

Bertram's Engineers calculated a specific combination of propeller diameter and pitch to give your vessel maximum efficiency. Calculations were based on engine power (at rated rpm), hull design and vessel weight, and were followed by extensive testing.

Therefore, any changes in size or pitch could reduce engine performance or propulsion system life by placing undue stress on running gear components.

If you replace your propeller, it is vital to use the original propeller size, diameter, and pitch as specified in ***Part II, Section 1.***

In the future, if there is a significant change in your vessel's primary use, or if you make a modification such as adding a fishing tower, you may wish to consider changing propellers. If you feel 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 modifications and past performance.

Your data should include measured speeds at six evenly-spaced engine rpm, including wide open throttle. You should record these figures using an accurate hand-held speed recording device.

When the Bertram Service Department receives your report, the staff will consult with Bertram's design and test engineers to see if a change in propellers might be worthwhile.

Section 5(S)

Supplementary Notes on Engines and Transmissions

This section supplements ***Part II, Section 5***. The information is provided by Florida Detroit Diesel - Allison, Inc., developer of the BK1100 propulsion system that powers your Bertram.

Contents

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

...A Message to the New Owner

You have taken delivery of the finest sport fishing vessel in its class and, as such, have also received the finest Diesel engine package... the powerful and reliable Detroit Diesel BK1100.

The BK1100 was developed by **FLORIDA DETROIT DIESEL-ALLISON** and **DETROIT DIESEL CORPORATION** over the past several years. It embodies all of our mutual marine diesel engineering experience and may well be the most user-engineered and dependable high performance Diesel package available anywhere.

In addition to the special design features exclusive only to the BK1100, great emphasis has been placed on dynamometer testing in **FLORIDA DETROIT DIESEL-ALLISON**'s Tropical Test Cell. Each unit is tested as a complete marine propulsion system, with the engine and gearbox documented as to actual performance under high-ambient air and sea water conditions.

Further, monitoring points are incorporated into the BK1100 at over 20 critical locations on the engine and gear to enable a qualified field serviceman to quickly and efficiently pinpoint engine/gear performance. This special care during production, design and testing of the BK1100 assures a higher level of trouble-free service in the Bertram 54.

Moving further ahead with our Product Support Programs, we now offer the Extended Service Coverage (ESC) for the BK1100 up to 60 months and unlimited hours. You and your crew should also seriously consider attending our 3-day Key Power Technical Institute "Captain's Seminar" during your next visit to Miami. Please call for details.

> *Note: Please be advised that you must contact **FLORIDA DETROIT DIESEL-ALLISON, INC.** to obtain and fill out the appropriate forms to effect your ESC coverage for your Bertram 54. You must do this within 180 days of the delivery date of your boat.*
> ***Caution: Failure to register will result in loss of Extended Service Coverage on your engines.***

Thank you for choosing the BK1100. We wish you the best in yachting with your Bertram 54, and we look forward to serving you soon.

Your friends at **FLORIDA DETROIT DIESEL-ALLISON, INC.**

2277 N.W. 14th Street / Miami, Florida 33125-0068 / (305) 638-5300 / Fax: (305) 638-4111 / Telex: 153635

Key Power Inc. TECHNICAL INSTITUTE

2295 N.W. 14th Street
Miami, Florida 33125-2188
(305) 637-1555
Broward 523-1572

BOAT OWNERS & CAPTAINS THREE DAY MARINE DIESEL SEMINAR

Coordinated By: **Certified DDA Instructors**
Sponsored By: **Key Power - Florida's Largest Marine Distributor**

The boater will be able to:

- Trouble-shoot, perform maintenance and up keep of engines.
- Explain and trace fluid flows through engine (Air, Water, Fuel).
- Perform preventive maintenance on engine.
- Evaluate status of injectors and change out when required.
- Run the racks to the governor.
- Understand the operation of the governor.
- Perform other tasks related to safe and economical engine performance,

"Hands On Learning" in our clean modern air conditioned facilities - Limited Class Size.

- Receive a Service Manual, as well as other handouts.

Scheduled Classes - Advanced Registration Required.

Complete Course Cost $345.00 ea. Course - 3 day, 24 hours, 8:00 A.M. - 4:00 P.M.
Accommodation Assistance Available. Evening Classes Available upon Request.

Call Key Power Tech: (305) 637-1555 Dade ▪ (305) 523-1572 Broward

To register for next class, complete and mail to Key Power Tech with check or money order.

Name (or) Names _____

Address _____

City _____ State _____ Zip Code _____

Telephone (Home) _____ (Office) _____

Boat Make _____ Boat size _____ Engine Make _____

Your registration will be confirmed by phone upon receipt.

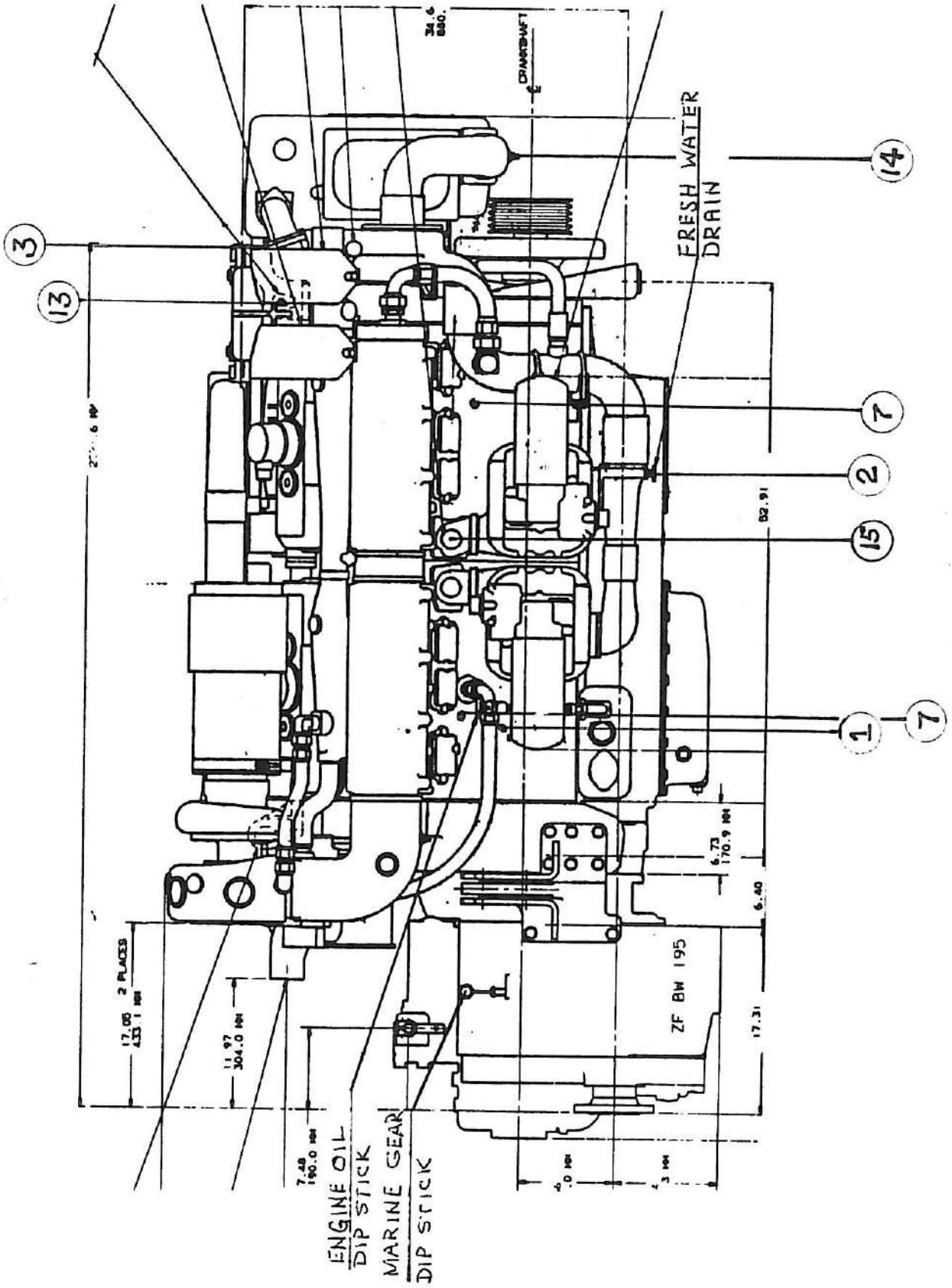

Figure 5(S)-1: Drawing "I"

Operation And Maintenance of the BK1100

All normal maintenance and operation procedures in the Detroit Diesel Corporation Operators and Maintenance Manual should be followed. Following are additional Florida Detroit Diesel-Allison, Inc. recommendations:

Excessive Idling

At any time of operation, engines should not be idled for more than 5 minutes in a "no load" condition. It is advisable to follow a procedure of being ready to cast off all dockside electrical and water lines as soon as practical after starting engines to avoid excessive idle time. Similarly, long periods of cool-down idling are not recommended.

Operating RPM

Normal or cruising rpm should be limited to 90% of rated engine rpm (2300 rpm), and the use of full throttle operation should be limited to 10 percent of operating time. Fuel load, boat hull condition, propeller size, passenger and equipment loading may not allow maximum engine rated speed (2300 rpm) under certain conditions. Under these conditions the engine speed should be limited to 90% of the obtainable engine speed for cruising. Steps must be taken to correct these conditions in order to allow the maximum engine rated speed (2300 rpm) to be obtained. Consult your local Bertram dealer for assistance.

Oil Change Intervals

Engine oil and oil filters should be changed every 150 hours of operation unless oil analysis dictates otherwise. Use lubricating oil meeting the specifications outlined in Detroit Diesel publication 7SE270 - 8808, *Lubricating Oil, Fuel Oil And Filter Recommendations*. A copy is included with this manual.

Coolants & Antifreeze

The engine cooling system must contain suitable corrosion inhibitors. Maintain the prescribed inhibitor strength level by adding inhibitor as needed after testing the coolant.

Test strips are available from many service outlets.

Should it be necessary to use antifreeze in the engine, it should meet the following specifications:

- GM 6038M Formulation
- GM 1899M Performance specifications
- Silicate not to exceed 0.15 percent maximum.

Follow the antifreeze maker's temperature chart for the proper mixture of water and Ethylene glycol.

Details can also be found in Detroit Diesel publication 7SE270 - 8808,*Coolant for Detroit Diesel Engines*. A copy is included with this manual.

Zinc Maintenance

The raw water cooling system has zinc electrodes located at strategic points to control electrolytic action. The raw water pump, heat exchanger core and fuel oil cooler are subject to electrolysis. The electrolytic action caused

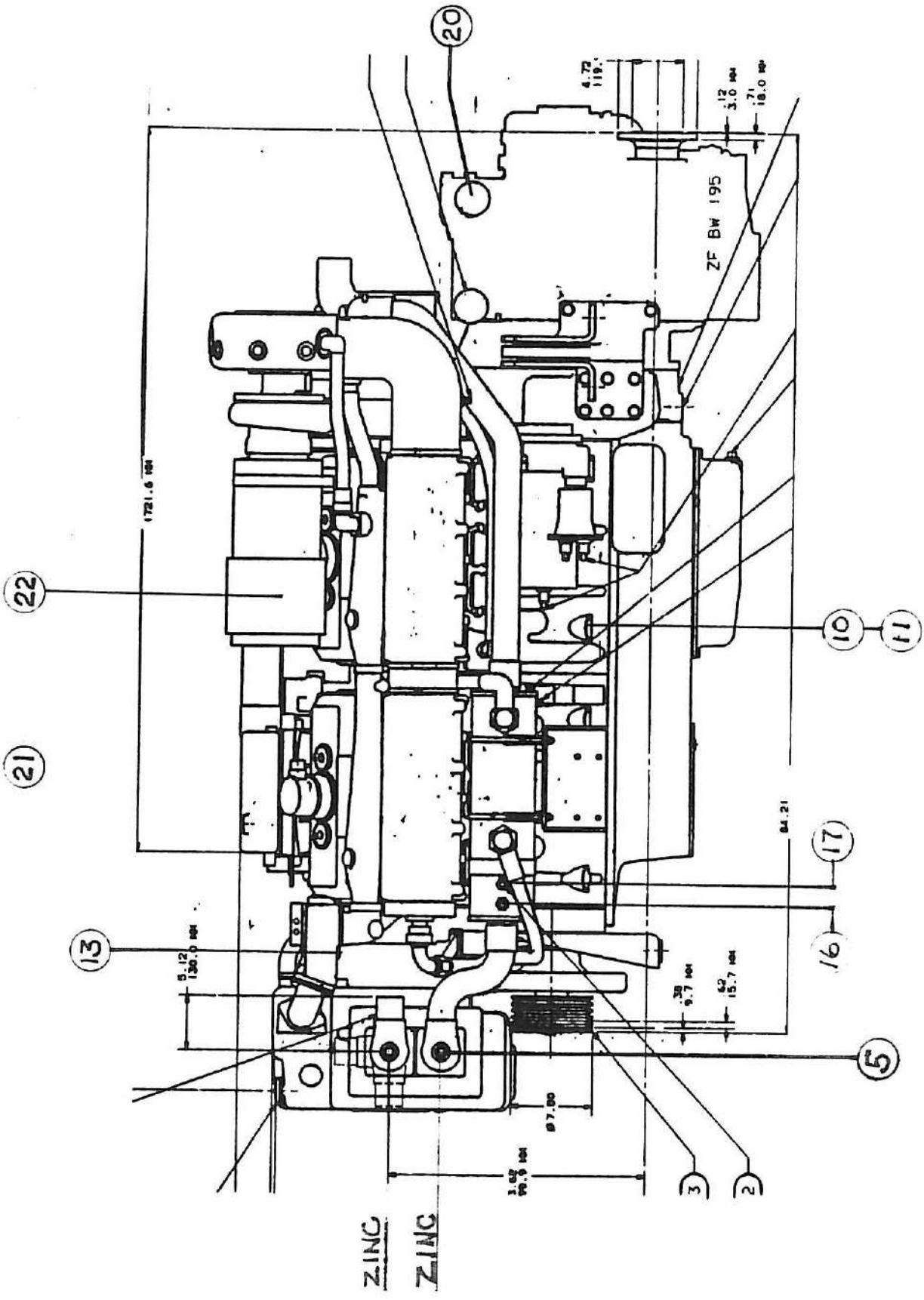

Figure 5(S)-2: Drawing "2"

by dissimilar metals in the presence of seawater attacks the zincs leaving the other metals intact.

NOTE:
Zincs should be checked every 30 days to make sure they are in good order.

The zinc anodes are located at the following points:

- Suction elbow of raw water pump
- Inlet to fuel cooler
- Outlet of fuel cooler
- Inlet to heat exchanger
- Outlet of heat exchanger

The original zinc anodes are painted red on your engine for easy identification, but may become corroded during years of use. It is wise to paint these anodes with red paint periodically.

Pressure and Temperature Metering Points

Your BK1100 engine is expected to operate in many parts of the world, some of which may be remote and distant from an authorized Detroit Diesel service station.

To aid in long distance evaluation of problems, we have installed pressure and temperature metering fittings in the engines. Our engineers can request that specific readings be taken from your vessel, and these can be compared to our test data.

Corrective action can usually be determined and action, as necessary, recommended through the nearest authorized Detroit Diesel Dealer/Distributor.

Locations of Pressure and Temperature Metering Orifices

	NAME OF POINT	LOCATION	DRAWING
1	Lube Oil Pressure	Lube Oil Distribution Block	1
2	Fresh Water Pressure	Lube Oil Cooler Housing	1
3	Fuel Pump Pressure	Inlet to the Secondary Filter	1
4	Raw Water Pump Pressure	Discharge of Pump at Pump	3&5
5	Raw Water Press. at Heat Exchanger	Raw Water Discharge of Fuel Cooler	2
6	Raw Water Pump Inlet Restriction	Air Box	3
7	Air Box Pressure	Air Box	1
8	Compressor Pressure	Air Box	1
9	Exhaust Backpressure	Each Exhaust Outlet	3
10	Crankcase Pressure	Pan Rail on Cylinder Block	2
11	Lube Oil Temperature in Pan	Front of Deep Pan	2
12	Lube Oil Temp into Eng. from Cooler	Lube Oil Cooler	--
13	Fresh Water Temp. out of Engine	Left and Right Bank Thermostat Housings	1&2
14	Fresh Water Temp. out of Heat Exch.	Fresh Water Suction Line Drain	1
15	Fresh Water Temp. into Engine	Oil Cooler Fresh Water Discharge to Engine	1
16	Fuel Temp. into Fuel Cooler	Fuel Cooler Inlet	2
17	Fuel Temp. out of Fuel Cooler	Fuel Cooler Outlet	2
18	Exhaust Temperature Out	Turbocharger Exhaust Outlet, Right and Left	3
19	Raw Water Temperature In	Inlet to the Pump	3
20	Raw Water Temperature Out	Outlet of Gear Oil Cooler	2
21	Ambient Temperature	Four (4) to Six (6) Feet from Engine	--
22	Air Inlet Temperature To Engine	Near Turbocharger inlet filter or silencer	2

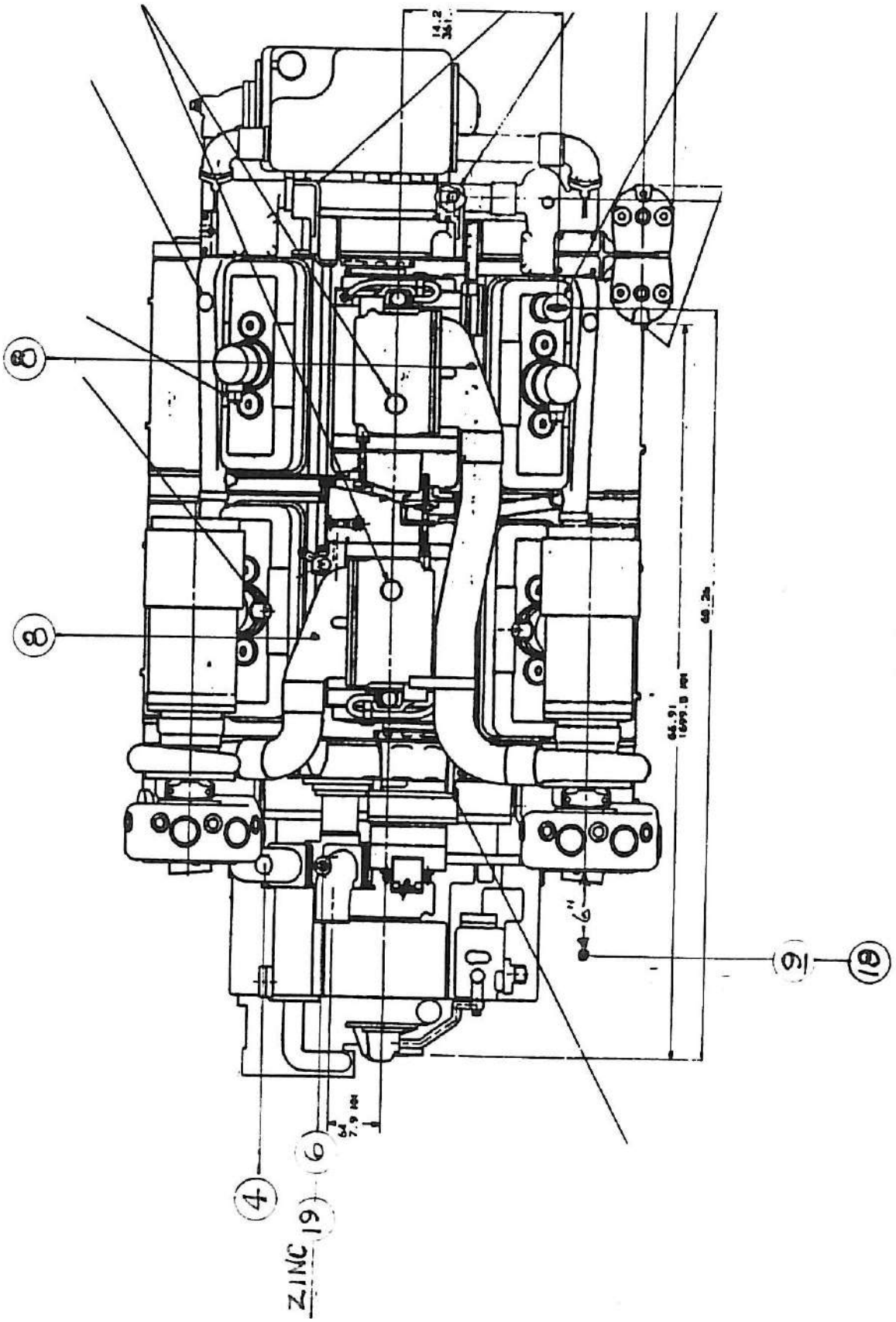

Figure 5(S)-3: Drawing "3"

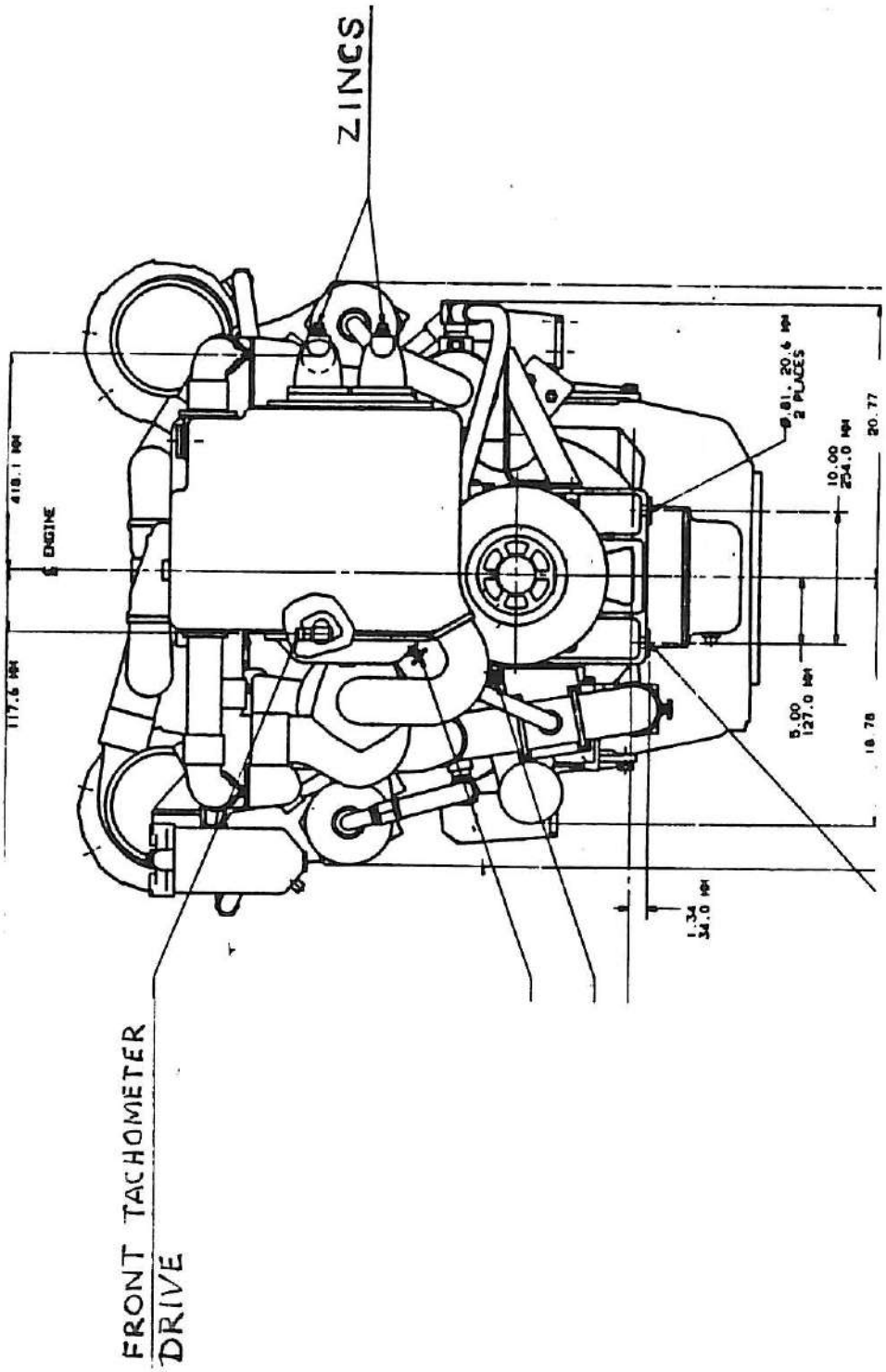

Figure 5(S)-4: Drawing "4"

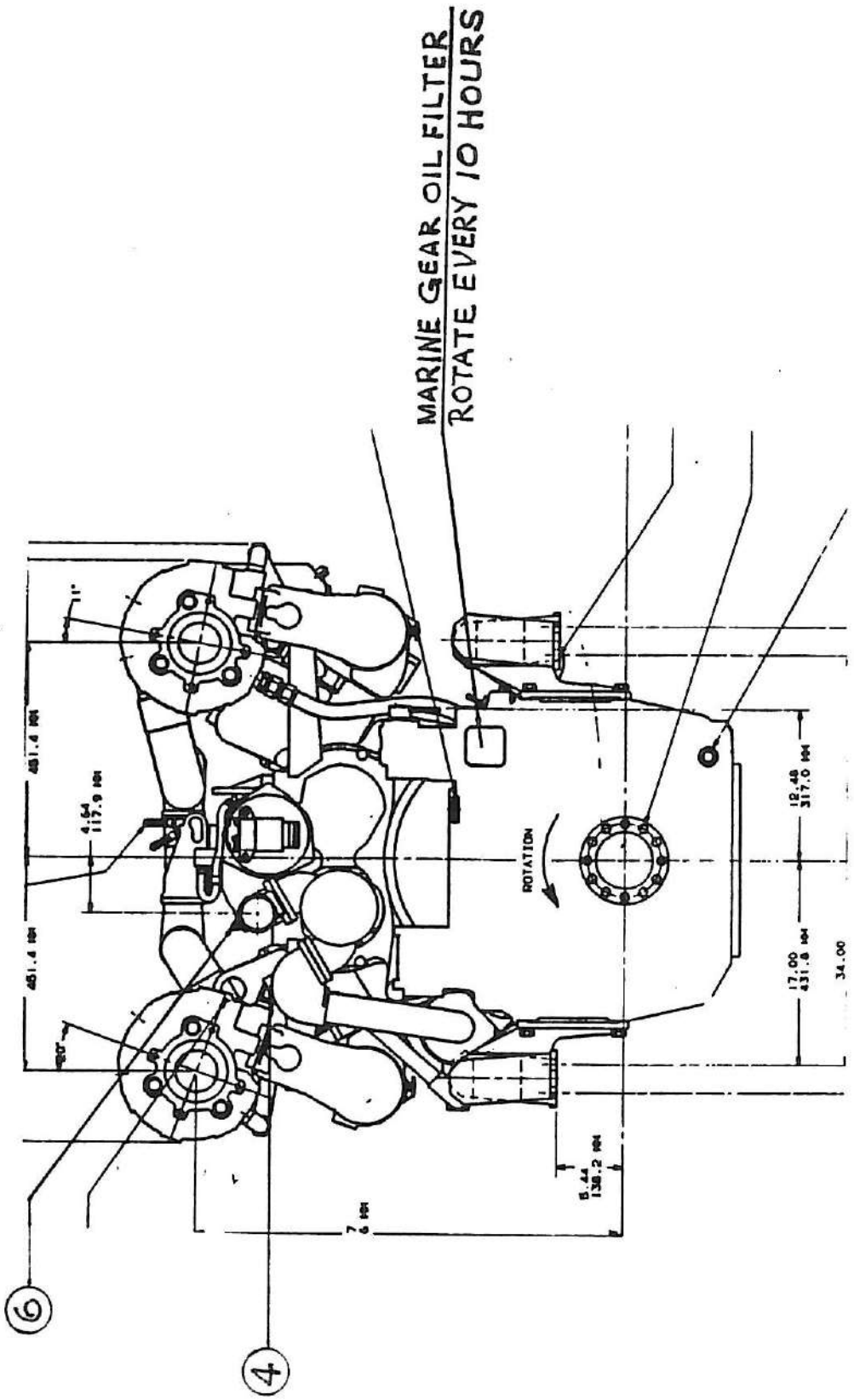

Figure 5(S)-5: Drawing "5"

Section 6

Fresh Water System

> **CAUTION**
>
> To avoid damage to your vessel, do not use lye-based clog dissolvers on the fresh water, toilet, or 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;
3) a pressure sensing device and gauge.

Fresh Water Tank

Your Bertram has a stainless steel fresh water tank amidships in the lazarette, aft of the aft fuel tank. This tank is filled through a deck fill plate on the starboard side aft (Figure 6-1).

The water tank level gauge sender is inside the tank; the gauge is in a cupboard in the galley. The gauge is powered through circuit breaker **#1M1 – WATER TANK GAUGE** on the Engine/generator Room 12Vdc Distribution Panel (Figure 10A-2).

NOTE:
You must fill the water tank using the deck fill system. You cannot fill it using the dockside water supply quick-connects on the cockpit pilasters.

Water Pump

> **CAUTION**
>
> When the tanks are empty, you must turn **OFF** the fresh water system circuit breaker.

For day-to-day operation, your vessel's fresh water pump is automatic. The pump is powered through circuit breaker **#107 – FR WATER PUMP** on the salon 120 Vac distribution panel (Figure 11-1).

The pump normally needs no priming, except before its initial use or if the fresh water tank is pumped dry. Pump and gauge are on the starboard side of the lazarette.

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

Priming the Water Pump

To prime your water pump:

1) be sure the tanks are at least partially full;
2) open the faucets;
3) set the mode selector switch to **AUTOMATIC**;
4) run the water until the air is out of the system and the faucets stop spitting;
5) close the faucets;
6) leave the mode selector switch in **AUTOMATIC** and the system should come up to operating pressure.

Expansion (Captive Air) Tank

The expansion tank holds a limited amount of fresh water under pressure. It is in the fresh water system primarily to extend the life of your fresh water pump by minimizing pump "short cycling." The tank also allows a limited use of the fresh water system if the fresh water system is not switched **ON**.

The expansion tank is in the engine/generator room just forward of the aft engine room bulkhead, on the starboard side.

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 water heater ON if water level is below the heater element. Open a hot water tap until water stops spurting to bleed air from the hot water system, then turn the water heater ON.

Water Heater Operation

The automatic water heater is on the starboard side of the engine/generator room, outboard of the starboard engine. The thermostat on this heater is preset by the manufacturer at 140° to 145°F, which Bertram recommends as maximum. The water heater is powered by 240Vac from circuit breaker **#201 – WATER HEATER** on the Salon 120/240Vac Distribution Panel (Figure 11-1) which is supplied either by the ac generators or by shore power.

Filling the Water Heater

To fill the water heater for the first time or after storage or repairs, follow these steps:

1) be sure 240Vac circuit breaker **#201 – WATER HEATER** is set to **OFF**;
2) be sure the drain plug is in the water heater inlet tee on the lower front of the heater;
3) open the cold water supply to the water heater;

NOTE:
The cold water supply valve MUST be open whenever the water heater is in use.

4) open a hot water faucet;
5) fill the water heater until water runs out of the open faucet;
6) allow all the trapped air in the heater tank and pipes to escape before closing the faucet;
7) set 240Vac circuit breaker **#201 – WATER HEATER** to **ON**.

Showers

Your Bertram's showers have mixing controls for adjusting the water temperature, plus hand held shower heads equipped with push-button cut-offs that retain the water temperature setting.

Your shipboard showers can either conserve or waste fresh water, depending on how

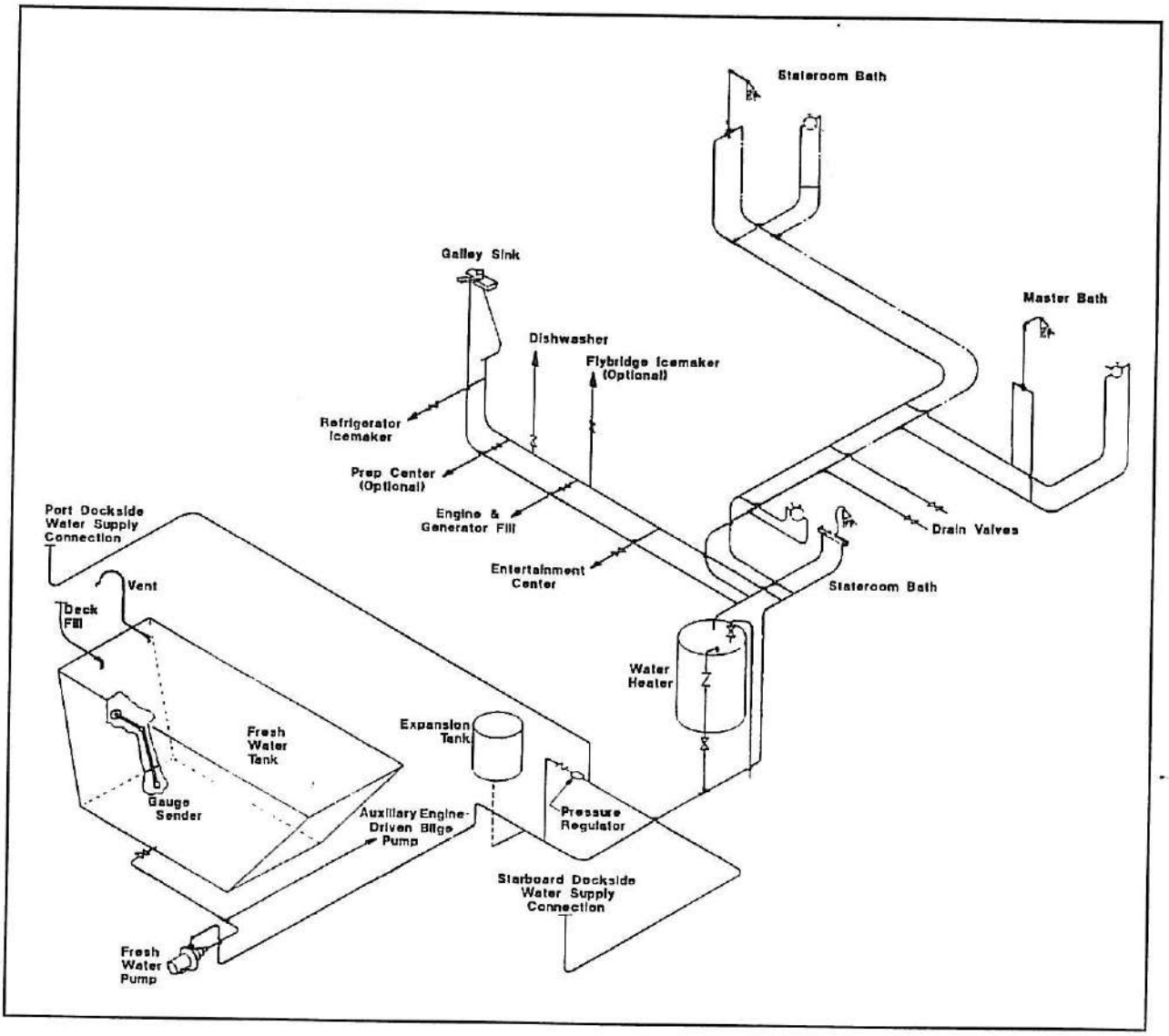

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Figure 6-1: Fresh Water System

you and your guests use them. Unless you equip your vessel with a desalinator (fresh water maker), you will probably need to conserve fresh water on a long trip. We suggest you and your guests take "sailor's showers."

A sailor's shower means that after adjusting the water temperature, you wet yourself thoroughly. Then you turn the shower off by using the shower head push-button, soap up, and then turn the shower back on to rinse off.

Shower Sump Pump

The shower sump is located in the bilge below the cabins. It is accessible through a hatch in the companionway sole. The shower sump has its own submersible pump, which is equipped with an automatic float switch and an alarm system.

The sump pump discharges shower water overboard, and is connected to 32Vdc current through circuit breaker **#3S9 – SUMP PUMP** on the Companionway 32Vdc Distribution Panel under the companionway stairs from the salon to the staterooms (Figure 10B-4).

This circuit breaker must be in the **ON** position if you use the showers or the air conditioning. This is because 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 shower sump has a control panel labeled Sump Tank. This panel is in the companionway, under the stairs, next to the companionway distribution panels. The Sump Tank panel has an audio alarm and a red **OVERFLOW** indicator light. This panel has a toggle switch to silence the audio alarm and another to allow manual operation of the sump pump if the automatic float switch fails.

You should regularly inspect the filter screen between the shower sump pump and the float switch, and clean it as necessary.

Lavatory Sinks, Galley Sink and Garbage Disposal

The galley and lavatory sinks get cold water from the fresh water tank and hot water from the water heater (Figure 6-1). All sinks drain overboard through hull-side fittings (Figure 6-2).

Garbage Disposal

The galley sink has a garbage disposal powered through circuit breaker **#162 – DISPOSAL/COMPACTOR** on the Galley 120/240Vac Distribution Panel (Figure 11-2). This circuit breaker must be **ON** and the cold water must be running for the garbage disposal to operate. Waste from the disposal goes into the galley sink drain and then overboard through the galley sink through-hull fitting.

Engine / Generator Cooling Water

The engine/generator room is equipped with a fresh water outlet located on the port side of the walkway overhead between the engines. The valve is in the water line, forward of the outlet, above the webframe step. This system allows you to easily add water to the closed fresh water cooling system on the main engines and the ac generators.

Dockside Water Supply

CAUTION

When leaving your vessel unattended, you should disconnect the dockside fresh water hose.

There are two dockside quick-disconnect fresh water hose connections, one on each side of the cockpit. They are behind hinged doors on the pilasters, with the shoreside 120/240Vac, cable television and telephone connections.

This convenience feature 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 onboard system.

NOTE:
You cannot use this system to fill the water tank. Instead, you must use the water tank deck fill plate.

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

Section 7

Bilge and Sump Pump System

NOTE:
The factory-installed bilge pumps on your Bertram are intended for control of spray, rainwater and normal accumulation of water due to seepage and spillage. They are not intended for damage control or other emergency use.

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 Diesel fuel oil or gasoline as well as any bilge pump discharge. Violators are subject to a penalty of $5,000.00.

CAUTION

To avoid damage to your vessel, do not use lye-based clog dissolvers on the fresh water, toilet or bilge pump systems.

The bilges on your Bertram are divided into three sections, and are watertight up to the hull chine. As shown on Figure 7-1, there are three independent bilge pump systems and a sump pump system. The shower sump and the three bilge pump systems each consist of a submersible pump and an automatic pump switch. The engine/generator room sump has a non-submersible pump and an automatic pump switch. To avoid accidental shutdown, the bilge pump control switches (Figure 2-2) and the engine/generator room sump switch (Figure 10A-2) have no **OFF** position.

Except for the shower sump pump, each pump is connected directly to your vessel's 32Vdc system through fuses on the Engine/generator Room **32VOLT BATTERY** Distribution Panel (Figure 10B-1).

Operation of the **MAN-AUTO** switch for the three bilge pumps is covered in ***Section 2*** under ***Bilge Pump Switches***.

Engine/generator room bilge water from the propeller shaft stuffing boxes is pumped overboard by the engine/generator room sump pump. It has no switch, and is always in the **AUTOMATIC** mode.

The shower sump and sump pump system pumps shower runoff water overboard, and is always in the **AUTOMATIC** mode.

Forward Bilge Pump

The forward bilge pump and bilge water level sensing switch are in the bilge under the companionway. They are accessible through a hatch in the companionway sole.

Power for this system is through fuse **#3B4 – FWD BILGE PUMP**, on the Engine/Generator Room Stbd 32Volt Battery Distribution Panel.

Shower Sump Pump

The shower sump, switch and sump pump are below the forward cabin. They are accessible through a hatch in the companionway sole.

Power for this system is through circuit breaker **#3S9 – SUMP PUMP** on the Companionway 32Vdc Distribution Panel.

Midships Bilge Pump

The midships bilge pump and switch are in the keel sump forward of the aft fuel tank. They are accessible from the engine room.

Power for this system is through fuse **#3B1 – MIDSHIPS BILGE PUMP** on the Engine/generator Room Stbd 32Volt Battery Distribution Panel.

Engine/Generator Room Sump Pump

The engine/generator room sump pump and switch are in the keel sump (near the midships bilge pump system) forward of the aft fuel tank. They are accessible from the engine/generator room.

Power for this system is through circuit breaker **#1M2 – ENG RM SUMP** on the Engine/generator Room 12Vdc Battery Distribution Panel.

Aft Bilge Pump

The aft bilge pump and switch are near the transom in the aft bilge area, and are accessible from the cockpit.

Power for this system is through fuse **#3B3 – AFT BILGE PUMP** on the Engine/Generator Room **STBD 32VOLT BATTERY** Distribution Panel.

Bilge and Sump Pump Switches

None of the three electric bilge pumps can be switched **OFF** from either the flybridge control station instrument console or from the distribution panels.

The bilge pump control is wired so the instrument panel switches can select between two operating modes: **MAN** (manual, running continuously) or **AUTO** (automatic, controlled by the bilge pump sensor and switch).

If the water in a bilge rises, and if the bilge pump's switch is in the **AUTO** mode, the bilge pump will be activated. This arrangement ensures that there will be a positive shutdown signal to the pump when the bilge is nearly dry.

The sump pump and its switch are in the engine/generator room sump. They are always in **AUTOMATIC** mode.

Bilge and Sump Pump Indicators

The bilge and sump pump indicator block is directly beneath the tachometer in the center of your instrument panel.

Pump Operation Indicators

On the right side of the bilge pump indicator block is a series of lights marked **PUMPS**. Three lights are amber, and one is red. Whenever the forward bilge pump, engine/generator room sump pump, or aft bilge pump is in operation, the corresponding *amber* light (**FWD, MID** or **AFT**) will illuminate.

If the *red* **MID** light illuminates, it indicates the engine/generator room bilge pump is operating; this means the engine/generator room sump pump is unable to control the level of water in the engine/generator room, and the higher-mounted bilge pump is needed as well. You should determine the reason for the in-

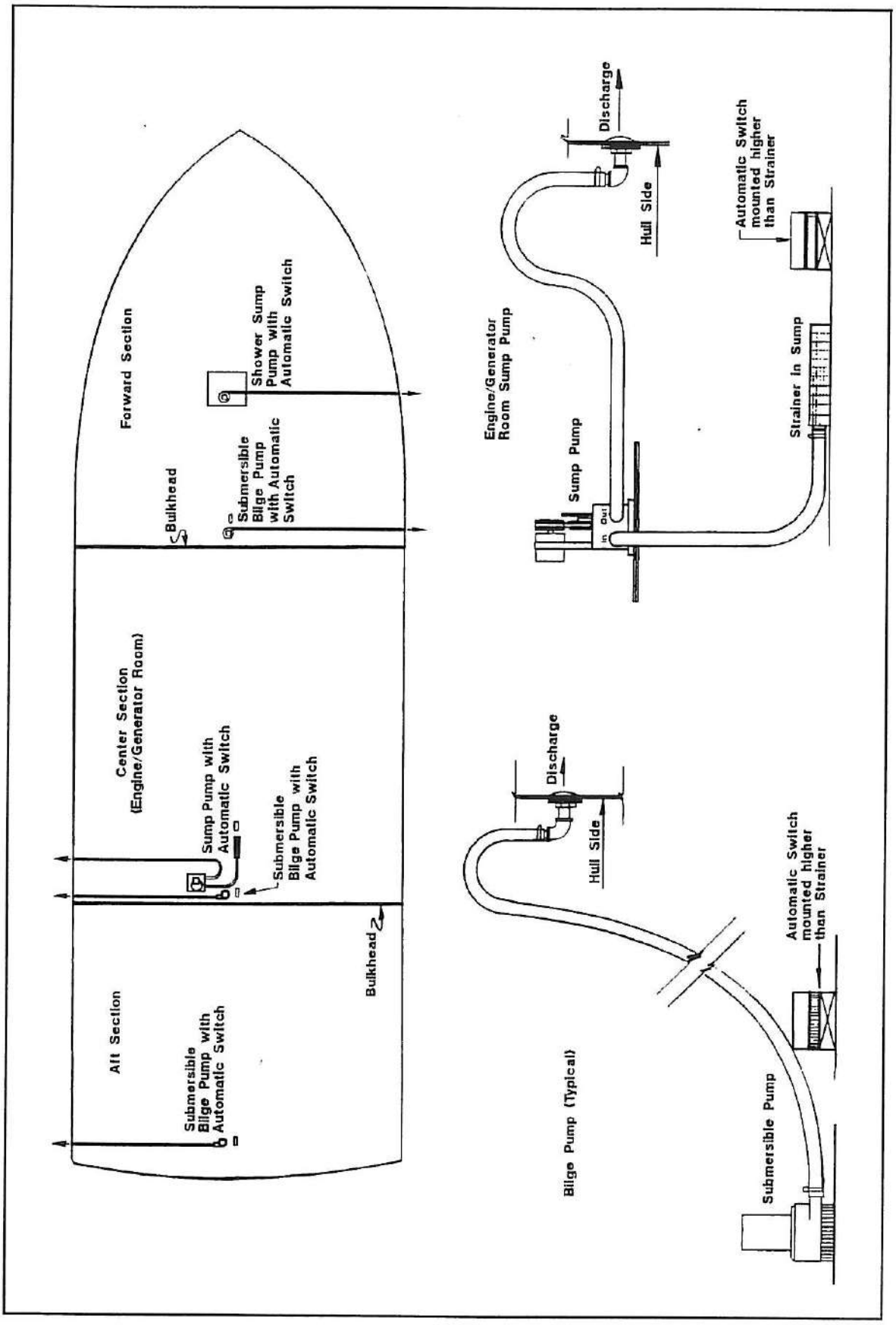

Figure 7-1: Bilge and Sump Pump System

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

creased water level immediately, and correct the problem as soon as possible.

Bilge Flood Indicators

There are two Bilge Flood Indicators:

1) on flybridge control panel, on the left side of the **BILGE** indicator block (directly beneath the dual tachometer) is a series of lights marked **FLOOD**;
2) on the salon Alarm Panel, located on the starboard side of the galley area above the stove (on the back of the rod locker) is a series of lights marked **BILGE FLOOD**.

The three red lights on each panel are marked **FWD**, **MIDSHIP** and **AFT**. They are connected to sensors mounted approximately three inches above the bottom in the forward bilge, engine/generator room bilge, and aft bilge.

The lights illuminate when water in the bilges rises to that level, and the alarm horn sounds at the same time. When a bilge flood alarm sounds and the light illuminates, you should determine the reason for the increased water level immediately, and correct the problem as soon as possible.

Bilge and Sump Pump Maintenance

Please review maintenance information on bilge pumps in ***Part III, Section 4***, under ***Bilge Pump Systems***.

Cleaning the Bilge and Sump Pump Strainers

Each bilge and sump pump has a strainer that must be kept clean and free of debris. For suggested maintenance intervals, see ***Part III, Section 1***.

Engine Driven Auxiliary Bilge Pump (Optional)

An optional auxiliary engine-driven bilge pump is available for your Bertram. This pump is belt driven directly from the starboard engine, and is engaged by a manual clutch. The pump is mounted on the aft side of the forward engine/generator room webframe just forward of the starboard engine, as shown in Figure 7-2.

The pump manifold is near the pump, below the webframe step. In each bilge compartment, there is a suction pickup on a hose connected to the pump manifold. Each pickup is protected from plugging by a strainer.

Auxiliary Bilge Pump Operation

The four manifold valves should normally be closed; when the pump is used, only the valve for the flooded bilge should be open. If other valves to dry bilges are open, the pump will suck air and will not pump the flooded bilge.

The pump should never be used when the bilges are dry, and must never run for more than 30 seconds after a bilge is pumped dry. If the pump runs dry, the rubber impeller can be damaged.

To use the auxiliary engine-driven bilge pump you must:

1) open the valve to the bilge compartment you wish to pump (and be sure the other

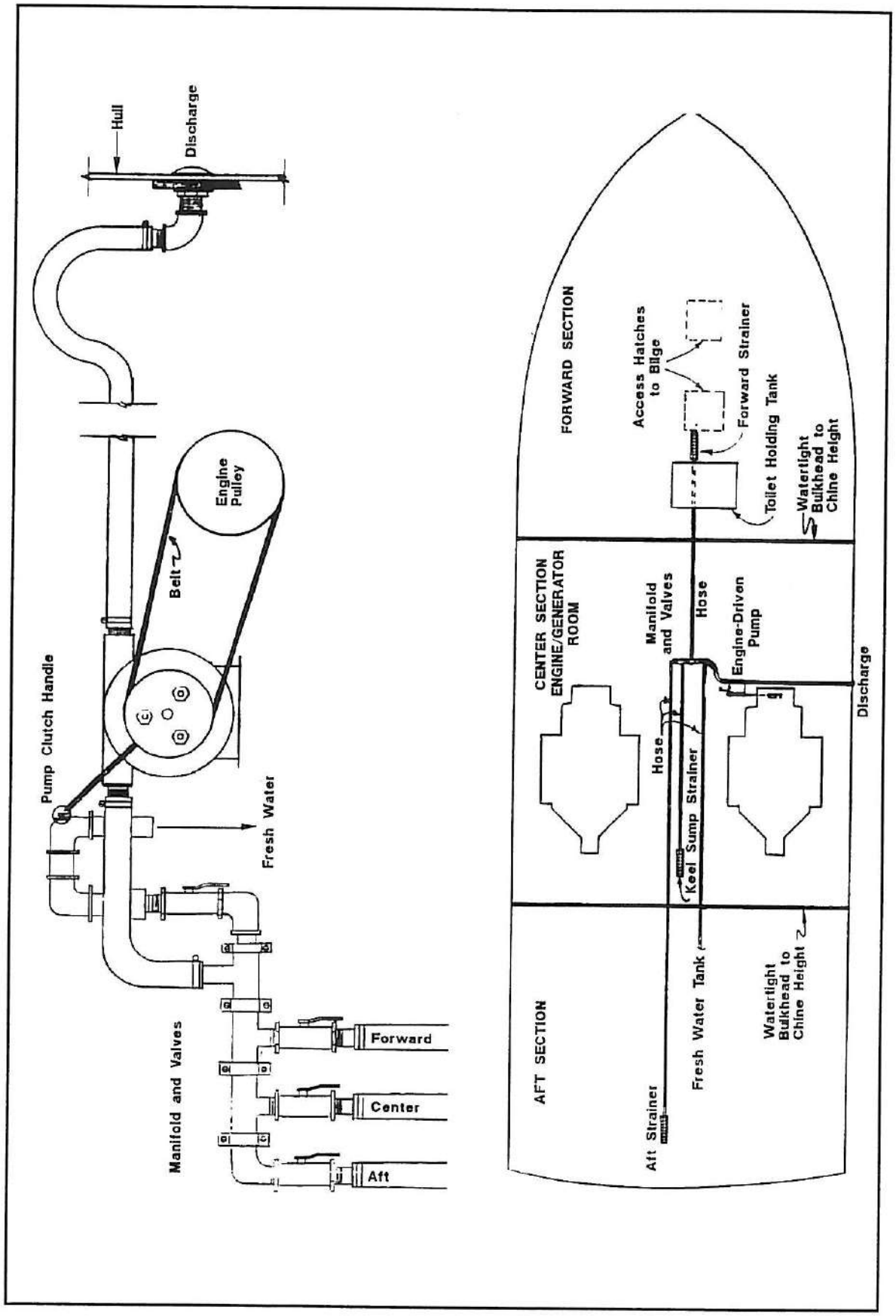

Figure 7-2: Auxiliary Engine-Driven Bilge Pump System

valves are closed to avoid the loss of suction);
2) engage the clutch by pulling it toward the vessel's centerline, as shown in Figure 7-2;
3) pump the bilge(s) dry;
4) disengage the clutch by pushing the lever away from the vessel's centerline;
5) be sure all the manifold valves are closed.

NOTE:
For maximum pump life:
1) Do not operate the pump dry;
2) do not operate at engine speeds exceeding 1,400 rpm;
3) operate the pump periodically from the fresh water system to check operation and keep the rubber impeller from taking a "set" or seizing.

Exercising the Auxiliary Bilge Pump

The auxiliary engine-driven bilge pump has a rubber impeller. You must exercise the pump periodically (Bertram recommends once a month) to check system operation and to prevent the rubber impeller from seizing or taking a "set".

To make it easy for you to exercise the pump, it is connected through the manifold to the fresh water system. You need to pump only a few gallons of fresh water overboard to exercise the pump and test its operation.

To exercise the pump, follow the directions in ***Part III, Section 1*** under ***Monthly Maintenance.***

Section 8

Ventilation and Air Conditioning Systems

Ventilation Systems

Your Bertram has both natural air and forced air ventilation systems. Natural air ventilation for the staterooms uses the foredeck hatch(es) to bring in fresh air. Natural air is delivered to and heated air removed from the engine/generator room via the hullside vents on both sides of the hull. These vents are equipped with built-in water traps.

Engine/Generator Room Ventilation

The natural air ventilation system (Figure 8-1) is designed so that when your vessel moves, fresh air is taken in through the hullside vents on the port and starboard sides and is ducted down to the engine/generator room. Exhaust air ducting leads from the generator area to the aft end of the engine/generator room. Heated air is vented from there to the hullside exhaust vents.

The 32Vdc electric power for these blowers is connected to the blower circuits through circuit breaker **#3D6, ENG ROOM AUTO BLOWERS,** on the Salon 32Vdc Distribution Panel (Figure 10B-2).

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 forward edge of the hatch and the other set midway from the forward 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.

This hatch also serves as a means of exiting the stateroom area if necessary.

Toilet (Head) and Shower Ventilation

To keep a comfortable climate in the heads on your Bertram, each head has two separate ventilation systems:

1) Ducts vent some of the interior conditioned air into the head and shower areas.
2) In each head, there is a 32Vdc exhaust blower and ducting. This blower is activated by a bulkhead-mounted **ON-OFF** switch.

The exhaust blower systems lower the humidity level in the head and shower areas by drawing moist air from the showers out of the head areas and exhausting it overboard.

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

The 32Vdc electric power for these blowers is connected to the blower circuits through circuit breaker **#3S5, BLOWER PORT**; **#3S6, BLOWER STARBOARD**; and **#3S7, BLOWER FORWARD**. These circuit breakers are located on the Companionway 32Vdc Distribution Panel (Figure 10B-4).

Heating and Air Conditioning System

The components in your onboard, reverse-cycle heat pump air conditioning system were designed and built for saltwater marine use. Your system employs four seawater-cooled, reverse-cycle condensers, and these units provide either heated or cooled air, as required for your comfort.

Condensing Units

There are four compressor/condensers located below decks in the engine/generator room, outboard of the port engine (Figure 8-2).

Stateroom compressor/condenser units are powered through individual circuit breakers on the Companionway 120/240Vac Distribution Panel (Figure 11-3):

- owner's stateroom – circuit breaker **#231 – AIR COND OWNERS**;
- starboard stateroom – circuit breaker **#232 – AIR COND GUEST**.
- forward cabin – circuit breaker **#233 – AIR COND FWD**.

The compressor/condenser unit for the salon and galley area is powered through circuit breaker **#211 – AIR COND SALON**, on the Galley 120/240Vac Distribution Panel.

Air Handling Units

There are four air handling units that work with the compressor/condenser units.

One air handling unit cools and heats each stateroom, and the fourth air handling unit cools and heats the salon and galley areas.

Condensate from the air handling units drains into the shower sump, from which it is pumped overboard.

Heating and Air Conditioning SMX Control

Your vessel's air conditioning system has four SMX microprocessor-based controls, one for each of its cooling/heating units. One SMX controller is located in each stateroom, and the fourth is located in the salon on the aft end of the rod locker.

The primary purpose of these state-of-the-art controls is to give you the maximum benefit from your vessel's air conditioning system. They also monitor the operation and interaction of all system components so effectively that component life is substantially extended.

Among its other features, each SMX control has a memory that stores all settings during any ac power interruption; it returns to those settings when power is restored (one second later, or a year later). Since ac power interruptions are a fact of marine life, as when switching over from shore power to generator power or the reverse, this feature eliminates constant resetting of your air conditioning controls.

In addition to the memory feature, the SMX controllers also have a compressor restart pressure-equalization feature. Air conditioning

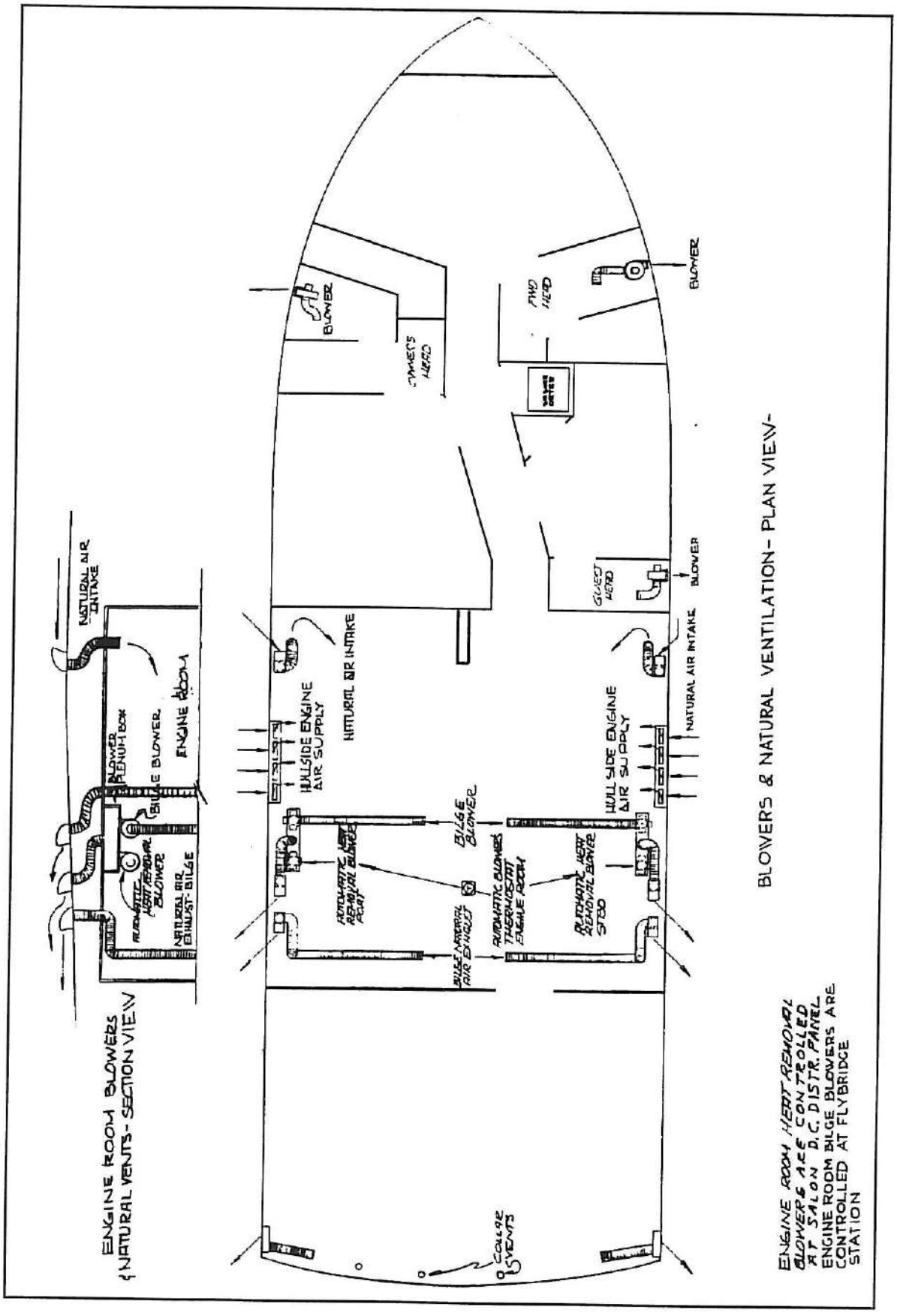

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Figure 8-1: Natural and Forced Air Ventilation System

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

compressors may be damaged if they are re-started before systems pressures are allowed to equalize, since this can result in a "compressor stall." Compressor stalls can be harmful to wiring, circuit breakers and switchgear, and they are likely to result in inconvenient trips ashore to find and reset the dockside circuit breakers.

Built into the SMX controller programming is a 2-second subroutine that equalizes system pressure every time a compressor is started. This prevents compressor stall and thus avoids possible system damage.

The SMX controllers also feature compressor restart sequencing. If the compressors are shut down by a power interruption, they are restarted one at a time, with a programmed ten second delay between restarts. This delay eliminates the heavy load of two compressors starting simultaneously.

To fully understand and 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* (included in 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.

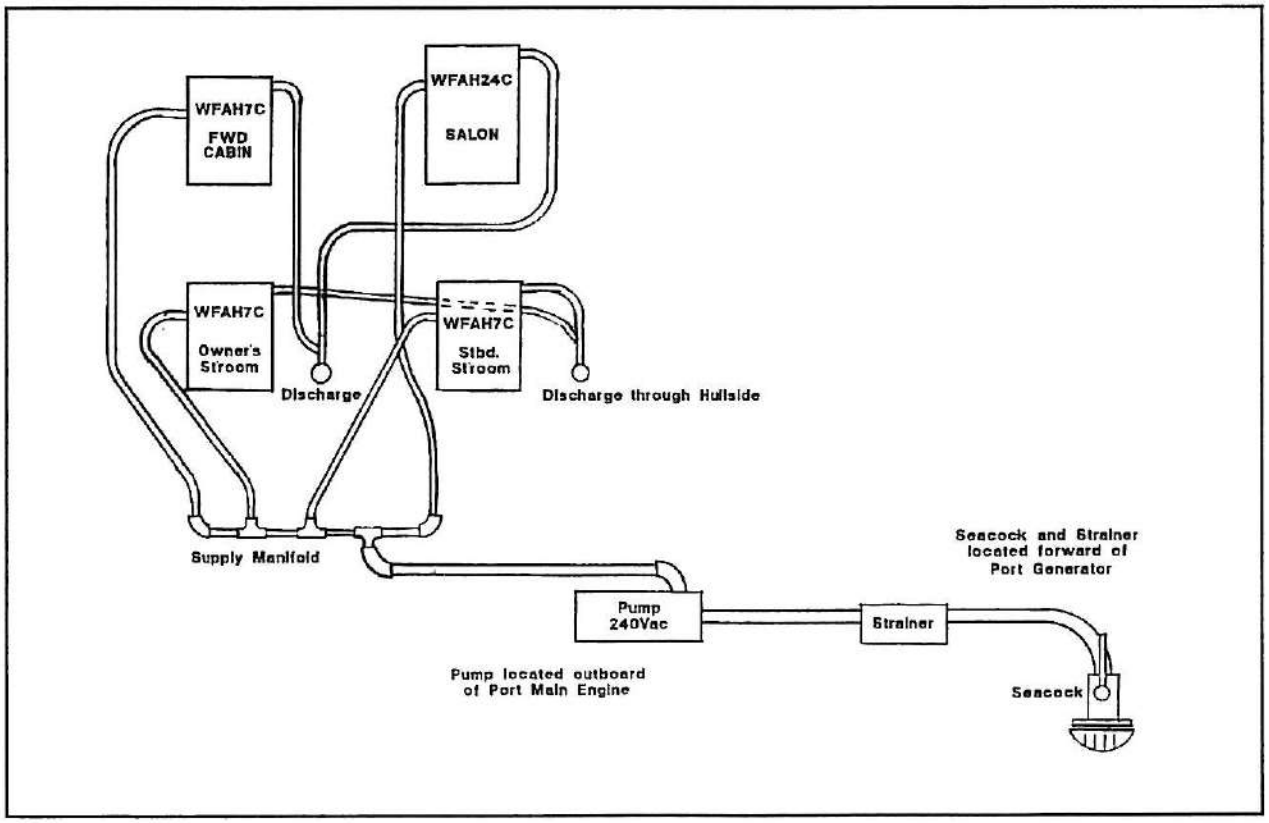

Figure 8-2: Air Conditioning Seawater System

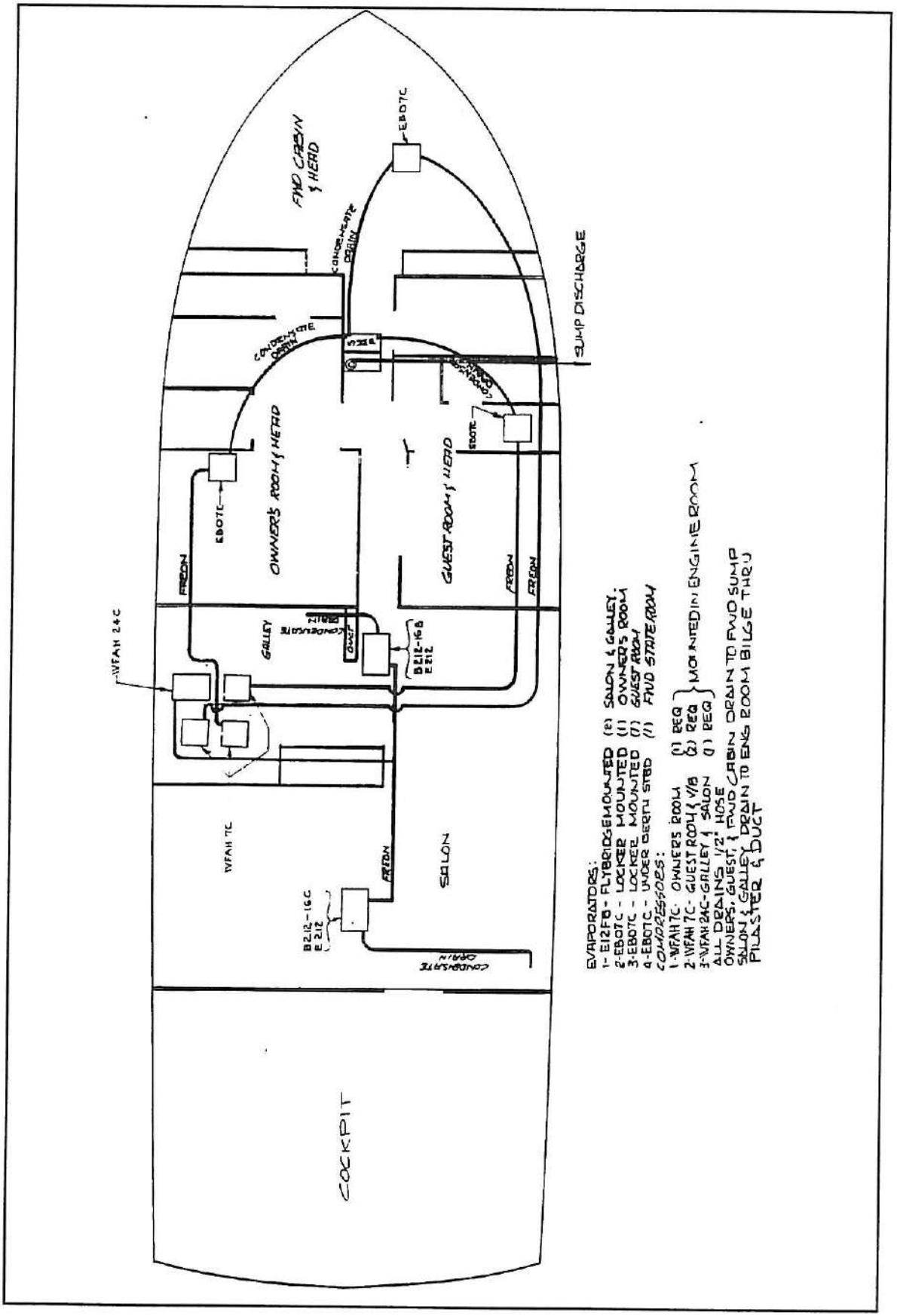

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Figure 8-3: A/C Freon Lines and Condensate Drains

NOTE:
It is VERY 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.

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 shutdown.*

The cooling seawater supply system consists of a seacock, a strainer, and a pump.The seacock and strainer are located forward of the port generator, outboard of the generator seacock and strainer.

Cooling seawater is drawn up through a through-hull fitting and the strainer. From the strainer, the seawater goes to the pump, then through one of the air conditioning compressors and back overboard. The seawater pump cycles with the compressors.

The air conditioning seacock and strainer are located forward of the port generator, outboard of the generator seacock/strainer.

NOTE:
When starting the air conditioning system, always visually check that there is a seawater discharge from the hullside fitting (on the port side) to ensure that the pump is operating properly.