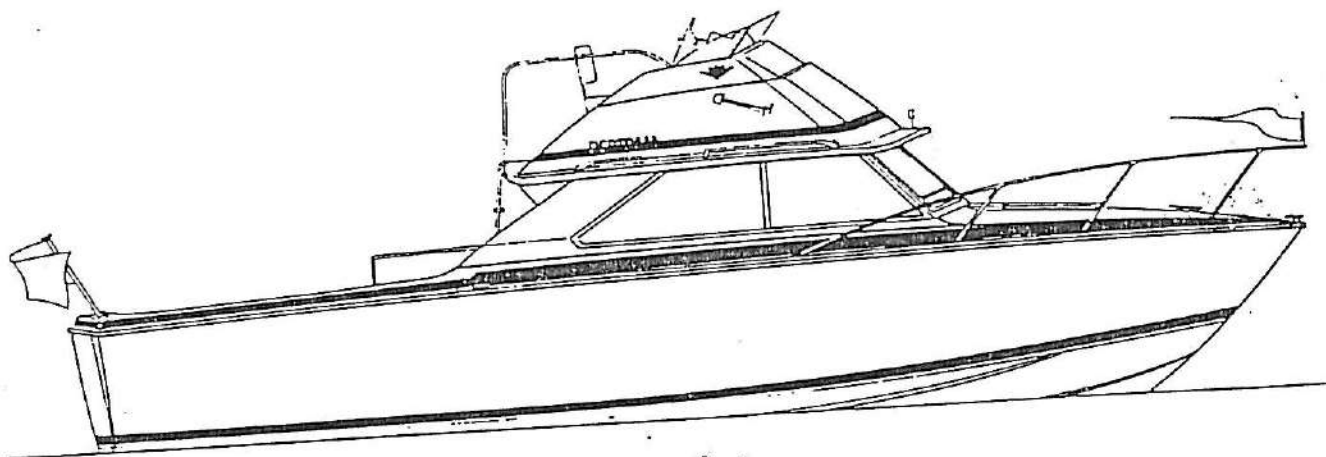


*clow 2/21*  
*f-l*

# BERTRAM



*AD orig.*  
*Suggest re-writing manual*  
*into the 280 format*  
**MODEL 285** *6/10*

## OPERATOR'S MANUAL

P/N 18681  
ISSUE 2508C

| REVISION AND EFFECTIVITY PAGE |                         |                                                  |
|-------------------------------|-------------------------|--------------------------------------------------|
| REVISION                      | EFFECTIVITY HULL NUMBER | CHANGES                                          |
| O                             | 501 AND SUBSEQUENT      | ORIGINAL ISSUE                                   |
| A                             | January 1987            | GENERAL CHANGES                                  |
| B                             | July 1988               | GENERAL UPDATE                                   |
| C                             |                         | <div> <div></div> <div></div> <div></div> </div> |

JAC

## A WORD OF WELCOME

We are pleased that you have chosen a Bertram, and know that its unique design will give you outstanding performance and many years of boating pleasure. Your Bertram is built with fine, modern materials and is manufactured to Bertram's demanding quality standards. It comes to you as a factory-tested and inspected boat.

As durable as its construction is, your Bertram will benefit by reasonable care. And, as is always true with things mechanical, maintenance, adjustments, or repairs may be required from time-to-time for certain components. Thus, this Operator's Manual, containing a wealth of detailed information, has been prepared for your particular model as a guide for keeping it in good operating condition.

To fully enjoy your Bertram, you should understand it completely. To this end, we suggest that you read this manual thoroughly. If any points arise that you do not completely understand, your Bertram dealer will be glad to assist you.

When your boat requires service, contact your Bertram dealer. He has been factory trained to help you and our factory service representatives are available to help him if need be.

We wish you many years of pleasurable yachting on your new Bertram

## PREFACE

This manual is divided into sections. Except for Section A, The Table of Contents, and Section B, Vessel Technical Data, each section covers a specific system or systems. Included in this manual are the recommended preventative maintenance schedules.

In addition to this manual, you will find the following two packets of information:

1. The 12 Vdc and the 120 Vac systems wiring diagrams and the basic mechanical drawings.
2. The users manuals and operating instructions supplied by the manufacturers of the major mechanical, electrical, and comfort equipment components.

These drawings and manuals will not only help you to get a better understanding of the equipment and systems on your Bertram and how they operate, but they will be invaluable to the technicians that service your Bertram.

Each appliance and major piece of on-board equipment is covered by manufacturers' operating and maintenance manuals. However, some on-board systems and equipment need scheduled preventative maintenance which is not discussed in these manuals. This scheduled maintenance is discussed in Section G, "MAINTENANCE" of this manual. Section G also includes recommended troubleshooting techniques, Bertram recommended storage and refloating procedures, and other special maintenance procedures.



## HISTORY

The Bertram Yacht Company is widely accepted through out the boating fraternity as the number one pleasure boat manufacturer in the world. The history of Bertram Yacht dates back to 1960, although the inspiration for the Bertram yacht line actually started in July of 1958 when Richard Bertram, a highly successful Miami yacht broker, watched a 24-foot tender designed by C. Raymond Hunt ferrying crews and sails around the harbor during the trials for the America's Cup Race.

Watching that performance, Richard Bertram was very impressed with the smooth ride, the ease of maneuvering, and the stability that this 24-foot "Hunter" demonstrated in the heavy seas. This radical design was a full-length, deep "V" hull and it was a major break through in boat design. Richard Bertram recognized this and commissioned Hunt to design and build a similarly shaped hull design in the form of a wooden 31-footer which was 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. With Richard 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 Bertram put his resources and reputation behind the newly formed Bertram Yacht Company.

The new hull design was just the beginning of a long list of innovative designs and materials. 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 to build his new boat from fiber reinforced plastic (FRP) a relatively new material to the pleasure boating industry. This first model 31-footer was the sensation of the 1961 New York National Boat Show. A year's production was sold out in advance.

With manufacturing of the 31-footer well under way and several additional models on the drawing boards, the 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 the Miami International Airport.

In 1968, the California based Whittaker Corporation, with interests in metals, chemicals, science, technology, and recreational products, 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 their interest in Bertram Yacht along with other marine related manufacturing operations. Today, Bertram Yacht is a division of Bertram-Trojan, Inc. and manufactures models from 28 to 54 feet in length.

Since 1961, most of Bertram's boat construction experience has been in making the highest quality recreational power boats. However, Bertram has also built a variety of commercial and military power boats for many foreign and domestic 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. The results of the continuing design research, material applications research, and construction methods research have been applied to Bertram's primary products.

One of the engineering and design areas where this basically conservative engineering oriented company has led the way was as one of the early users of balsa core construction in decks and superstructures beginning in 1965. Bertram was also one of the first in this industry to use aluminum decks and superstructure on fiberglass boats. This was used on the 58-foot yacht and on commercial vessels. Bertram was also first in the design and use of fiberglass fuel tanks and was also the first production boat company to make its own aluminum window frames.



## FOREWORD

This manual is not intended to replace years of boating experience or even one of the several excellent safe boating classes taught by the U. S. Coast Guard Auxiliary and the U. S. Power Squadron. We included some material relative to certain aspects of safe boating that a careful boat operator should be aware of.

## WARNINGS, CAUTIONS, AND NOTES

Throughout this manual you will find special information in the form of warnings, cautions, and notes that 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. The mere existence of a warning or a caution note within a box of asterisks will not by itself eliminate the dangers. Your close attention to the instructions, plus basic "good seamanship" are the major accident prevention measures.

```
*****
*
*                               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:

Notes are in boldface type and are intended to stress important pieces of information.

We wish you many years of pleasurable yachting on your new Bertram.

### GETTING ACQUAINTED WITH YOUR BERTRAM MODEL 285 FLYBRIDGE CRUISER

#### THE COCKPIT

The three hatches in the cockpit sole at the stern provide access to the aft bilge. The aft bilge contains the rudder post, stuffing boxes, and the components of the hydraulic steering system. The optional aft bilge pump and its automatic float switch and the bilge flood alarm switch (mounted higher than the bilge pump) are accessible through the center hatch, as is the fuel gauge sender, fuel supply fittings, and the trim tab pump. A port and starboard hatch aft of the motor boxes provide access to the propeller shaft log stuffing boxes and their sprayshields. On each side of the cockpit is a storage space with a sliding cover. The shoreline is permanently connected in the port side storage locker.

#### THE ENGINE COMPARTMENT

Over each engine is a hinged hatch for access to the engines and the spaces outboard of each engine. In addition to the hatch over each engine, an access hatch is provided between the engines.

The center hatch provides access to the battery disconnect switches and fuse panel mounted on the forward engine-compartment bulkhead. The optional air conditioning system sea-water cooled condenser is in the engine-compartment on the port side. The A/C seacock, strainer and pump are just aft of the forward engine-compartment bulkhead.

The engine-compartment sump pump, its automatic float switch, and the midship bilge flood alarm switch are located at the forward end of the engine-compartment. There are also port and starboard fuel valves to control the fuel supply to their respective engines. The seacocks and seawater strainers for each engine and the garboard hull drain are in the aft end of the engine-compartment.

The fixed Halon fire extinguisher cylinder is mounted on the aft engine-compartment bulkhead. The supply seacock for the toilet system is located under the forward end of the starboard engine. The head exhaust blower is mounted on the bulkhead forward of the port engine. Outboard of the engines are the port and starboard exhaust blowers which ventilate the bilge area. The port and starboard batteries are located outboard of the port engine. They may be relocated to provide better weight distribution, depending on the options selected. The optional converter (battery charger) is located outboard of the starboard engine. The toilet holding tank is located outboard of the port engine. The "Y" control valve that allows you to select

where the toilet empties, (the holding tank or directly overboard) and the manual overboard discharge pump are forward of the holding tank and accessible through the port engine hatch. For additional information see "Toilets" in the Mechanical Section of this manual.

### THE FLYBRIDGE CONTROL STATION

The flybridge control station has a helm seat adjustable for height facing the control console with its built-in footrest. The engine gauge panel, twin tachometers, and the system control switches are mounted on the flybridge control console forward of the helm. The throttles and gear shifts are on each side of the helm. The trim tab controls and the alarm panel are mounted on the control panel as is the Halon fire extinguisher monitor panel. Inside a storage space, in the console, is the 12 Vdc "electronics" distribution panel that powers the communications and navigation equipment that you choose to have on your vessel.

### THE CABIN INTERIOR

Forward of the lower step with its built-in storage space are two bilge pump access hatches. The shower and air conditioner sump pump is under the cabin sole between the water tanks and is accessible through the aft cabin hatch. The forward bilge pump and its automatic float switch and the bilge flood alarm switch (mounted higher) are accessible through the forward bilge access hatch.



The fresh water tank is located just forward of the forward engine-compartment bulkhead. The fresh water system pump is located in a locker aft of the "Vee" berth bulkhead on the port side. Water is heated by a 120 Vac shore-power, water heater enclosed in the galley cabinet below the stove area.

If your boat has the optional air conditioning system, the evaporator and controls are built into the deckhouse overhead.

The dinette table has a movable leg that permits it to be lowered, and a filler cushion is provided to convert it to a double bed. Access to the rope locker is provided by doors on the forward storage locker.

120 VAC outlets are provided in the galley, the head (toilet), the dinette, and the face of the starboard "vee" berth.

The 12 Vdc distribution panel is located, to starboard, in the "vee" berth area.

The 120 Vac distribution panel is located in the aft dinette seat, facing inboard.



## TABLE OF CONTENTS.

### FRONT MATTER

Dealer Evaluation Card

Title Page

Revision Page

Preface

Foreword

### A. CONTENTS SECTION

Table of Contents.....A-1

### B. TECHNICAL DATA SECTION

A. VESSEL TECHNICAL DATA.....B-1

B. MAIN ENGINES.....B-2

C. ENGINE BATTERIES.....B-2

D. PROPELLERS.....B-2

E. PROPELLER SHAFTS.....B-3

F. FUEL REMAINING IN TANKS.....B-3

Table B-1, Fuel Readings Vs Tank Gallonage.....B-3

G. VENTILATION AND EXHAUST BLOWERS.....B-3

H. BILGE AND SUMP PUMPS.....B-4

I. HOLDING TANK CAPACITY.....B-4

J. PERFORMANCE CHARTS.....B-4

## C. CONTROLS AND INSTRUMENTS SECTION

|                                              |      |
|----------------------------------------------|------|
| WITCHES.....                                 | C-1  |
| . Battery Power.....                         | C-1  |
| . Before Starting Engine.....                | C-1  |
| . Starting Engine.....                       | C-1  |
| . Battery Paralleling Switch.....            | C-2  |
| . After Engine Starts.....                   | C-2  |
| . Stopping Engine.....                       | C-2  |
| . Accessory Switches.....                    | C-3  |
| .....A-1                                     |      |
| STRUMENTS.....                               | C-4  |
| . The Importance of Instruments.....         | C-4  |
| .....B-1                                     |      |
| . Oil Pressure Gauge.....                    | C-4  |
| .....B-2                                     |      |
| . Temperature Gauge.....                     | C-5  |
| .....B-2                                     |      |
| . Tachometer.....                            | C-5  |
| .....B-2                                     |      |
| . Hour Meter.....                            | C-6  |
| .....B-3                                     |      |
| . Voltmeter.....                             | C-6  |
| .....B-3                                     |      |
| . Fuel Gauge.....                            | C-6  |
| .....B-3                                     |      |
| ARM SYSTEMS.....                             | C-7  |
| .....B-3                                     |      |
| . Engine alarms.....                         | C-7  |
| .....B-4                                     |      |
| . Bilge Alarm Switches.....                  | C-8  |
| .....B-4                                     |      |
| . Fire Alarm Switches.....                   | C-9  |
| .....B-4                                     |      |
| . Fire and Bilge alarm Lights.....           | C-9  |
| HANICAL CONTROLS.....                        | C-9  |
| . Engine Speed and Marine Gear Controls..... | C-9  |
| . Steering System.....                       | C-10 |
| . Trim Tabs.....                             | C-10 |

## TABLE OF CONTENTS.

### FRONT MATTER

Dealer Evaluation Card

Title Page

Revision Page

Preface

Foreword

### A. CONTENTS SECTION

Table of Contents.....A-1

### B. TECHNICAL DATA SECTION

|    |                                                 |     |
|----|-------------------------------------------------|-----|
| A. | VESSEL TECHNICAL DATA.....                      | B-1 |
| B. | MAIN ENGINES.....                               | B-2 |
| C. | ENGINE BATTERIES.....                           | B-2 |
| D. | PROPELLERS.....                                 | B-2 |
| E. | PROPELLER SHAFTS.....                           | B-3 |
| F. | FUEL REMAINING IN TANKS.....                    | B-3 |
|    | Table B-1, Fuel Readings Vs Tank Gallonage..... | B-3 |
| G. | VENTILATION AND EXHAUST BLOWERS.....            | B-3 |
| H. | BILGE AND SUMP PUMPS.....                       | B-4 |
| I. | HOLDING TANK CAPACITY.....                      | B-4 |
| J. | PERFORMANCE CHARTS.....                         | B-4 |

## C. CONTROLS AND INSTRUMENTS SECTION

|    |                                            |      |
|----|--------------------------------------------|------|
| A. | SWITCHES.....                              | C-1  |
| 1. | Battery Power.....                         | C-1  |
| 2. | Before Starting Engine.....                | C-1  |
| 3. | Starting Engine.....                       | C-1  |
| 4. | Battery Paralleling Switch.....            | C-2  |
| 5. | After Engine Starts.....                   | C-2  |
| 6. | Stopping Engine.....                       | C-2  |
| 7. | Accessory Switches.....                    | C-3  |
| B. | INSTRUMENTS.....                           | C-4  |
| 1. | The Importance of Instruments.....         | C-4  |
| 2. | Oil Pressure Gauge.....                    | C-4  |
| 3. | Temperature Gauge.....                     | C-5  |
| 4. | Tachometer.....                            | C-5  |
| 5. | Hour Meter.....                            | C-6  |
| 6. | Voltmeter.....                             | C-6  |
| 7. | Fuel Gauge.....                            | C-6  |
| C. | ALARM SYSTEMS.....                         | C-7  |
| 1. | Engine alarms.....                         | C-7  |
| 2. | Bilge Alarm Switches.....                  | C-8  |
| 3. | Fire Alarm Switches.....                   | C-9  |
| 4. | Fire and Bilge alarm Lights.....           | C-9  |
| D. | MECHANICAL CONTROLS.....                   | C-9  |
| 1. | Engine Speed and Marine Gear Controls..... | C-9  |
| 2. | Steering System.....                       | C-10 |
| 3. | Trim Tabs.....                             | C-10 |



## D. VESSEL OPERATIONS AND SAFETY AFLOAT

|    |                                                               |      |
|----|---------------------------------------------------------------|------|
| A. | VESSEL SAFETY.....                                            | D-1  |
| 1. | Fueling Instructions.....                                     | D-1  |
| 2. | Before Fueling.....                                           | D-2  |
| 3. | After Fueling.....                                            | D-2  |
| B. | CARBON MONOXIDE GAS.....                                      | D-3  |
| C. | THE FISHING TOWER.....                                        | D-5  |
| D. | WHEN UNDERWAY.....                                            | D-5  |
| E. | PROPELLER HAZARD.....                                         | D-6  |
| F. | ALCOHOL STOVE FLARE-UP.....                                   | D-7  |
| G. | THE FIRE WARNING AND THE FIRE EXTINGUISHING SYSTEMS....       | D-7  |
| 1. | General.....                                                  | D-7  |
| 2. | The Fire and Bilge Flood Alarm Systems.....                   | D-8  |
| 3. | The Fixed Fire Extinguisher Discharged<br>Monitor System..... | D-9  |
| 4. | The Portable Fire Extinguishers.....                          | D-9  |
| 5. | The Halon 1301 Fixed Fire Extinguisher System ....            | D-11 |
| 6. | System Function.....                                          | D-12 |
| 7. | After the Fixed Fire Extinguisher<br>System Discharge.....    | D-13 |
| 8. | Inspection and Restarting Vessel Systems.....                 | D-14 |
| H. | THE FIRE FIGHTING PLAN.....                                   | D-15 |
| I. | THE FIRE OR EMERGENCY EVACUATION PLAN.....                    | D-16 |
| J. | THE USE OF PERSONAL FLOATATION DEVICES.....                   | D-17 |
| K. | THE RING BOUY.....                                            | D-19 |
| L. | RADIOS AS EMERGENCY EQUIPMENT.....                            | D-19 |
| M. | MANEUVERING.....                                              | D-19 |

|     |                                                  |      |
|-----|--------------------------------------------------|------|
| N.  | SINGLE ENGINE RUNNING.....                       | D-20 |
| O.  | DAMAGED UNDERWATER EQUIPMENT.....                | D-20 |
| P.  | VESSEL SPEED.....                                | D-21 |
| Q.  | RUNNING AGROUND.....                             | D-22 |
| R.  | RECOMMENDATIONS FOR REFLOATING VESSEL.....       | D-23 |
| S.  | FLOTSAM (Floating Debris).....                   | D-25 |
| T.  | VIBRATIONS.....                                  | D-25 |
| U.  | TOWING.....                                      | D-25 |
|     | 1. General.....                                  | D-26 |
|     | 2. Personal Safety.....                          | D-26 |
| V.  | NAVIGATION and RUNNING LIGHTS.....               | D-27 |
| W.  | VISUAL DISTRESS SIGNALS.....                     | D-28 |
| X.  | SOUND SIGNALS.....                               | D-29 |
| Y.  | CALLING AT PORTS AWAY FROM HOME.....             | D-29 |
| Z.  | LEAVING YOUR BERTRAM.....                        | D-29 |
| AA. | HULL EFFICIENCY.....                             | D-30 |
| BB. | ATMOSPHERIC CONDITIONS.....                      | D-31 |
| CC. | MARINE GROWTH.....                               | D-31 |
| DD. | WATER IN THE BILGE.....                          | D-31 |
| EE. | DRAFT.....                                       | D-32 |
| FF. | HEIGHT.....                                      | D-32 |
| GG. | TRIP PREPARATION.....                            | D-32 |
|     | Before Leaving Dockside Checkoff Sheet.....      | D-33 |
| HH. | PREPARATIONS FOR ROUGH WEATHER.....              | D-34 |
|     | Heavy Weather Check List.....                    | D-35 |
| II. | THE BEAUFORT SCALE OF WIND FORCE.....            | D-36 |
|     | Table D-1, The Beaufort Scale of Wind Force..... | D-37 |

## E. ELECTRICAL SYSTEMS

|    |                                         |     |
|----|-----------------------------------------|-----|
| A. | GENERAL.....                            | E-1 |
| B. | ELECTRICAL DISTRIBUTION PANELS.....     | E-1 |
| C. | GROUND AND BONDING SYSTEM.....          | E-1 |
|    | 1. Bonding.....                         | E-1 |
|    | 2. Electrolysis.....                    | E-2 |
| D. | 12 VDC SYSTEM.....                      | E-2 |
|    | 1. Batteries.....                       | E-2 |
|    | 2. Battery Switches.....                | E-2 |
|    | 3. Distribution.....                    | E-3 |
|    | 4. Automatic Converter.....             | E-4 |
| E. | 120 VAC SYSTEM.....                     | E-4 |
|    | 1. Shore Power.....                     | E-4 |
|    | 2. Distribution.....                    | E-5 |
|    | 3. Galvanic Isolator.....               | E-6 |
|    | 4. European Shore Power (Optional)..... | E-8 |
| F. | CIRCUIT BREAKERS and FUSES.....         | E-9 |

## F. MECHANICAL SYSTEMS SECTION

|    |                                       |      |
|----|---------------------------------------|------|
| A. | FUEL SYSTEM.....                      | F-1  |
| 1. | The Fuel Tank.....                    | F-1  |
| 2. | Fuel Vent and Fill.....               | F-1  |
| 3. | Fuel Supply Lines.....                | F-1  |
| 4. | Fuel Filters.....                     | F-1  |
| 5. | Type of Fuel.....                     | F-2  |
| B. | PROPULSION SYSTEM.....                | F-2  |
| 1. | Engines.....                          | F-2  |
| 2. | Marine Gears.....                     | F-3  |
| 3. | Propeller Shafts.....                 | F-3  |
| 4. | Propellers.....                       | F-3  |
| 5. | Engine Shaft Alignment.....           | F-4  |
| 6. | Shaft Log and Stuffing Box.....       | F-5  |
| 7. | Shaft Log Sprayshield.....            | F-6  |
| 8. | Rudder Stuffing Box.....              | F-7  |
| 9. | Installation of Propellers.....       | F-7  |
| C. | TOILET SYSTEMS.....                   | F-9  |
| D. | BILGE PUMPS.....                      | F-10 |
| E. | FRESH WATER SYSTEM.....               | F-11 |
| 1. | Tanks.....                            | F-11 |
| 2. | Filling the Tanks.....                | F-11 |
| 3. | Water Heater.....                     | F-12 |
| 4. | Water Pump.....                       | F-12 |
| 5. | Shower.....                           | F-12 |
| 6. | Shower Sump Pump.....                 | F-13 |
| 7. | Dockside Water Supply (Optional)..... | F-13 |



|    |                                         |      |
|----|-----------------------------------------|------|
| F. | AIR CONDITIONING SYSTEM (Optional)..... | F-13 |
| 1. | Basic Instructions.....                 | F-13 |
| 2. | Operating Instructions.....             | F-13 |
| 3. | Thermostat.....                         | F-15 |

### G. MAINTENANCE SECTION

|    |                                      |      |
|----|--------------------------------------|------|
| A. | PREVENTATIVE MAINTENANCE.....        | G-1  |
| 1. | Periodic Maintenance.....            | G-1  |
| 2. | Daily.....                           | G-1  |
| 3. | Every 100 Hours or 60 Days.....      | G-2  |
| a. | Exterior.....                        | G-2  |
| b. | Interior.....                        | G-2  |
| c. | V-Berth.....                         | G-3  |
| d. | Head.....                            | G-3  |
| e. | Galley.....                          | G-3  |
| f. | Engine-Compartment.....              | G-4  |
| g. | Lazarette.....                       | G-6  |
| h. | Flybridge Control Station.....       | G-6  |
| 4. | As Required.....                     | G-6  |
| 5. | Crevise Corrosion.....               | G-7  |
| 6. | Electrolysis.....                    | G-7  |
| B. | STORING YOUR BERTRAM.....            | G-7  |
| 1. | Dry Storage.....                     | G-7  |
| 2. | Wet Storage.....                     | G-9  |
| 3. | Fitting Out.....                     | G-9  |
| 4. | Prelaunch and Postlaunch Checks..... | G-9  |
| a. | Prelaunch.....                       | G-10 |

|     |                                                                                         |      |
|-----|-----------------------------------------------------------------------------------------|------|
| b.  | Postlaunch.....                                                                         | G-10 |
| c.  | Electrical system check.....                                                            | G-11 |
| d.  | Engine Check.....                                                                       | G-11 |
| e.  | Controls Check.....                                                                     | G-11 |
| C.  | APPEARANCE AND CARE.....                                                                | G-12 |
| 1.  | Care of Fiberglass.....                                                                 | G-12 |
| 2.  | Seasonal Care (at fitting out time).....                                                | G-12 |
| 3.  | Loss of Gloss.....                                                                      | G-12 |
| 4.  | Stains.....                                                                             | G-13 |
| 5.  | Scratches and Abrasions.....                                                            | G-13 |
| 6.  | Bottom Blisters.....                                                                    | G-14 |
| 7.  | Painting Fiberglass Surfaces.....                                                       | G-15 |
| 8.  | Battery Care.....                                                                       | G-16 |
| a.  | Battery Water.....                                                                      | G-16 |
| b.  | Excessive Loss of Liquid.....                                                           | G-17 |
| c.  | Maximum Charge Voltage.....                                                             | G-17 |
| d.  | Cleaning Batteries.....                                                                 | G-18 |
| e.  | Battery Gases - EXPLOSIVE.....                                                          | G-18 |
| 9.  | Spilled Battery Acids.....                                                              | G-19 |
| a.  | Acid splashed in the eye.....                                                           | G-19 |
| b.  | Acid splashed on other parts of the body,<br>the clothing, or parts of your vessel..... | G-19 |
| c.  | If a considerable amount of acid is<br>spilled from the battery.....                    | G-19 |
| 10. | Fuel Tank Replacement.....                                                              | G-19 |
| a.  | Fuel Tank Removal.....                                                                  | G-19 |
| b.  | New Tank Installation.....                                                              | G-20 |

A. VESSEL TECHNICAL DATA

MODEL 285

---

BOAT NAME

---

OWNER'S NAME

---

OWNER'S ADDRESS

---

HAILING PORT

---

HULL NUMBER

DOOR KEY NUMBER

REGISTRATION NUMBER

LENGTH OVERALL = 28 Feet, 6 Inches

BEAM = 11 Feet, 0 Inches

DRAFT = 3 feet, 0 inches

FUEL CAPACITY = 240 U.S. Gallons

WATER CAPACITY = 50 U.S. Gallons

TONNAGE MEASUREMENT

(A Volume Unit of Measure)

GROSS = 10.19

NET = 8.15

DISPLACEMENT

(In Pounds)

Full fuel & water, 2 people, & 250

pounds of gear = 11,980

B. MAIN ENGINES

*add. Value*

Manufacturer = MerCuriser

Gear Manufacturer = Borg-Warner

Model Number = 5.7/260

Gear Model Number = 10-17-006

Gear Ratio = 1.52:1

Fuel Filter Primary Number = Mercury 35-60494

Lube Oil Filter Manufacturer and Element Number = QuickSilver 14957

PORT ENGINE

STARBOARD ENGINE

Serial Number = \_\_\_\_\_

Serial Number = \_\_\_\_\_

Gear Serial Number = \_\_\_\_\_

Gear Serial Number = \_\_\_\_\_

C. ENGINE BATTERIES

STANDARD BATTERY:

Manufacturer = Deka

Model Number = MO-427

Voltage = 12 Volts

Capacity = 75 Ampere hours

OPTIONAL BATTERY:

Manufacturer = Surrette

Model Number = T-12-135

Voltage = 12 Volts

Capacity = 120 Ampere hours

D. PROPELLERS

Manufacturer = Dymex

Style = 3-Blade 17x16x1-1/4 cup

Diameter = 17 inches;

Pitch = 16

Material = Bronze

Port Rotation = Left Hand (Bertram Part Number 08455)

Starboard Rotation = Right Hand (Bertram Part Number 08456)



#### E. PROPELLER SHAFTS

Material = Stainless steel

Diameter = 1-1/4 inches

Length = 63-1/2 inches

Bertram Part Number = 08D5616-6

#### F. FUEL

Table B-1 shows the relationship of the fuel gauge indication and the approximate number of gallons (fuel tank label capacity) of fuel in the tank.

| TABLE B-1. FUEL GAUGE READINGS Vs TANK GALLONAGE |               |
|--------------------------------------------------|---------------|
| Gauge Reading                                    | Forward Tank  |
| Full                                             | 240 gallons * |
| 3/4                                              | 167 gallons * |
| 1/2                                              | 79 gallons *  |
| 1/4                                              | 31 gallons *  |
| Empty                                            | 0 gallons     |

\* Usable fuel is considered to be 90% of the fuel tank label capacity.

#### G. VENTILATION And EXHAUST BLOWERS

##### ENGINE-COMPARTMENT

HEAT REMOVAL BLOWERS = Two (2) 130 CFM, 12-Voltd.c., manually controlled.

## H. BILGE AND SUMP PUMPS

### PUMP RATED CAPACITIES

Bilge Pumps = 1,750 Gallons per Hour  
Engine Room Sump Pump = 800 Gallons per Hour  
Shower sump pump = 700 Gallons per Hour

## I. HOLDING TANK CAPACITY:

11 Gallons

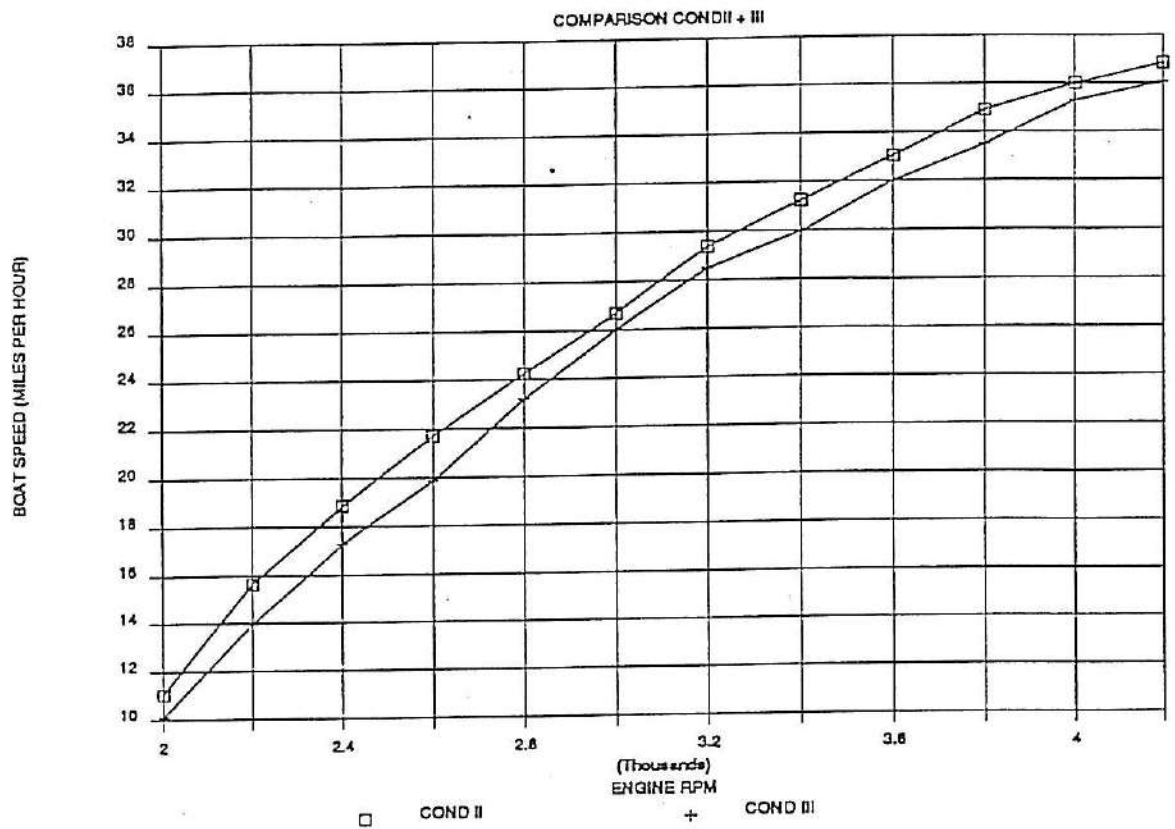
## J. PERFORMANCE CHARTS

Performance data (SPEED, RANGE, and FUEL [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. Factors such as: the installation of certain options (i.e., a tuna tower), boat loading and trim, weather conditions, engine and boat conditions, propeller condition, and manufacturing tolerances may affect actual performance obtained. Based on prudent seamanship, RANGE is calculated on 90% of the fuel tank label capacity.

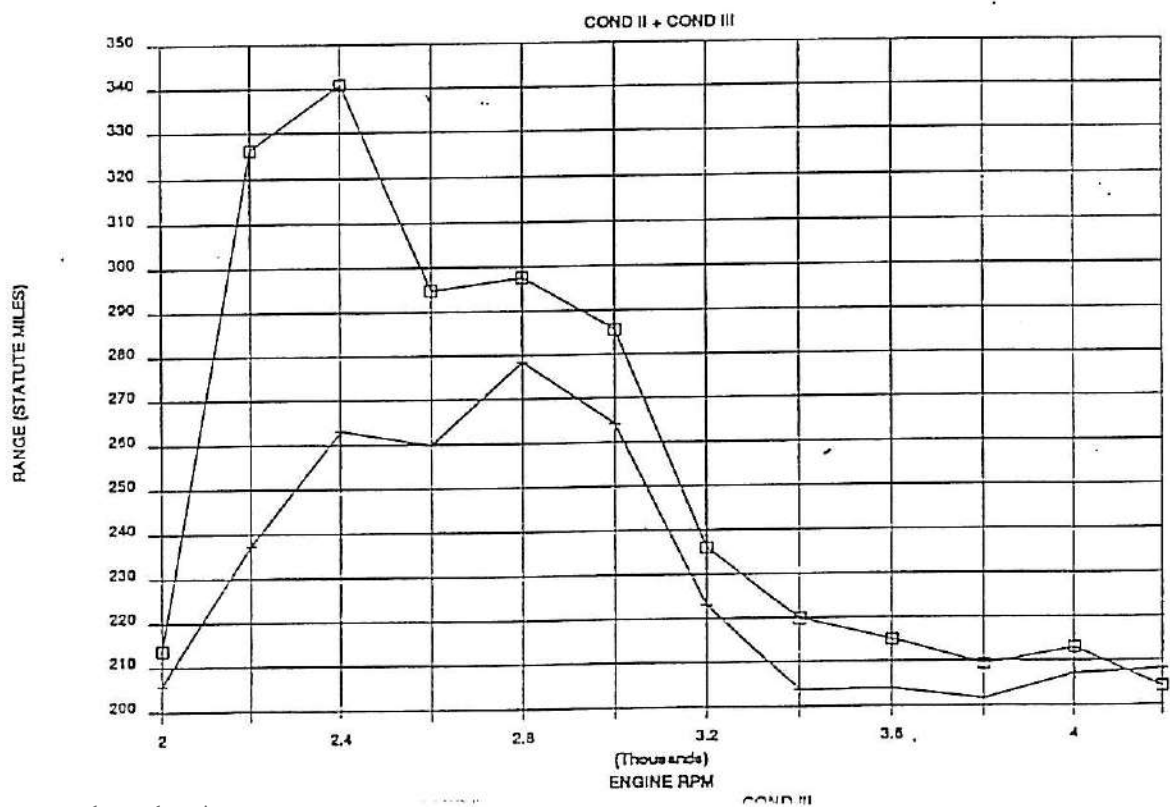
The first three charts (Boat speed [in statute miles per hour], Range [in statute miles], and Fuel [in gallons of fuel per hour]) are furnished as an example and they shall be used for reference only.

The last three charts are left blank for you to plot in curves of data that you obtain on your own boat, and these should be used when planning your trips.

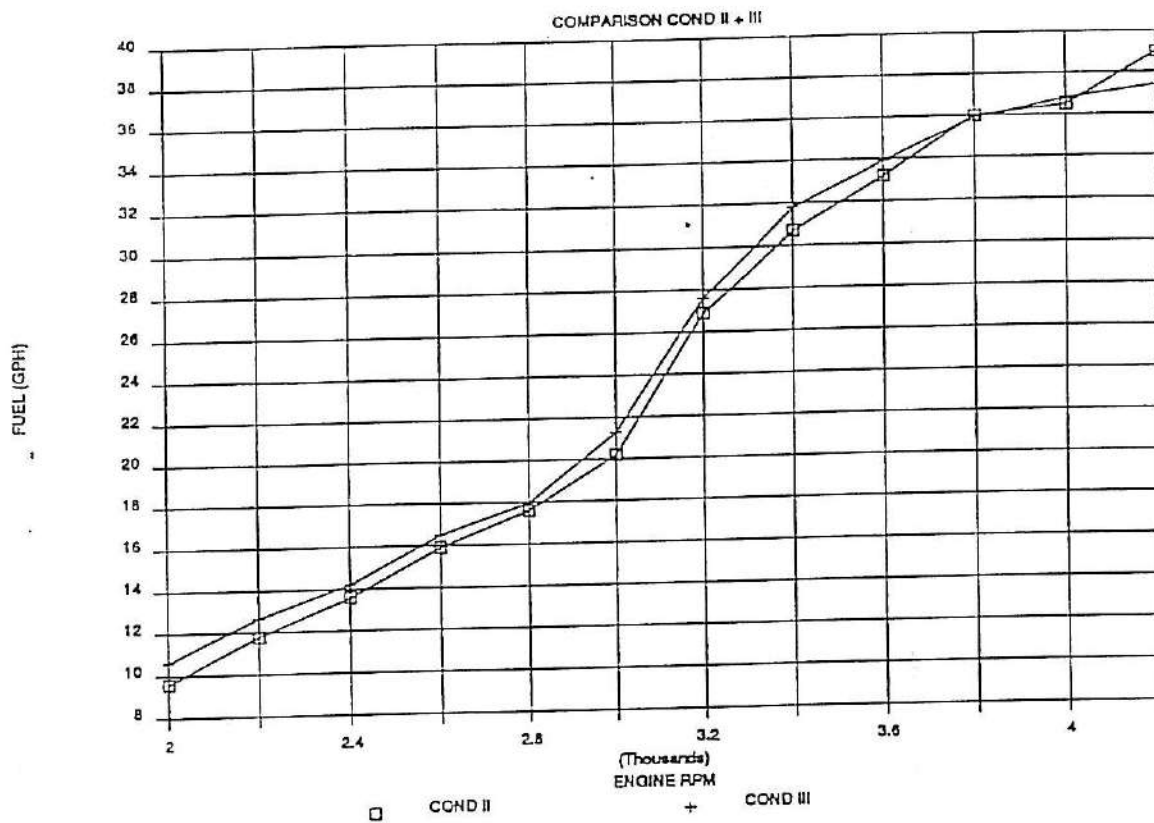
# BERTRAM 28 FBC 260 MERCUISER



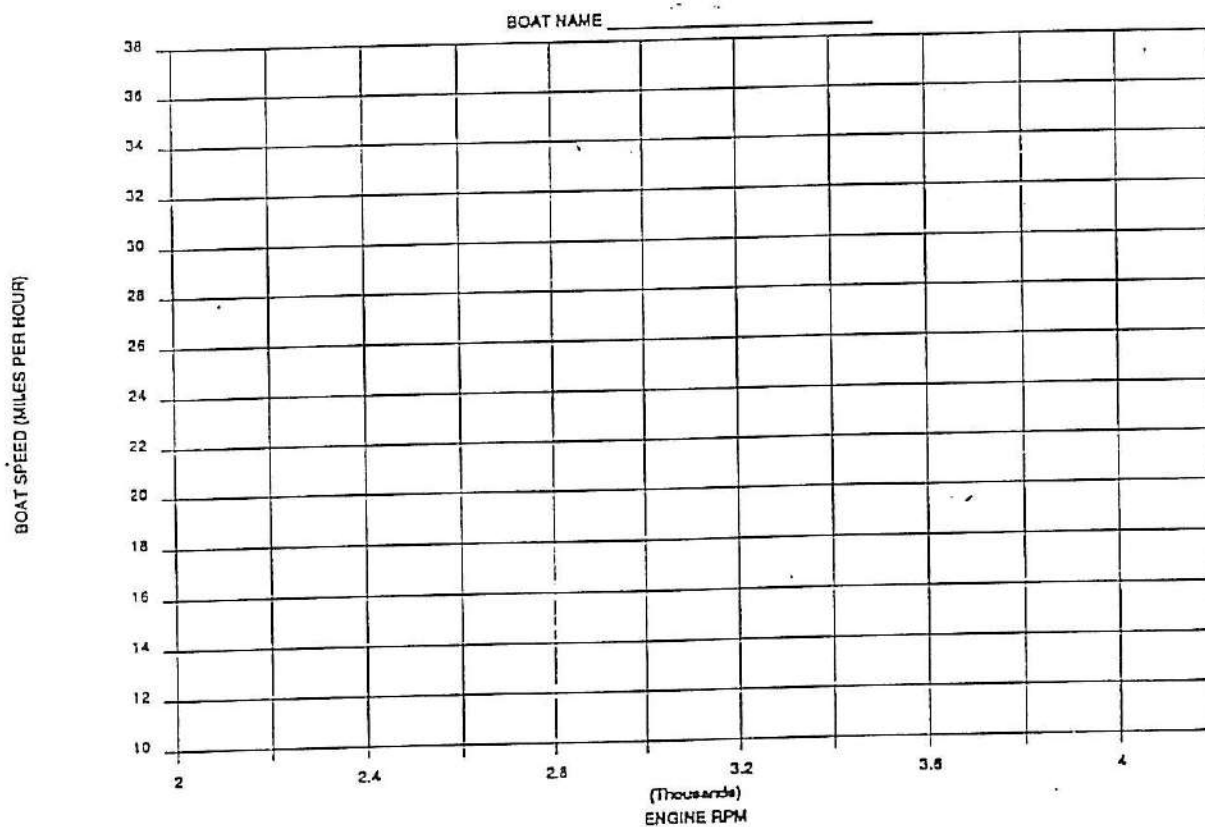
# BERTRAM 28 FBC 260 MERCUISER



# BERTRAM 28 FBC 260 MERCUISER

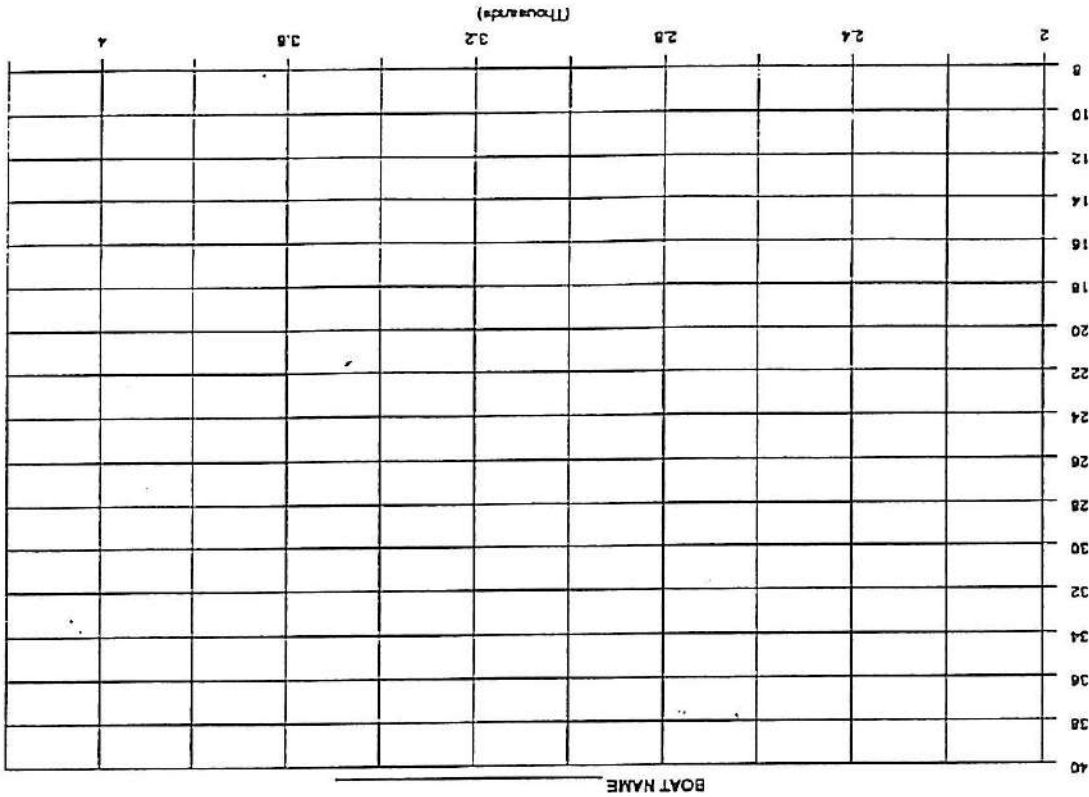


# BERTRAM 28 FBC 260 MERCUISER



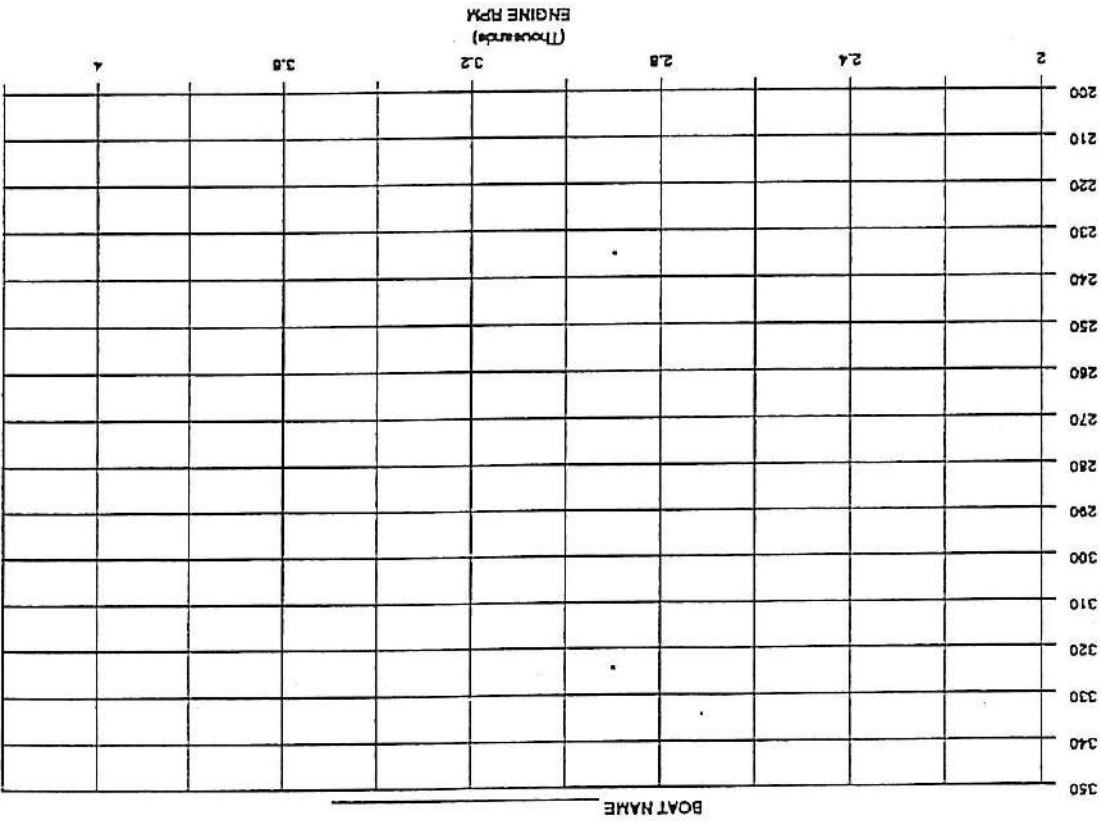


FUEL (GPH)



BERTRAM 28 FBC 260 MERCURUISER

RANGE (STATUTE MILES)



BERTRAM 28 FBC 260 MERCURUISER



Move "On-Stop" switch to "Stop" position.

#### 6. Stopping Engine.

properly.

Visually check the flow of water from the exhaust outlet on transom. This will indicate if the cooling system is operating properly.

#### 5. After Engine Starts.

the start switch.

In the event that starting is difficult because of weak battery, this switch can be held in either "ON" position while using the start switch.

#### 4. Battery Paralleling Switch.

the engine.

If engine fails to start within 10 seconds, release the start switch, as excessive cranking will result in unnecessary wear on the starter motor and drain on the battery. Wait 2 or 3 minutes and try again. It may help to pump the throttle while cranking the engine.

#### NOTE:

extinguish.

Alarm bell should stop ringing and all alarm lights should 4) Hold switch until engine starts, then release start switch.

illuminate.

3) Activate the start switch. The alarm bell should continue to ring and the "Engine Temp" and "Gear Temp" alarm lights should

alarm lights should illuminate.

The alarm bell should ring and the "Oil Pres" and "Exhaust Temp"

## 7. Accessory Switches.

At the flybridge control station are switches for the Horn,

Instruments, Wipers, Blower, (opt) Bilge Pump, and

Navigation/Anchor Lights. The Instrument switch controls the

Instrument lights and the compass light.

The Fwd. Bilge Pump switch, located on the 12 Vdc Distribution

Panel, controls the pump under the main cabin sole. The engine-

compartment Sump Pump is automatic at all times and does not have

a separate switch. The (opt) Aft Bilge Pump switch, located on

the flybridge control station, controls the pump at the stern.

The fwd and aft bilge pumps can be operated manually, but

normally these switches are kept in the automatic position. All

three pump systems are connected directly to the batteries and

are protected by fuses on the Main Battery Switch panel. The

Main Battery Disconnect switches, when off, do not turn off power

to the bilge pumps, the Fire/Bilge Alarm system or to the optional

12 Vdc converter.



Almost all serious engine trouble will be reflected on the oil pressure gauge. Therefore, if any radical change in pressure should occur, turn the engine off immediately. During operation, there may be some slight fluctuations in the gauge reading. This is normal due to the nature of the lubricating oil and temperature variation. Consult the engine manual for proper oil pressure. When the engine is first started, the oil pressure will have a higher reading but will decrease in pressure as the engine warms to normal temperature. Your Bertram is equipped with a warning alarm that should sound if the oil pressure becomes dangerously low.

2. Oil Pressure Gauge.

First starting the engine. Note what constitutes the "normal" readings or ranges of operation of the instruments. All the gauges operate on the boat's 12V system and all gauges do not register to any particular position when the ignition is off.

checking them frequently when running and particularly when with the function of each of your gauges and accustom yourself to Tachometer, Voltmeter, and Water Temperature. Become familiar system. The engine gauges are as follows: Oil Pressure, Your Bertram is equipped with gauges for each engine and fuel

1. The Importance of Instruments.

## B. INSTRUMENTS

### 3. Temperature Gauge.

The temperature gauge records the water temperature circulating through the engine. The engines are equipped with a thermostat that controls the water flow, thus regulating the temperature. The temperature and oil pressure gauges should be observed simultaneously and most malfunctions will be reflected in both gauges. Consult the engine manual for the proper operating temperature. The alarm system should warn you if engine temperature is excessive.

#### NOTE:

As the engine temperature rises, oil pressure will drop so the oil pressure gauge should be used in conjunction with the water temperature gauge.

### 4. Tachometer.

This instrument registers the revolutions per minute of an engine. There is no direct correlation of RPM's to speed of the boat due to slippage at the propeller. A substantial increase or decrease in the boat's maximum RPM's is an indication that something is wrong and a check should be made of the boat's engines and/or running gear.

## 5. Hour Meter.

These meters register the number of hours that the engines have been operating, regardless of engine speed (RPM). The engine hour meters are energized by the ignition switch. They are used to schedule maintenance.

## 6. Voltmeter.

The level of charge in each of the main engine batteries is indicated by the volt meter. A reading of 12.8 volts is normal for a fully charged battery when the ignition is switched "On." There is little chance that the engine will start without paralleling the batteries when the voltmeter reads below 11 volts. When the engine is running, a reading of 13 to 15 volts indicates a normal charging rate.

## 7. Fuel Gauge.

Because of the fuel tank configuration, the fuel gauge can not register accurately as gallonage. The tank is larger at the top portion so there are actually more gallons in the upper half of the tank than the lower half. This should be considered during long range trips to avoid running too low on fuel or the possibility of running out of fuel.

Fuel gauge readings indicate the amount of fuel as shown in Table B-1, Fuel Gauge Readings vs Tank Gallonage.

## C. ALARM SYSTEMS

### 1. Engine Alarms.

Each engine is equipped with an alarm system that warns the operator if lube oil pressure is too low or if engine coolant temperature; the transmission temperature; or, the exhaust temperature is too high. If the alarm should sound, immediately check the gauges to determine the problem and shut down the affected engine.

#### NOTE:

Gear oil temperature and exhaust temperature are not monitored by gauges.

If low oil pressure is the problem, check the following:

- a. Low lube oil in crankcase.
- b. Leak in oil system.
- c. Faulty alarm switch.
- d. Faulty oil pump.

If the engine temperature gauge indicates a problem, check the following:

- a. Low coolant in (optional) heat exchanger.
- b. Loose or worn belt.
- c. Restricted seawater strainer.
- d. Closed or partially closed seacock.
- e. Faulty water pump.
- f. Faulty thermostat.
- g. Faulty alarm switch.
- h. Collapsed water suction hose (check with engine running).
- i. Restriction inside the engine.



light.

alarm bell should ring and the "bilge" lamp on alarm panel should

button. When button is pressed, the float is raised and the

occasionally. There is a cover on each switch with a red test

bilge. It is recommended that the bilge alarm switches be tested

switches, which are the same type, but located lower in the

boat. Do not confuse the alarm switches with the bilge pump

switches are installed several inches above the bottom of the

one in the engine-compartment, and one at the stern. Bilge alarm

There are three bilge alarm switches, one in the forward bilge,

## 2. Bilge Alarm Switches.

- f. Defective sea water flow switch (located in sea water system).
- e. Collapsed water suction hose.
- d. Defective sea water pump.
- c. Closed or partially closed seacock.
- b. Restricted seawater strainer.
- a. Flow of water from exhaust outlet at transom.

following:

If exhaust temperature alarm indicates a problem, check the

- d. Defective alarm switch.
- c. Transmission Cooling System.
- b. Clutch slipping (check control cable adjustment).
- a. Low transmission fluid.

following:

If gear temperature alarm indicates a problem check the

Clutch and throttle controls are installed alongside the steering wheel. These twin lever controls are directly connected to the engine throttles and the marine gears by push-pull cables thus

\*\*\*\*\*  
\*  
\* shifting.  
\*  
\* ine gear to decrease and helps facilitate  
\*  
\* allows the hydraulic pressure within the mar-  
\*  
\* gears to the opposite direction. This pause  
\*  
\* to idle and pause in neutral before shifting  
\*  
\* It is advisable to allow the engines to come  
\*  
\* Do NOT shift above 1000 RPM while maneuvering  
\*  
\* CAUTION  
\*  
\*  
\*\*\*\*\*

D. MECHANICAL CONTROLS

1. Engine Speed and Marine Gear Controls.

panel.

Lights can be tested by using test switch on bridge instrument

4. Fire and Bilge Alarm Lights.

dissipates.

panel should illuminate. The switch will reset itself after heat the fire/bilge alarm bell should ring and "fire" lamp on alarm heat to the metal disc. Do not use an open flame. When tested, of each engine. The switches can be tested by applying suffice There is one fire alarm switch (heat detector) above and forward

3. Fire Alarm Switches.

providing positive action from steering station to engine. The clutch controls are located to the port of the steering wheel and have black knobs. There are detent positions which allow you to "feel" the fwd, neutral, and reverse positions. The throttle control levers are to the starboard of the steering wheel and have red knobs. Engine speed is increased by pushing the levers forward and decreased by pulling the levers back.

## 2. Steering System.

Your boat is equipped with a hydraulic steering system. The basic system is composed of three working parts: The steering station pump, the slave or steering cylinder; and the reserve valve. When the steering wheel is turned, hydraulic fluid is pumped to the steering cylinder attached to the rudder arms. The hydraulic fluid reservoir contains 2 quarts of fluid under 30 PSI air pressure and has a sight glass indicating the fluid level. The system is designed to prevent any outside air from entering the reservoir. Air pressure can be recharged by using an ordinary bicycle tire pump attached to the valve on top of the reservoir. The reservoir is located in the engine-compartment.

## 3. Trim Tabs.

The trim tab system on your Bertram is electric-hydraulically operated and receives its power from the 12V DC distribution panel. Trim tabs are used to regulate the attitude of the boat while underway in much the same way that flaps aid an airplane. The trim tabs can also be used to adjust the boat's running angle



in adverse seas or with unusual load conditions. The trim tabs are operated by a rocker-type switch panel located on the starboard side of the flybridge helm. If used properly, the trim tabs will aid in trimming the boat in a fore and aft position, allowing an overall smoother ride.

The trim tab rocker switch is marked "Bow Up" and "Bow Down". When you push "Bow Up", the trim tabs move to their upper position. This is the "normal" position and should be best for most cruising speeds. When running an inlet or before a following sea, be sure the trim tabs are in their full up position. When you push "Bow Down", the trim tabs will be lowered to a down position. Under certain speed and load conditions you will need some "Bow Down" tab. You will learn to judge the running attitude of your boat by the bow's relation to the horizon.

After starting the engines of your Bertram, depress the "Bow Up" position of both trim tab switches, thus assuring that the tabs are in the full "up" position. After getting underway and upon reaching a plane, depress the "Bow Down" position of the trim tab switches lightly, bringing the bow down slightly. The speed of your boat and the degree of choppiness of the water will determine the extent you lower the trim tabs. Note: The faster you go, usually the less tab is required. Too much "Bow Down" at any speed will reduce the boat's speed and will change the handling characteristics of your vessel.



While running, if your boat lists to one side, due to improper loading of gear or passengers, or if due to a beam wind, the boat can be leveled by adjusting the tabs. For instance: if the boat lists to port, depress Starboard Bow Up momentarily, then depress Port Bow Down momentarily. If this does not completely correct the list, repeat the operations. For a starboard list reverse the procedure.

#### NOTES:

- 1) Never press one switch "Bow Down" while pressing the other "Bow UP". This will blow the fuse on 12V dc Distribution Panel. The prolonged holding of either switch in the "Bow Up" or "Bow Down" position will also cause the fuse to blow. The fuse will have to be replaced to make the trim tabs operative again.
- 2) Never "back down" above idle speed, while the trim tabs are in the down position. Because of the force of the water on the trim tabs in reverse, it is possible to damage both trim tab cylinders and/or the internal seals of the cylinders. Additionally, always return the trim tabs to the full up or "Bow Up" position prior to docking boat. This procedure will prevent marine growth from developing on the hydraulic rams

## VESSEL OPERATIONS AND SAFETY AFLOAT

### A. VESSEL SAFETY

#### NOTE:

Starting in 1977, federal standards have steadily increased the level of component and systems safety as related to the fuel and electrical systems for gasoline powered vessels. These tightened standards have resulted in increased boating safety.

#### 1. Fueling Instructions.

```
*****
*
*                               WARNING
*
* THE FIRST TIME ANY TANK IS FILLED, MAKE A
* CAREFUL CHECK TO ENSURE THAT FUEL DOES OVER-
* FLOW THROUGH THE VENT. IF NOT, DO NOT START
* THE ENGINES. INSTEAD, IMMEDIATELY NOTIFY
* DEALER AND THE BERTRAM SERVICE DEPARTMENT.
*
*****
```

```
*****
*
*                               WARNING
*
* GASOLINE VAPOR IS BOTH HEAVIER THAN AIR AND
* HIGHLY EXPLOSIVE. FOR MAXIMUM SAFETY WHEN YOU
* FUEL GASOLINE POWERED VESSELS, THE FOLLOWING
* STEPS SHOULD BE TAKEN, EACH TIME YOUR BERTRAM
* IS FUELED.
*
*****
```

For maximum safety each of the following steps should be followed each time your Bertram is fueled.

## 2. Before Fueling.

- 1) Close all hatches, the cabin door, and the engine boxes.
- 2) Turn "OFF" all equipment, such as engines, stove, pumps, and bilge blowers.
- 3) Always make sure that the filling hose nozzle touches the deck fill plate before any fuel is pumped and while pumping.

## 3. After Fueling.

- 1) Open all hatches, the cabin door, and the engine boxes.
- 2) Then visually and by smell, check for fuel leaks and/or fumes.
- 3) Operate your bilge blowers for at least four (4) minutes and leave them running until engines are started.
- 4) Close hatches and boxes only after engines have run for a while.

### NOTE:

On gas powered boats, it is recommended that blowers be kept running during any low speed operation.

```
*****
*                                     *
*               CAUTION               *
*                                     *
*   To avoid engine stoppage, and fuel line   *
*   contamination, Do NOT let your fuel   *
*   tank run dry in use.                       *
*                                     *
*****
```

## B. CARBON MONOXIDE GAS

```
*****  
*                                     *  
*                               WARNING:                               *  
*                                     *  
* GASOLINE AND DIESEL INTERNAL COMBUSTION EN- *  
*                                     *  
* GINES USE PETROFUELS AND EMIT CARBON MONOXIDE *  
*                                     *  
* GAS, WHICH IS COLORLESS, ODORLESS, AND LETHAL *  
*                                     *  
* IF BREATHED IN SUFFICIENT QUANTITIES. THE FOL- *  
*                                     *  
* LOWING LISTED PRECAUTIONS ARE CONSIDERED MAN- *  
*                                     *  
* DATORY FOR SAFE, PLEASANT POWER BOATING. *  
*                                     *  
*****
```

- 1) When at anchor, be sure to OPEN sufficient windows, hatches, and vents to maintain adequate ventilation even with the air conditioner operating.
  - 2) When you are tied up to a dock and/or immediately alongside of other vessels or when rafted up against one or more other vessels, pay particular attention to the generator exhaust emissions from the nearby vessels; since a LETHAL concentration of carbon monoxide could be drawn into your vessel from the outside by your ventilation system.
- Remember that carbon monoxide (CO) poisoning is recreational boatings most insidious hazard. CO poisoning first attacks the brain's judgment center and its first symptoms (headache and nausea), are easily confused with seasickness. CO is lethal and its effects are cumulative. As CO builds up in your body, your blood can carry less and less oxygen. This can take place over a long period of time and at relatively low concentrations.



Carbon monoxide gas is colorless, tasteless, and odorless.

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

- a) throbbing in the temples;
- b) dizziness;
- c) ringing in the ears;
- d) Watering and itching eyes;
- e) headache;
- f) nausea; and/or,
- g) cherry pink or red skin color.

YOU SHOULD IMMEDIATELY:

- a) Move everyone on-board out on deck in the fresh air;
- b) open all hatches, windows, and vents to air out your vessel;
- c) stop your engines until you have located the source of the carbon monoxide, if it comes from your vessel; and,
- d) make all the necessary corrections and/or repairs before getting underway again.

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

### C. THE FISHING TOWER

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

The height and weight of a fishing tower (also called a tuna or marlin tower), and that of occupant(s) change your vessel's vertical center of gravity. This may result in excessive heeling and slower recovery to an upright condition. Therefore, in adverse sea and/or weather conditions do NOT occupy this tower.

### D. WHEN UNDERWAY

```
*****
*                                     *
*                               WARNING                               *
*                                     *
* WHEN UNDERWAY, TO REDUCE THE CHANCES OF SOME- *
*                                     *
* ONE FALLING OVERBOARD, DO NOT LET ANYONE:      *
*                                     *
* 1. MOVE TO OR FROM THE FOREDECK ALONG THE      *
*                                     *
* OUTSIDE OF THE CABIN; OR,                    *
*                                     *
* 2. MOVE ABOUT TOPSIDE WITHOUT THE PROPER      *
*                                     *
* NON-SLIP "BOATER" FOOTWARE.                  *
*                                     *
*****
```

As stated in the above warning, certain aspects of being on any moving vessel can be dangerous. However, these dangers can be reduced if you are the type of operator that exercises caution where required. For instance, moving forward on deck or moving about the foredeck when your vessel is under way should always be done cautiously.

## E. PROPELLER HAZARD

```
*****
*                                     *
*                               WARNING                               *
*                                     *
* IT IS VERY DIFFICULT FOR SOMEONE STANDING OR *
* FLOATING IN THE WATER TO TAKE EVASIVE ACTION *
* SHOULD HE SEE A POWERBOAT HEADING IN HIS DIR- *
* ECTION EVEN AT SLOW SPEED.  THEREFORE, TO RE- *
* DUCE THE RISK OF SERIOUS INJURY, WHEN BOATING *
* NEAR PEOPLE IN THE WATER, SHIFT TO NEUTRAL *
* AND STOP ENGINES.  DO NOT ENTER OR LEAVE THE *
* WATER FROM YOUR VESSEL WITH ENGINES 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, should anyone be in the water, if your vessel has a swim platform, or if people wish to board or disembark by the stern, stop both engines and ensure that both propellers have stopped turning before allowing anyone to:

- 1) go out on the swim platform;
- 2) enter or leave the water via the swim platform; or,
- 3) board or disembark from your vessel by climbing out of or down into a dinghy via the swim platform.



#### F. ALCOHOL STOVE FLARE-UP

```
*****  
*                                     *  
*                               WARNING                               *  
*                                     *  
* AN ALCOHOL STOVE FLARE-UP MAY OCCUR DURING                       *  
* PREHEATING, PARTICULARLY IF A BURNER VALVE IS                   *  
* OPENED BEFORE PREHEATING IS COMPLETE. IF THIS                   *  
* HAPPENS, SHUT OFF BURNER AND RESTART PER THE                     *  
* MANUFACTURER'S INSTRUCTIONS.                                     *  
*                                     *  
*****
```

#### NOTE:

An alcohol flame may not be visible under certain light conditions.

#### G. THE FIRE WARNING AND FIRE EXTINGUISHING SYSTEMS

1. General. Boating safety studies show that the best way to fight shipboard fires is to prevent them. Most shipboard fires are preventable by the obvious steps of:

- 1) not allowing fuel spillage or fumes to accumulate in the bilge;
- 2) properly storing paint and other combustibles;
- 3) taking appropriate care when cooking, especially frying;
- 4) taking appropriate care with smoking materials; and,
- 5) not exceeding the safety factor built into electric wiring.

Unfortunately however, all on-board fires cannot be prevented and boating safety statistics\* show that unless the fire is put out

\* DOT U.S.C.G. COMDTINST M16754.1G "BOATING STATISTICS" JUNE 1986



in the first 5 to 10 minutes, 80% of all pleasure craft that catch on fire are destroyed. To give you the best available fire warning and fire fighting capabilities, the following equipment is furnished as a part of your Bertram:

- 1) If an over temperature (fire) condition is detected by the fire detecting circuit, the circuit activates sounding the alarm bell and illuminating the instrument panel fire alarm light.
- 2) A fixed Halon fire extinguisher system.
- 3) A battery-powered smoke detector mounted in the cabin.
- 4) Three (3) mounted, hand-held, dry-chemical fire extinguishers.

2. The Fire and Bilge Flood Alarm Systems. The fire warning system is part of the Bilge Flood/Fire alarm system. The over temperature (fire) detector part of the system consists of two (2) engine compartment fire detectors connected to a fire alarm bell and to a red fire alarm warning light on the flybridge control station.

#### IMPORTANT

- 1) The fire/bilge alarm system can only be disabled by removing the panel fuse.
- 2) The fire detection circuit has an alarm bell. The Halon bottle discharged alarm system has an alarm horn.

### 3. The Fixed Fire Extinguisher Discharged Monitor System.

A second fire warning system at the helm station is an integral part of the Halon fixed fire extinguisher system. This system consists of an alarm horn and a red warning light. It is powered by the alarm fuse on the 12 Vdc Battery Disconnect Switch Panel. The fire extinguisher monitor panel also has a test switch which sounds the alarm horn and illuminates the red light on the instrument panel exactly as it would if the Halon bottle were discharged.

### 4. The Portable Fire Extinguishers.

```
*****
*                                     *
*                               CAUTION *
*                                     *
* Do NOT use water based extinguishing agents *
*                                     *
* on electrical fires due to the potential dan- *
*                                     *
* ger of electric shock to the fire fighter *
*                                     *
* and the possibility of short circuiting the *
*                                     *
* electrical circuits and causing more fires. *
*                                     *
*****
```

For any fires other than engine-compartment fires or for fires that have gotten outside the engine-compartment, Bertram supplies three (3) each mounted, type B-1, dry-chemical, portable (hand-held), fire extinguishers, U.S.C.G. approved Type BC-1.

#### NOTE:

A hand-held fire extinguisher empties in 8 to 20 seconds if you hold its trigger and do not release it.

For the purposes of selecting the correct fire fighting tool, fires are divided into the following three classes:

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

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

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

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



5. The Halon 1301 Fixed Fire Extinguisher System. To give the Halon the chance to put out a fire, the concentration must be kept as high as possible. This means keeping the engine-compartment hatches closed..

```
*****
*
*                               WARNINGS
*
* 1.YOUR FIXED FIRE EXTINGUISHERS FIGHT ENGINE-
* COMPARTMENT FIRES. FIRES OUTSIDE THE ENGINE-
* COMPARTMENT OR OTHER FIRES ARE TO BE FOUGHT
* WITH HAND-HELD EXTINGUISHERS.
*
* 2.BURNED HALON CAN BE TOXIC DO NOT BREATHE THE
* FUMES, SMOKE FROM FIRE, OR ENGINE EXHAUST.
*
*****
```

```
*****
*
*                               CAUTION
*
* Most fire fighting agents stop engines by oxy-
* gen depletion, Halon 1301 MAY NOT. If you do
* NOT quickly stop your engines, the Halon gas
* concentration will be rapidly lowered and may-
* be eliminated as an effective fire fighter.
*
*****
```

Halon 1301 was selected for several reasons, it is safe and clean (it leaves no water, foam, powder, or other residue behind). Halon 1301 works chemically to stop a fire, by breaking the chain reaction by which the fire propagates itself from one fuel molecule to another.



6. System Function. The Halon 1301 system is U.S. Coast Guard approved and is fully automatic. The Halon cylinder is installed in the engine-compartment. This bottle has sufficient Halon for more than the necessary five-percent (5%) concentration needed to extinguish most fires. The cylinder nozzle is heat actuated when the temperature in this compartment reaches 165°F. This system protects the engine-compartment and is connected to the fire extinguisher discharged panel which is equipped with a warning horn and a red warning light.

At the same time, the over temperature condition in the engine-compartment will be sensed by one or both of the compartment's heat detectors. A detected fire causes several events to happen:

- 1) The Fire Warning System alarm bell sounds and the red alarm light illuminates on the instrument panel.
- 2) The automatic mechanism releases the Halon.
- 3) The alarm horn sounds and the red light on the Fire Extinguishing Monitor Panel illuminates.

#### NOTES:

- a) Depending on the rate of temperature rise, the time between the Fire Warning System alarm and the Halon Discharged alarm may be too short to be identified as separate events.
- b) To prevent the Halon bottle from exploding due to pressures created by over heating, it has a relief device to release the Halon if the compartment temperature reaches a preset level.

## 7. After the Fixed Fire Extinguisher System Discharges

```
*****
*
*                               WARNING
*
* DO NOT OPEN THE ENGINE-COMPARTMENT HATCH
*
* OR TRY TO ENTER THIS COMPARTMENT FOR AT
*
* LEAST 15 MINUTES AFTER A HALON DISCHARGE. TO
*
* ALLOW OXYGEN TO ENTER BEFORE HOT METALS ARE
*
* COOL MAY CAUSE REIGNITION OR FLASH BACK.
*
*****
```

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 (15) minutes for any heated metal or fuel to cool off before opening the engine-compartment hatches.

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

- 1) If the Halon has not already done so, IMMEDIATELY shut down your engines. The engine "STOP" switches are on the flybridge control station console, one switch for each engine. It must be stressed, that for Halon to be fully effective as a fire extinguisher in your engine-compartment, the engines MUST be shut down just as-soon-as-possible after the system automatically discharges.
- 2) Shut down the engine-compartment blowers.

- 3) except for the bilge pumps, navigation lights (if after dark), and the emergency radio, shut down all electrical power;
- 4) do NOT open the engine-compartment hatches for at least 15 minutes.
- 5) stand by with portable extinguishers should the fire spread past the engine-compartment bulkheads.

#### 8. Inspection and Restarting Vessel Systems.

```

*****
*
*                               WARNING
*
* HALON 1301 IS SAFE TO BREATH.  BUT, ITS COMBUS-
* TION PRODUCTS ARE TOXIC.  WAIT FOR BLOWER/VENT-
* ILATION TO COMPLETELY CHANGE ENGINE-COMPARTMENT
* AIR BEFORE ENTERING.
*
*****

```

Wait a minimum of fifteen (15) minutes before carefully checking to ensure the fire is totally out. To verify, feel the engine-compartment hatches and bulkheads to be sure that these surfaces are cool to the touch before cautiously opening the hatches, restarting the engine-compartment blowers or your engines.

- 1) Have the proper type of United States Coast Guard approved hand held fire extinguishers ready.
- 2) Ventilate the engine-compartment by switching "ON" the engine-compartment forced air blowers.



- 3) Carefully examine the engine-compartment for damage and to determine the cause of the fire.
- 4) Make the necessary emergency repairs.
- 5) Restart the engines.

NOTE:

The engines may be hard to start due to residual Halon in the engine-compartment.

- 6) Activate only those electrical circuits necessary to safely maneuver your vessel.
- 7) Return to dockside.
- 8) Have the Halon fixed fire extinguisher system and any portable fire extinguishers that were used checked and serviced as soon as possible.

#### H. THE FIRE FIGHTING PLAN

After an active fire prevention program, a well designed and well rehearsed vessel fire fighting plan is probably the next single most vital step toward organizing the fire fighting efforts of the vessel operator and guests. Such organization can be vital, since studies of fires at sea show that a quick reaction time is absolutely essential to extinguishing a shipboard fire. Therefore, the vessel operator as well as other designated persons on board should be thoroughly familiar with:

- 1) The operation of the fixed Halon fire extinguishing system;



- 2) the location of the switches to shut-down:
  - a) the engines;
  - b) the 12 Vdc power supply; and,
  - c) the bilge blower system.
- 3) the location of, and instructions on the operation of, every hand-held portable fire extinguisher on-board as well as what type of fire(s) it should or should not be used on.

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

#### I. THE FIRE OR EMERGENCY EVACUATION PLAN

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

- 1) The location of the Personal Flotation Device (PFDs), life vests and how to don them;
- 2) the location and operation of any other emergency flotation equipment such as a life raft;
- 3) the speedy operation of the forward hatch; and,

4) how to quickly summon help by:

- a) Using the hailing/emergency channel of the on-board VHF (in inland or coastal waters) or the single side-band radio (past the continental limits);
- b) When and how to use flares and/or daylight visual distress signals;
- c) the use of the orange and black distress flag; and,
- d) the Emergency Position Indicating Radio Beacon (EPIRB).

#### J. THE USE OF PERSONAL FLOTATION DEVICES

By federal regulation and most state laws, all vessels, powered or not, are required to have one (1) proper size U.S.C.G. approved PFD readily available for each adult and each child on board (commonly called a life preserver or life jacket). If your vessel is not used commercially, PFDs may be Type I, II, or III. Bertram furnishes four (4) Type II buoyant vests, adult size (90 pounds or more). This type of Personal Flotation Device (PFD) can turn its wearer to a vertical or slightly backward position in the water. The vests are high visibility orange and comply with the U.S. Coast Guard requirements for a Type II device and carry the U.S. Coast Guard's approval label. Type II PFDs come in four sizes, adult (90 pounds plus); child medium (50 to 90 pounds); child small (30 to 50 pounds); and, infant (less than 30 pounds).

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

The recommended water entry technique while wearing a PFD is to wrap both arms as-tightly-as-possible around the chest, under the chin to protect the face and keeps the PFD from riding up. Tuck the head down into the pocket made by the folded arms. Always jump into the water feet first. Keep the feet and knees together and the knees slightly bent.. As soon as you are in the water you should join others for mutual assistance and warmth.

Bertram furnishes only adult sized PFDs and the U.S. Coast Guard requires that everyone on-board, including children, have the correct size PFD. Please keep in mind that putting PFDs away wet and/or stored in a damp locker promotes mildew and hastens deterioration. They should be thoroughly rinsed off in fresh water, dried, and stored in a cool dry place out of direct sunlight. Storage should include being kept away from oil, paint, and greasy substances. In this connection, you should know that for purposes of satisfying the legal requirements, the U.S. Coast Guard does not consider as "Readily available" any



PFDs found left in their original plastic wrappers since persons under stress may be unable to get them out quickly.

#### K. THE RING BOUY

Federal regulation also requires at least one (1) U.S. Coast Guard approved throwable Type IV life ring or buoyant cushion. This device must be carried where it is IMMEDIATELY AVAILABLE to those on deck.

Bertram supplies a U.S.C.G. approved 20-inch diameter ring buoy with mounting brackets for mounting in a suitable location. Bertram recommends that you attach about 60-feet of light line to the ring buoy. You may add other on-board "throwables" and/or replace it with any other approved Type IV device if desired.

#### L. RADIOS AS EMERGENCY EQUIPMENT

The use of a marine radio as a method of obtaining help in an on-board emergency cannot be over estimated.

#### M. MANEUVERING

Your Bertram has contra-rotating twin propellers (the propellers rotate in opposite directions) in order to balance the torque. When you engage one engine in forward gear, and the other in reverse gear, the boat will turn completely around in its own length if your twin rudders are in the center position. You can make such a turn in either direction. With the port engine forward and the starboard engine in reverse you will turn clockwise. With the starboard engine forward and port engine in



reverse you will turn counter-clockwise. You can accentuate the spin by applying rudder in the spin's direction. This feature can be used when docking parallel to a dock or pier. Approach at a slow speed and at a 30° angle and if possible against tide flow or wind, whichever is greater. When your bow is about 5 feet from the dock, put the dockside engine in neutral and the far side engine in reverse. This will reduce your forward movement and bring your stern alongside the dock. Docking can usually be accomplished with the clutches alone. No steering or use of the throttle is required.

#### N. SINGLE ENGINE RUNNING

There may come a time when only one engine is operating, so before such a situation occurs it would be wise to practice with one engine to learn how the boat handles. Note that your vessel must be moving fairly fast after a dead stop before the rudders will make the correction to the desired course. Also notice that with only one engine, steering while in reverse is very poor.

#### O. DAMAGED UNDERWATER EQUIPMENT

```
*****
*
*                               CAUTION
*
* Only under EMERGENCY CONDITIONS should your
* Bertram be operated at cruising speed with
* a vibration caused by damaged propellers or
* running gear. Seek a tow, or, if necessary,
* proceed with EXTREME CAUTION at IDLE SPEED.
*
*****
```

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

#### P. VESSEL SPEED

```
*****
*                                     *
*                               CAUTION *
*                                     *
*   Prolonged operation at or near wide open *
*                                     *
*   throttle will shorten engine life. *
*                                     *
*****
```

Your Bertram handles easily and creates little wake at slow speeds. As you increase speed, she will initially increase her trim-angle, that is, her bow rises. She will then start to level off and assume a planing attitude. Do not hold her at her maximum trim-angle longer than is necessary. Take note of your engine revolutions-per-minute (RPMs) at maximum trim-angle. Then cruise either under that speed or over it. For maximum fuel economy and to prolong engine life, your top cruising speed should be 3200 R.P.M..

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

## Q. RUNNING AGROUND

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

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

Over the years, an active boater may sooner or later hit a piece of floating debris (flotsam) and/or run aground. After either accident, you must immediately protect yourself and your vessel. You can minimize vessel damage by taking the following steps in order:

- 1) Resist the natural impulse to "throw" the transmission into reverse and instead, pull both throttles back to reduce the engine speed to idle or less than 1000 RPM.
- 2) Then shift both clutches into neutral.
- 3) Depending upon whether you have struck a piece of flotsam or have run aground take the following steps:



- 3.a) If aground, stop both engines.
- 3.b) If you have struck a piece of flotsam, scan the waters ahead and behind for additional flotsam to see if it is safer to proceed or to try to back out of danger.
- 4) Then leave the danger area at the slowest possible speed.

#### R. RECOMMENDATIONS FOR REFLOATING VESSEL

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

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

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



- 1) First, determine the location and extent of any hull damage. Bertram hulls are among the strongest made, but running any vessel up onto a sharp coral reef or a pointed rock can damage it. If necessary, make a patch using one or more of the two-part, emergency, fast-setting epoxy, hull-patch kits, readily available at marine hardware stores. These can be applied to almost any hole from either inside or outside your Bertram as the situation requires. At least one of these kits should be a part of your emergency supplies. Otherwise, cram anything available into the hole to stop or at least cut down the water coming in.
- 2) Once your water tight integrity has been established or restored, and you have determined that you are better off afloat than grounded, break out your anchor and prepare to set it off of your stern as quickly as possible to prevent being driven further aground.
- 3) For maximum effectiveness, set the anchor as far behind your vessel as available line permits with an offset to the port or starboard to compensate for the wind or current, whichever is stronger.
- 4) If two anchors are available, depending on the sea conditions it is usually worthwhile to take the time and effort to put them both out, one off the port quarter and one off of the starboard quarter. By pulling first on one line and then on the other, this arrangement may make it possible to "walk" your vessel off.

5) In any case, ALWAYS keep tension on the kedje line. If you cannot "kedje" 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.

#### S. 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.

#### T. VIBRATIONS

Should you either run aground 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 a vibration is noticed, proceed to dockside at the reduced speed. Depending on the damage done, it might be necessary to shut down one engine.

#### U. TOWING

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

```

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

```

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

- 1) Most recreational type boats do not have suitable deck fittings for towing operations.
- 2) the boating public in general has both a limited knowledge and practice of good seamanship; and,
- 3) boating personnel sometimes failed to conform to good seamanship practices through inexperience and/or expediency.

2. Personnel Safety. In all towing operations the primary objective is to ensure the personnel safety on both vessels. Thus the first goal always is to save lives and avoid inflicting personal injury. The saving of property is only secondary and must NEVER take precedence over personal safety.



## V. NAVIGATION and RUNNING LIGHTS

Your Bertram comes with a complete set of navigation/running lights installed that 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 place of the U.S. Inland Rules. For U.S. navigable waters, you must check the Great Lakes and Western Rivers Rules.

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

### NOTE:

All of the navigation lights furnished on your Bertram meet the current 72 COLREGS requirements. However, it is the legal responsibility of the vessel's owner to:

- a) Ensure that in the event of vessel superstructure (i.e., the addition of a fishing tower, radar, and/or other electronic equipment), that the required areas of visibility for each of these lights is not obstructed.
- b) Ensure that his vessel complies with any future changes to the existing 72 COLREGS.



## W. VISUAL DISTRESS SIGNALS

```
*****
*
*                               WARNING
*
* DO NOT USE AUTOMOTIVE ROAD FLARES AS YOUR RE-
*
* QUIRED NIGHT SIGNALS.  THE "SLAG" FROM ROAD
*
* FLARES CAN CAUSE INJURY AND/OR START A FIRE.
*
*****
```

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

If you choose to carry pyrotechnic signaling devices, it is your responsibility to ensure that they have not exceeded their expiration date (42-months from date of manufacture). This expiration date is clearly marked on the approval label. Bertram does not supply such equipment. You, the operator, should study the latest issue of the Coast Guard pamphlet "Visual Distress Signals for Recreational Boats", copies of which are available from the Department of Transportation, U. S. Coast Guard.

## X. SOUND SIGNALS

The length of this vessel falls within the Coast Guard category that requires both a bell and a whistle or a horn. Bertram has equipped this vessel with a suitable bell (unmounted) that satisfies the Federal Requirement for use in fog and a dual electric horn that is suitable for the sound signals required by the Rules-of-the-Road, fog, and other signaling. The horn push-button switch is on the flybridge control console.

## Y. CALLING AT PORTS AWAY FROM HOME

You are not likely to have trouble with shore current in the United States. However, you should be careful when cruising abroad, check shore power for 120 Vac, single-phase. Also, when cruising abroad, try to purchase fuel equal to American standards. (See Fuel Systems section for requirements in your engines.) Carry extra fuel filters with you, since replacements may be necessary.

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

## Z. LEAVING YOUR BERTRAM

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

1. Switch "OFF" all ignition or engine circuits.
2. Lock all doors, windows, and hatches.

3. Make sure mooring lines are well secured with adequate allowance for the tide.
4. Fenders and spring lines should be set.
5. The Automatic bilge pump should be left on the "AUTO" position. If for any reason your vessel is taking on water, the batteries should be checked frequently.

#### AA. HULL EFFICIENCY

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

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



## BB. ATMOSPHERIC CONDITIONS

There are additional operational considerations for you to keep in mind while operating your Bertram; for instance, engine performance will be affected to a slight degree by local atmospheric conditions. Among other things, your engines develop slightly less power in warm air temperatures. Similarly, dry air and high altitude reduces power. If you cruise regularly in waters well above sea level, have a certified mechanic make the necessary adjustments to your engines to get the correct air/fuel mixture. Planing hulls perform slightly better in salt water than in fresh water due to the difference in displaced water weight.

## CC. MARINE GROWTH

To obtain the maximum hull efficiency, keep the boat's bottom free of marine growth, including grass. Any bottom growth will cause an increase in her drag as she moves through the water, decreasing speed and fuel efficiency.

## DD. WATER IN THE BILGE

Keep the bilges dry to minimize excess weight and sloshing. Bilge water's added weight causes your vessel to ride lower. This will increase drag, reduce speed, lower fuel efficiency, and decrease overall performance. The bilges are kept dry by the sump and bilge pumps.

## EE. DRAFT

To avoid going aground or damaging your underwater gear in shallow waters, it is vital you know how much water your vessel draws (her draft). Any vessel's draft varies depending on load. Bertram suggests that you determine the draft at or near the maximum load you expect to be carrying. 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 step 1) from the docking plan dimension given for the distance between the covering board top (at the transom's center) to the propeller bottom. This is your vessel's maximum draft.
- 3) Record this dimension where it will be readily available, for instance on your compass deviation card.

## FF. HEIGHT

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

## GG. TRIP PREPARATION

To minimize problems and to get the maximum pleasure from your Bertram, we suggest that you go over a written checkoff list each time you use her. The following items should be on this list:

### BEFORE LEAVING DOCKSIDE CHECKOFF SHEET

- ☐ 1) Pump bilges as needed (check bilge pump operation).
- ☐ 2) Check lubrication oil levels.
  - ☐ PORT a) Engine. ☐ b) Transmission.
  - ☐ STBD a) Engine. ☐ b) Transmission.
- ☐ 3) Check coolant levels.
  - ☐ PORT Engine.
  - ☐ STBD Engine.
- ☐ 4) Check the fuel, coolant, and oil systems for leaks.
- ☐ 5) Check the seawater strainers, clean if necessary.
- ☐ 6) Check that all seacocks are open.
- ☐ 7) Check fuel tank level.
- ☐ 8) Check fuel/water separators, empty if needed.
- ☐ 9) Check the fluid level in all batteries.
- ☐ 10) Check the operation of the navigation and anchor lights.
- ☐ 11) Check that there is one correct sized life jacket (PFD) for every one aboard.
- ☐ 12) Check that the throwable Type IV PFD (life preserver) is on-board and is in its mounting bracket.
- ☐ 13) Check that current visual distress signals are on-board.
- ☐ 14) Check that the portable fire extinguishers are on-board, are usable, and are in their mounting brackets.
- ☐ 15) Check that your first aid kit is on-board.
- ☐ 16) Check that the necessary charts are on-board.
- ☐ 17) Check that communications and navigation equipment works.
- ☐ 18) Check the latest marine weather forecast.
- ☐ 19) Test the Fire/Bilge Flood alarm system.
- ☐ 20) Check the Fire Extinguisher System Monitor Panel.
- ☐ 21) Top off the fresh water tank.



## HH. PREPARATIONS FOR ROUGH WEATHER

\*\*\*\*\*  
\*  
\* CAUTION \*  
\*  
\* Keep foredeck hatch secured and engine-com- \*  
\* partment hatches in place while underway to \*  
\* prevent bilge flooding. \*  
\*  
\*\*\*\*\*

Among the several compelling reasons to buy a Bertram are its long tradition of exceptional strength and its seaworthiness. However, remember the basic fact that there is no vessel, regardless of its size and strength is completely immune to the dangers of heavy weather. Therefore, when you prepare for heavy weather, or if you run ahead of a heavy following sea, ensure that all hatches are in place. You should also be aware of the fact that in case of fog or other limited visibility, you are required by the law (Rules of the Road) to:

- 1) SLOW DOWN. If you are navigating in waters marked on your charts as falling under the Inland rules, you are required to slow to a "MODERATE SPEED" in accordance with the Inland Rules. Under the International Rules you must slow to a "SAFE SPEED". Admiralty courts have generally held that a "safe speed" is the maximum speed at which a vessel can come to a complete stop in one-half (1/2) the existing visibility.
- 2) Post at least one lookout (besides the helmsman) who's sole responsibility it is to watch for vessels and other hazards to navigation.

Therefore, in anticipation of the inevitable rain, fog, high winds, and/or rough seas that you will eventually encounter, here are a list of preparations that you will want to take. This checklist is suggested as an agenda of things that you should do before a heavy weather situation gets out of control. You will undoubtedly have several of your own items to add to this list:

#### HEAVY WEATHER CHECK LIST

- ☐ 1) Close and secure all hatches, doors, and windows.
- ☐ 2) Use the MAN (manual) bilge pump switch positions to ensure that all bilges are pumped dry. This should be repeated as often as seems 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 life jackets (PFDs) 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 what ever emergency gear you feel may be needed, such as flash lights, the first aid kit, a sea anchor, distress flares, etc.
- ☐ 7) Plot (prepare) 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, it is better to have all hands busy rather than sitting and worrying, therefore inform your passengers of the following:
  - a) what you are doing; and,
  - b) what you want each of them to do or NOT to do.

## II. THE BEAUFORT SCALE OF WIND FORCE

To more accurately and quickly transmit wind and wave information over the radio, the British "Royal Meteorological Office" developed a table (with comparison photographs) of each of the thirteen wind forces of the Beaufort scale (see Table D-1, The Beaufort Scale of Wind Force). Some of these photographs are in Chapman's text "Piloting", the basic text book for boaters.



TABLE D-1, THE BEAUFORT SCALE OF WIND FORCE

| BEAU-<br>FORT<br>SCALE | DESCRIPTION     | SEA CONDITIONS                                                                             | WIND<br>SPEED<br>(KNOTS) | WAVE<br>HEIGHT<br>(FEET) |
|------------------------|-----------------|--------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| 0                      | Calm            | Sea 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, & spray                                                 | 17 - 21                  | 6.0                      |
| 6                      | Strong breeze   | Large waves, white foam crests, & 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, & 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                     |

## ELECTRICAL SYSTEMS

### NOTE:

Wiring Diagrams for the 12 Vdc and 120 Vac Systems are in a separate package.

#### A. GENERAL

Your boat has two electrical systems: a 12 Vdc system, protected by fuses which operates on power from the engine starting batteries and a 120 Vac system, protected by circuit breakers that is powered from a shore connection.

#### B. ELECTRICAL DISTRIBUTION PANELS

The 12 Vdc distribution panel is located in the cabin and the 12 Vdc main battery disconnect switch and fuse panel is located in the engine-compartment. The 120 Vac distribution panel is set into the inboard side of the aft dinette seat. The shoreline main a.c. circuit breaker is located in the port cockpit locker with the shoreline.

#### C. GROUND AND BONDING SYSTEM

Your Bertram is fitted with a bonding system which is designed to minimize stray current corrosion.

1. Bonding. As a part of the electrical system, your Bertram is equipped with a bonding system designed to minimize stray current corrosion which consists of two main grounding straps running fore and aft through the bilge area. These main grounding straps are connected by jumpers to the underwater fittings and hardware as well as the engine block. All on-board

ac equipment is also connected by a grounding conductor to this system. This is to improve protection against electrical shock.

2. Electrolysis. If your vessel is going to remain idle for extended periods of time, 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 the vessel's bonding system.

#### D. 12 VDC SYSTEM

##### 1. Batteries.

There are two batteries in the engine-compartment: one for the starboard engine and one for the port engine. The batteries are charged by the engine alternators or by an optional ac converter. These batteries are always independent and momentary paralleling of both batteries is for assistance in starting only.

##### 2. Battery Switches.

The main engine battery switches are heavy-duty rated. To power your boat's 12 Vdc system these switches must be "ON" (these switches should be turned "OFF" when the boat is unattended, especially for long periods of time). The battery switches do not:

- 1) control power to the alarm system, bilge pumps, or the Halon Fire Extinguisher System (these circuits are continually energized for the protection of the boat and are protected by fuses at the top of the Battery Switch panel), nor



2) control the optional converter output used to keep the batteries charged when the engines are off or when the boat is unattended (providing the 120 Vac shoreline is plugged in and operating). The converter d.c. wires are protected by two 45A fuses behind the Battery Switch panel.

```
*****
*
*                               CAUTION
*
* The BATTERY SWITCHES are designed for use
* under normal conditions. If the switch is
* used to open the circuit during engine crank-
* ing, the switch should be replaced to avoid
* possible future failure.
*
*****
```

```
*****
*
*                               CAUTION
*
* The BATTERY SWITCHES should NOT be opened
* while engine is running. To do so may dam-
* age diodes in the engine driven alternator.
*
*****
```

### 3. Distribution.

Each item requiring dc power is protected by its own fuse. A blown fuse indicates a problem in the circuit or in the equipment being controlled by that fuse. The cause of the problem must be found and corrected to avoid further inconvenience. Provisions



```

*****
*
*                               CAUTION
*
*   When CONNECTING or DISCONNECTING shore cord,
*   ensure that all ac panel breakers are "OFF".
*   This prevents any arcing at the shore cord
*   connections. Shore cord has a twist-lock
*   fitting. Ensure it is locked properly to
*   prevent arcing and damage to the fitting.
*
*****

```

The shore power cord is permanently connected to the main a.c. circuit breaker inside the port cockpit locker. The shore line is wired in accordance with current industry standards. However, you may occasionally find some dock outlets improperly wired. For your protection, the 120 Vac distribution panel has lights to indicate normal or reversed polarity. If the amber light is lit, the polarity is correct and you may safely turn on the panel circuit breakers. If the red light is lit, the polarity is reversed and must be corrected on the dock before turning on the circuit breakers.

## 2. Distribution.

```

*****
*
*                               WARNING
*
*   BEFORE OPENING THE 120 VAC DISTRIBUTION
*   PANEL OR SERVICING THE 120 VAC EQUIPMENT, BE
*   SURE TO DISCONNECT SHORE POWER CORD.
*
*****

```



All ac circuit breakers on the Bertram 28 are of the two pole common trip type that disconnect both current carrying conductors (black wire and white wire). The white wires (ground potential) are isolated from the boat ground. It is recommended that any future ac equipment be installed in the same manner using the proper circuit breakers and wire size.

The Norcold refrigerator operates from either 12 volt battery power or from 120 Vac power. When turned on, it operates on battery power until 120 Vac shore power is applied. It then automatically switches to ac power thus preventing further battery drain. When the refrigerator is in use, both the ac and dc "refrigerator" breakers should be "ON". The Norcold can not be operated on 50 Hz shore power. If your boat has the European Shore Power System, a.c. power to the refrigerator is disconnected.

### 3. Galvanic Isolator.

The galvanic isolator on your Bertram is a solid state device designed to stop the accelerated underwater corrosion that can occur when the vessel is dockside and connected to shore power. This is a passive unit that requires no maintenance and it acts as an electrical filter to prevent the flow of dc galvanic corrosion currents through the power system (green "safety") grounding conductor without sacrificing the safety features of the ac grounding system.

To minimize shock hazard when your vessel is connected to shore power, the shore power green grounding conductor is electrically connected to the vessel grounding system. This, in effect electrically connects your vessel's underwater metal fittings (bonding system) to the shore ac grounding system and to other vessels which are connected to the shore grounding system. This condition can cause difficulties, in that your expendable zinc anode system may be overloaded to the point where it cannot furnish sufficient protection against this type of corrosion. To stop the overload, the galvanic path must be cut without cutting the green grounding conductor in your shoreline. To do this, a galvanic isolator is wired in series with the (green) shoreline grounding conductor and the ac panel or power selector switches. The isolator has a buzzer alarm which is activated by ac current flow in the shoreline grounding conductor either from your vessel as an ac stray current through the bonding system or from the shore power source. This buzzer will not be activated by the on-board ac generators.

A grounding conductor is not normally a current carrying conductor; however, there are abnormal conditions when an ac current may flow in this conductor. Two of the possible conditions are:

- 1) A breakdown of the insulation between a current carrying conductor and the grounding conductor.

- 2) Incorrect or inadequate wiring on shore or on your vessel.

```
*****
*                                     *
*                               WARNING *
* THE ABNORMAL CONDITION MUST BE CORRECTED. DO *
* NOT DEFEAT THE BUZZER OPERATION. AC CURRENT *
* FLOW IN THE GROUNDING CONDUCTORS MAY HAVE A *
* VOLTAGE POTENTIAL SUFFICIENT TO CAUSE SERIOUS *
* INJURY OR DEATH BY ELECTRIC SHOCK. *
*****
```

#### 4. European Shore Power (Optional).

Bertrams equipped with the optional 240 Vac European Shore Power have no need for polarity indicator lights because they use a step-down transformer to polarize the ac system.

1. If this boat is to be operated in foreign ports that have shore power that is 220 Vac to 250 Vac and 50 Hz, instead of 120 Vac 60 Hz, the European system must be installed on the boat.
2. This system uses a transformer built into the boat that provides 120 Vac on the a.c. system when using 240 Vac shore power.
3. The standard ac equipment remains unchanged as it was selected to be able to work on either 50 or 60 Hz current. Motor driven equipment will be only slightly less efficient on 50 Hz.
4. The Wiring Diagrams include a plan that shows how the transformer is connected.



5. If a boat equipped with the European transformer system docks in American or similar ports where 125/250-Vac, 60 Hz shore outlets are available, it will be necessary to remove the 125 Vac male connector on shore end of the shore cord and replace it with a 125/250 Vac male connector. The shore cord black and white wires should be connected to the "x" and "y" terminals (either way is OK) and the green wire to the green terminal. No neutral wire to the "w" terminal is required. If the outlet on the dock is 125/250 Vac, 50 amp "Crowfoot type", then an adapter is required in addition to the new plug on the shore end of the cord.
6. When the boat is in foreign ports, it will be necessary to make special adapters or to replace the shore end fittings with suitable connectors. In either case the green wire should be matched to the on-shore grounding wire. The white wire should be connected to the neutral source, and the black wire should be connected to the "hot" wire.
7. The operation of the European System is identical to that described for use with the standard system.

#### F. Circuit Breakers and Fuses.

If a breaker trips or a fuse blows repeatedly, the problem should be corrected. In no circumstance should the breaker or fuse be replaced with one having a higher amp rating. A higher amp. rating could overload the circuit and cause a fire.

## MECHANICAL SYSTEMS SECTION

### A. FUEL SYSTEM

#### 1. The Fuel Tank.

The fuel tank is made of molded fiberglass and fire retardant resin. The tank is constructed in accordance with accepted standards and is not part of the hull, but is laminated to it. A small centerline cockpit hatch provides access to the tank fittings. The fuel gauge sender, with sight gauge, is located there. The remote gauge is located on the flybridge control station. There are sealed anti-siphon valves in each supply line to the main engines. The anti-siphon valves are connected directly to the hexagon shaped head of the suction tube which extends to the bottom of the tank. The lower end of this tube is fitted with a strainer.

#### 2. Tank Vent and Fill.

The fuel fill fitting is installed on the starboard side of boat above the sheer fender, the vent fitting is directly below it.

#### 3. Fuel Supply Lines.

The fuel hoses lead to each engine and a shut-off valve is provided at each main engine for servicing filters.

#### 4. Fuel Filters.

A filter is mounted on the starboard side of each main engine. They should be replaced at least once a year. Complete inspection of entire engine fuel system for any possible leaks or damage should be performed at the same time. Spares should be

carried on-board, for immediate replacement, if water in the fuel is encountered.

```
*****
*                                     *
*                               WARNING                               *
*                                     *
*                         SHUT OFF FUEL VALVES                         *
*                                     *
* BE CAREFUL WHEN OPENING FUEL FILTER OR ANY                         *
* OTHER FUEL FITTING. GASOLINE IS EXTREMELY                         *
* FLAMMABLE AND HIGHLY EXPLOSIVE UNDER CERTAIN                     *
* CONDITIONS.                                                         *
* ALWAYS STOP ENGINES AND DO NOT SMOKE OR ALLOW                     *
* OPEN FLAMES IN THE AREA WHEN FUEL FITTINGS                       *
* ARE OPEN.                                                           *
*                                     *
*****
```

#### 5. Type of Fuel.

See Engine Manual for type of gasoline.

### B. PROPULSION SYSTEM

#### 1. Engines.

All necessary data and information about the engines are contained in the Manufacturer's Engine Manual and are not repeated here. Just a reminder, engine life and performance is dependent on the way they are cared for, so follow the manufacturer's instructions and watch the instruments carefully.

Check the engine oil level each time the engines are to be run. If they are fresh water cooled also check the coolant level.



## 2. Marine Gears.

The reverse gear is hydraulically operated. Information and maintenance procedures can be found in the Engine Manual. To check fluid level, run engine at slow speed, in neutral, for a short time. Stop engine and immediately check level on gear's dipstick. Use Type "A" Transmission fluid in the gear.

## 3. Propeller Shafts.

Information as to size, length, and shaft material are in the "Technical Data" section of this manual.

## 4. Propellers.

Information on the propellers shipped with your Bertram are in the "Technical Data" section of this manual. The propellers recommended are those with which your boat was tested.

The combination of propeller diameter and pitch has been selected to give maximum efficiency based on engine power, its rated RPM, hull design, and the weight of the vessel. The propeller is one part of a balanced propulsion system. Any changes in its size or pitch could reduce engine life or performance and place undue stress on other components of the running gear. When you find it necessary to replace a propeller, it is important to use the same type, diameter, and pitch as the original.

```

*****
*                                     *
*          CAUTION                  *
*                                     *
* Only in an emergency should the boat be oper- *
* ated with vibration caused by damaged propel- *
* lers or running gear. Seek a tow or proceed *
* with extreme caution at idle speed.         *
*                                     *
*****

```

### 5. Engine Shaft Alignment.

At the factory your engines were aligned properly but they should be checked periodically to insure proper alignment and performance. The initial alignment check is considered part of the pre-delivery preparation. After delivery, alignment is an owner maintenance responsibility. It is good practice to open the coupling before haul-out and then check alignment after launching. Let the boat settle in the water for a day or two before making final alignment adjustments. We recommend the following:

- 1) Remove all bolts in the coupling flanges at the end of the marine gear.
- 2) Slide shaft aft until the flanges are about 1/4 of an inch apart.
- 3) Press the flanges together by hand with a 0.010-inch feeler gauge between them.
- 4) Insert the feeler gauge at 90° intervals around the flanges to assure equal clearance at all faces. If alignment is correct, the 0.010 or 0.013 feeler gauge will be tightly gripped

at all points around the edges of the coupling. In other words, the faces when touching, should be no more than 0.003 of an inch apart at any other point.

- 5) If a feeler gauge is not available, use 4 strips of paper about 1/2-inch wide and space them equally around and between the flanges. By gently pulling on each, the relative amount and direction of misalignment can be determined.

Engine alignment is best accomplished by an experienced mechanic working with the proper tools. Keep this in mind before trying to move a marine engine on its foundation.

#### 6. Shaft Log and Stuffing Box.

The shaft log is the tunnel in which the propeller shaft turns. In your Bertram the shaft log is of fiberglass construction. Inside the boat, a stuffing box is attached to the shaft log by a flexible hose held in place by hose clamps. The flexible hose serves to absorb any normal shaft vibration.

The stuffing box prevents water from leaking along the shaft into the boat. The key stuffing box components are the braided flax packing and the packing gland. Keeping the packing gland tight keeps the stuffing box from excessive leaking. It is normal to have a slight drip from the stuffing box as this serves as a lubricant, but if leaking is excessive, the packing gland should be tightened. Be careful not to overtighten as this will glaze the packing and score the shaft. If packing is too tight, the gland will get too hot to hold with your hand. When running at



If it becomes necessary to repack the stuffing box:

- 1) remove the boat from the water;
- 2) remove the sprayshield;
- 3) unbolt and slide the packing gland forward on the shaft;
- 4) remove the old packing;
- 5) install seven (7) separate 1/4-inch by 1/4-inch rings of new tallow flax packing (Do not spiral the rings around the shaft, each packing ring must be separate);
- 6) slide the packing gland aft;
- 7) tighten it to a point where the shaft will not turn to seat the packing;
- 8) back the gland off until shaft is free and there is a slight drip;
- 9) run the shaft for a while and reset if necessary; and
- 10) replace the sprayshield.

Remember that a slight drip of water is necessary for proper lubrication.

#### 7. Shaft Log Sprayshield.

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

#### 8. Rudder Stuffing Box.

The rudder stuffing boxes are packed in a similar manner and with the same material (use 5 rings instead of 7) as the propeller stuffing boxes, except it is not necessary that they drip just that the rudders turn freely.

#### 9. Installation of Propellers.

The installation of the propeller completes the propulsion system of the boat. With the amount of power being transmitted at this point, it is important that the fitting of shaft to propeller be done properly in order to provide maximum shaft and propeller life. If necessary to replace either propeller or shaft, follow these guidelines:

- 1) Inspect the shaft keyway and key for proper radii.
- 2) Each propeller is keyed to a shaft with a key. A locating pin in the key, positions it properly. Check that the key fits snugly in its slot.
- 3) Check the fit of the key in the propeller.
- 4) If the key does not fit, carefully file the propeller keyway using gentle and end even strokes along the whole keyway.
- 5) Place the propeller on the shaft (without the key) and seat the propeller on the shaft taper. The fit should be tight with no wobble and no space between the shaft and the forward and aft ends of the propeller hub.

- 6) Mark the shaft at the hub forward end with a sharp pencil.
- 7) Remove the propeller.
- 8) Insert the key in shaft keyway ensuring that the locating pin is properly seated in the propeller shaft.
- 9) Reinstall the propeller.
- 10) Ensure that the propeller is fully seated with the forward end of the hub touching the pencil line you made in Step 6.
- 11) Use a feeler gauge to check for 0.006 to 0.010 inch clearance between the top of the key and the bottom of the keyway in the propeller hub.
- 12) Remove the propeller.
- 13) Coat with any nongraphite, water-proof grease.
- 14) Reinstall the propeller.
- 15) Install the plain (full) nut.
- 16) Torque the nut with a wrench to seat propeller.
- 17) Remove the full nut and install the jam (half) nut.
- 18) Tighten the jam nut slightly more than finger tight.
- 19) Install the full nut.



20) Lock both nuts together by holding the jam nut while tightening the full nut.

21) Install a cotter pin and bend its legs.

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

### C. TOILET SYSTEMS

```
*****
*
*                               WARNING
*
* Overboard discharge of waste from this type of toilet system
* is prohibited by Federal and local laws in restricted waters,
* In addition, it is required that the seacock be locked in a
* closed position. This may be accomplished by using a pad-
* lock, a non-releasable wire-tie, or by removing the seacock
* handle.
*
*****
```

The toilet is flushed with seawater that is supplied from a seacock under the forward end of the starboard engine. Electric power for the toilet is from a fuse on the 12-Volt d.c. distribution panel. The holding tank is installed outboard of the port engine along with a "Y" valve, a hand pump, and a discharge seacock. The "Y" valve is labeled "Holding Tank" and the "Overboard Discharge".

To bypass the holding tank, place the "Y" valve handle in the "Overboard Discharge" position and open the large discharge seacock. The electric pump on the toilet will then pump directly overboard. To pump into the holding tank, place the "Y" valve handle in the "Holding Tank" position and close the discharge seacock. Since the holding tank has limited capacity, the head has a "HOLDING TANK MONITOR" panel with amber and red indicator lights. The amber light tells you when the holding tank is nearly full and the red light tells you when the tank is completely full. When the red light is illuminated, further flushing could damage the toilet system. Two methods may be used to pump out the holding tank. In areas where overboard discharge is prohibited, the deck mounted "WASTE" fitting must be used. In this case a pump on the dock is used to pump out waste and transfer it to an approved disposal system. The discharge seacock must be closed to prevent filling the tank with seawater. In areas that permit overboard discharge, open the discharge seacock, and use the manual pump to empty the holding tank.

#### D. BILGE PUMPS

Operation of the bilge pumps is described under "Accessory Switches" in the Controls and Instrument Section of this manual.

```

*****
*
*                               WARNING
*
*   The Federal Water Pollution Control Act prohibits the
*   discharge of oil or oily waste into or upon the navigable
*   waters and contiguous zone of the United States; if such
*   discharge causes a film or sheen, or discoloration of, the
*   surface of the water, or causes a sludge or emulsion beneath
*   the surface of the water. Violators are subject to a penalty
*   of $5,000.
*
*****

```

#### E. FRESH WATER SYSTEM

##### 1. Tanks.

The two interconnected fresh water tanks are located under the cabin sole in a fore and aft position.

##### 2. Filling the Tanks.

The water fill fitting is on starboard side of the boat:

```

*****
*
*                               CAUTION
*
*   When filling tank do NOT use full city pres-
*   sure. To do so, it is possible to use more
*   pressure and volume than the vent line can
*   discharge, thereby causing the tank to rup-
*   ture. It is suggested to have the hose at-
*   tended while filling the tank.
*
*****

```



### 3. Water Heater.

CAUTION

Turning on the electricity with no water in the heater, or with the water level beneath the immersion heating element, will burn out the element in a very short time.

The automatic water heater is located behind the refrigerator. In addition to the 120-Volt a.c. power for the heater, a built-in heat exchanger is connected to the port engine cooling system which heats the water when the engine is running.

The heater's thermostat is pre-set by the manufacturer at 140° F to 145° F which Bertram recommends as maximum.

4. Water Pump.

4. Water Pump.

This pump is automatic and self-priming and maintains static pressure at 25 PSI. The fresh water system must be turned off when tank is empty.

5. Shower.

5. Shower. Showers can take a little or a lot of water. A suggestion would be to take a "sailor's shower". After adjusting the water temperature, wet yourself thoroughly, turn the shower off by using the push-button on shower head, soap up and then turn the shower back on to rinse off.

#### 6. Shower Sump Pump.

There is a shower sump below the cabin sole. It has a pump and automatic float switch to discharge the water overboard. The filter screen between pump and float switch should have routine inspection to ensure that screen remains clean.

#### 7. Dockside Water Supply (Optional).

An optional dockside water hose connection is located inside the cockpit. This feature is a convenience for use at dockside that allows the use of available water. A pressure regulator in the supply line reduces the normal city water pressure. This system cannot be used to fill the water tanks.

When leaving your boat unattended, the dockside hose should be disconnected.

### F. AIR CONDITIONING SYSTEM (Optional)

#### 1. Basic Instructions.

Before operating the air conditioning system for the first time, make sure that the sea valve is open and that the sea water intake strainer is clean and sealed. The sea water intake strainer should be rechecked periodically.

2. Operating Instructions. Before using system be sure to read and follow the Operation Manual provided by the manufacturer.

NOTE:

When starting system always check the seawater discharge on hullside to be sure that pump is operating normally.

To operate system, proceed as follows:

- 1) Corresponding circuit breaker on distribution panel should be "On".
- 2) Mode Switch should be "Off".
- 3) Turn Thermostat control fully counter-clockwise for heating or fully clockwise for cooling.
- 4) Set Fan Speed to "High".
- 5) Set Mode Switch to "Fan". This energizes the fan and the sea water pump. Check the overboard discharge to be sure water is flowing through the condensing unit.
- 6) Set Mode Switch to "Run". The compressor will start to cool or heat according to setting of the thermostat.
- 7) To set the thermostat allow sufficient time for the unit to cool or heat the room to the desired temperature. When the room temperature is comfortable, turn the thermostat knob slowly toward the center position until it "clicks" once. The thermostat is now set to maintain a constant temperature.
- 8) Select the fan speed desired. When operating on the heat cycle, allow the unit to run on low fan for 5 to 15 minutes until it begins to heat well. Then, increase fan to "Medium"



setting and run system in this position for most efficient output. On the cooling cycle, use any fan speed desired. Keep in mind, however, that the lower the fan speed, the less capacity the system has.

NOTE:

Do not use the circuit breaker to turn the air conditioning on or off. To do so may trip the breaker.

9). To turn the system off, turn the Mode Switch to "Off".

3. Thermostat.

The thermostat serves to cycle the compressor on and off. On the cooling and heating system the thermostat provides an automatic change-over from cooling to heating with a  $3.5^{\circ}$  F differential. Rotating the thermostat to the left after it has been set for cooling will cause the unit to heat. If you rotate the thermostat to the right, the unit will cool. If the thermostat is left stationary after being set, the unit will cycle from neutral to cooling if cooling is needed, or it will cycle from neutral to heating if heating is needed.

## MAINTENANCE SECTION

### A. PREVENTATIVE MAINTENANCE

#### 1. Periodic Maintenance.

The required maintenance of your Bertram during the boating season depends to a great extent on the conditions under which your boat is used. Adequate ventilation of the cabin during periods of non-use will reduce the interior maintenance and keeping the exterior waxed will minimize the exterior maintenance. In this section, a suggested preventative maintenance program is set for the boat under "average" conditions. If this program is used, it should be used in conjunction with the periodic maintenance recommended in the respective operating manuals for the engines.

#### 2. Daily.

- 1) Pump bilges as required.
- 2) Ventilate engine compartment by operating the blowers and opening the engine boxes.
- 3) Check engine lubricating oil levels, and transmission levels.
- 4) Check engine coolant levels (if fresh water cooled).
- 5) Check fuel, water and oil systems for leaks.
- 6) Visually check raw water strainers for dirt accumulation. Clean as necessary.
- 7) With engines running, check engine circulating water by observing engine exhausts. Water must be exhausting at the transom outlet.

- 8) Check the battery water level.
- 9) Check for slow drip at shaft stuffing boxes.
- 10) Top off fuel tank and water tanks at end of day's operation.
- 11) Wash down boat with fresh water.

3. Every 100 Hours or 60 Days.

The following is the breakdown of items to check and inspect associated with the area indicated.

a. Exterior.

- 1) Exterior fiberglass finish - clean and wax.
- 2) Clean all hardware and apply protective polish.
- 3) Tighten any loose fittings.
- 4) Clean all exterior seat cushions. Clean covers with a mild soap solution or light Clorox solution. Wash any cleaning materials off with fresh water.

b. Interior

- 1) Completely air out the boat.
- 2) Air out all life jackets.
- 3) If any mildew is found, thoroughly wash down the area with a mild Clorox solution.
- 4) Operate all drawers and doors. Slight adjustment may be necessary on the doors and drawers due to expansion from



moisture. Drawers can be made to slide easier by using wax or lubricant.

- 5) Check all hand fire extinguishers for full charge.
- 6) Check operation of bilge alarm float switch.

c. V-Berth.

- 1) Check operation of lights.
- 2) Check the 120 Vac duplex outlet for operation.
- 3) Check bow hatch for operation and water tight fit.

d. Head

- 1) Check operation of lights.
- 2) Check the 120 Vac duplex outlet for operation.
- 3) Check hot and cold water faucets for operation.
- 4) Check shower sump pump for operation and clean filter.

e. Galley.

- 1) Check hot and cold water faucets for operation.
- 2) Check sink drain for pluggage and leaks.
- 3) Check lights for operation.
- 4) Test GFI outlet.
- 5) Clean and check stove for operation.

- 6) Check refrigerator for operation. Defrost and clean refrigerator with a solution of baking soda.
- 7) Check forward bilge pump and float switch.

f. Engine-Compartment.

- 1) Follow periodic preventative maintenance for engines and marine gears as specified in the engine manual.
- 2) Check stuffing boxes. A slight drip is desirable as it lubricates the packing. If the stuffing box is leaking excessively, tighten the nuts slightly to draw down the gland on the backing.
- 3) Check exhaust hoses and hose clamps.
- 4) Check the raw water strainers. These strainers should be free of any foreign matter. If they need cleaning, close the appropriate seacock and loosen the wing nuts on the top of the strainer body. Swing the top to one side and remove the basket for cleaning. Replace the basket, secure the top, reopen the seacock, and check for leaks.
- 5) Check engine mounting bolts to see that they are tight. If bolts are found to be loose, realign the engine. If the coupling must be broken loose, lubricate coupling bolts.
- 6) Check all hoses on engines and hose clamps.
- 7) Check fuel lines, flare nuts, and valves for leaks.

- 8) Check control cable brackets for tightness. Lubricate the threaded cable ends and check cotter pins.
- 9) Check electrical connections. Clean if corroded.
- 10) Check exhaust blowers for operation and hoses for leaks.
- 11) Check wiring to see that it is not rubbing or wearing the insulation.
- 12) Check gauge senders and alarm system make-break switch wiring and tightness.
- 13) Check fresh water system lines and fittings for leaks.
- 14) Check fresh water pump for condition and operation.
- 15) Check air conditioning -(if installed).
  - a. Condensing unit
  - b. Hose and hose clamps
  - c. Clean raw water strainer
  - d. Operation of pump
- 16) Check all battery cells with hydrometer. They should be between 1.250 and 1.265. Add water if necessary.
- 17) Check battery terminals, remove the cables, and scrape and coat the terminals with Vaseline.

See Warning in Battery Care Instructions of this section.

- 18) Clean out stringer limber holes.



19) Remove and clean screen on bilge pump and check operation of pump.

20) Check steering reservoir fluid level and pressure.

g. Lazarette

- 1) Inspect all fuel lines, flare nuts and valves for leaks.
- 2) Inspect rudder ports for leaks. The rudders use a packing gland different from the propeller shaft stuffing box. However, the same procedure is followed to stop excessive leaking.
- 3) Check all fittings for steering system; clevis bolts, rudder arms, lock nuts and lock bolts for tightness and smooth operation. Lubricate tie rod end fittings.
- 4) Check operation of the optional bilge pump and float switch.

h. Flybridge Control Station

- 1) Check operation of all switches, gauges, and controls.
- 2) Check electrical connections for tightness and corrosion.
- 3) Lubricate control heads.

4. As Required.

Haul boat out of the water, scrub bottom if necessary, and repaint with anti-fouling paint.

### 5. Crevice Corrosion.

It is advisable to rotate the shafts about every 7 days to prevent a condition called crevice corrosion, occurring on the shafts in the area of the struts and shaft logs. This might occur if shafts remain in the same position over a long period of time when the boat remains in water, as in wet storage.

## 6. Electrolysis.

When the boat remains idle for extended periods of time, it is suggested that a zinc "fish" be placed over the side by means of a heavy wire with a clip attached at the other end. The clip should be attached to an engine or gear with the "fish" remaining in the water. This will control electrolytic action affecting the components mounted in or on the hull. When the "fish" has greatly disintegrated, it should be replaced as it will no longer be effective. These items can be purchased from marine stores or made up if desired. Remove the zinc from the water before any attempt is made to move the boat under power.

## B. STORING YOUR BERTRAM

1. Dry Storage.

```
*****  
*                                     *  
*                               CAUTION                               *  
*                                     *  
* Discharged batteries are subject to severe                       *  
* damage if exposed to freezing temperatures.                      *  
* Store all batteries in a fully charged cond-                   *  
* ition and maintain charge during storage.                       *  
*                                     *  
*****
```

Indoor storage is generally preferred if there is good ventilation and the location is otherwise safe and dry. For any special instructions on covering for outdoor storage, refer to "Docking Plan" drawing. Keep the bilges dry and open all valves and/or seacocks. Drain all tanks, water lines, and pumps of water to prevent damage from freezing. Add antifreeze to any low position lines that can't be drained. In warm climates, draining will prevent water stagnation.

It is always best to store electrical equipment in a warm, dry place over the winter. If possible, remove the fresh water pump and motor assembly for storage. If the pump is to be left on the boat through the winter, it must be thoroughly drained. Remove the inlet and outlet connections from the pump. Open the windows and hatches sufficiently to allow air to circulate. Also, leave the locker doors and drawers open. Dry out the refrigerator. If possible, remove the mattresses and cushions, clean and store in a dry place. If they must be left aboard prop up on one end for maximum ventilation.

Synthetic material lines need only proper handling and occasional cleaning. Natural fiber lines should be dried and kept in a well ventilated place.

With any toilet, after water supply and discharge lines are drained, apply a light coat of oil to all metal parts.



```

*****
*                                     *
*                               CAUTION                               *
*                                     *
*   Do NOT oil any rubber or leather parts.                         *
*                                     *
*****

```

To protect chrome, stainless or aluminum deck hardware, first remove any salt deposits with water. Then clean with a good quality non-abrasive type metal cleaner. Finally give items a light coat of grease.

## 2. Wet Storage.

All the preceding applies except, of course, valves and seacocks should remain closed, the batteries stay on board, and the main battery switches placed in the "Off" position. Also recommended is the using of zinc "fish" as pointed out previously under "Electrolysis". Bilge pumps should be in Automatic mode. Batteries must be kept charged.

## 3. Fitting Out

In order to ensure maximum pleasure and enjoyment after an extended lay up, a thorough check of the boat and equipment is necessary with maintenance being done as indicated. The following list should serve as a guide for the more important items to be accomplished (not necessarily in the order to be done.)

## 4. Prelaunch and Postlaunch Checks

In all likelihood, your Bertram has been delivered to you in the water with these checks made by your Bertram dealer. However, when hauled, and you are fitting out for a new season, be sure these checks are made.

a. Prelaunch

- 1) Thru-hull strainers clean and secure.
- 2) Bilge drain plug should be in place and secure.
- 3) Shafts should turn freely.
- 4) Secure propeller nut, jam nut, and cotter pin.
- 5) Do rudders fit well in rudder port?
- 6) Are set screws holding bearing shell in struts in place?
- 7) Are seacocks or valves free and operable? Not overly free which would allow them to accidentally close.

b. Postlaunch

- 1) Are equipment supply and discharge lines secure?
- 2) Are fittings tight?
- 3) Make sure propeller shaft stuffing boxes are properly adjusted.
- 4) Check shaft alignment. (Procedure is outlined in "Mechanical Systems Section").
- 5) Make sure rudder packing glands are properly adjusted.
- 6) Are bilge pumps working?
- 7) Are bilge blowers working?

c. Electrical System Check

- 1) Batteries are properly charged at 1.260 sg. If below 1.220 sg. have them charged.
- 2) Engine wire looms secure, away from exhaust manifold, connections tight.
- 3) Check the standard and optional electrically operated equipment to make sure each is working properly.

d. Engine Check

- 1) Fuel lines, cooling lines secure and fittings tight.
- 2) Exhaust fittings secure and tight.
- 3) Check engine alignment. See Section F of this manual for details.
- 4) Engine mount fastening tight, locked.
- 5) See engine manual for service instructions.

e. Controls Check

- 1) Clutch adjusted, fittings secured. See that the shift levers on transmissions have full engagement when control levers on bridge are moved to full ahead or astern.
- 2) Throttle adjusted, fittings secured.
- 3) Steering positive, linkage secure, rudder moves freely.
- 4) All gauges, water temperature, oil pressure, tachometer, and voltmeter fully operating (after starting engines).



## C. APPEARANCE AND CARE

### 1. Care of Fiberglass.

The fiberglass construction which makes up the entire hull and most of the superstructure consists of several parts. The exterior layer gelcoat is a special polyester resin into which coloring pigments have been incorporated to give built-in color. Just beneath the gelcoat is a series of glass fabric laminations bonded together with polyester resin. The complete lamination and gelcoat are bonded together by a chemical action and the part is a one-piece unit. The outside gelcoat gives the fiberglass part its glossy finish. The following recommendations will help you keep this unique material in the same condition it was when it left the factory.

### 2. Seasonal Care (at fitting out time)

- 1) Clean surface with soap and water.
- 2) Treat with white automotive type polishing compound used lightly.
- 3) Wax and polish the surface with an automotive type wax. Some modern products give you rubbing and waxing action in one. These products are acceptable.

### 3. Loss of Gloss.

To restore the glossy appearance of the gelcoat surfaces, a light buffing may be advisable. For hand buffing, use a slightly abrasive rubbing compound similar to DuPont Number 7. If a power

buffer is used, Mirro-Glaze Number 1 or a similar product is recommended. After buffing, the surface should be waxed and polished as described above for "Seasonal Care".

#### 4. Stains.

The fiberglass gelcoat surface is highly resistant to stains, most of which can be removed easily with household detergent. Crayon, lipstick or shoe polish can be removed with plain alcohol. Ink spots will come off with Ajax or similar detergent. While penetrating stains are very uncommon, some products with unusual chemical contents may go too deep for ordinary methods of removal. In such cases, weak solutions of acids or alkalies, such as hydrochloric acid or ammonia, can be tried. These may, however, produce a slight discoloration in the gelcoat. If none of the above methods are successful, it may be necessary to sand down through the gelcoat to remove the stain. This will require refinishing (see below).

#### 5. Scratches and Abrasions.

Those that do not penetrate the full thickness of the gelcoat can be treated by lightly sanding and buffing the area. Larger scratches that penetrate the gelcoat but do not go deeply into the fiberglass or weaken the structure can also 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. Allow to dry completely.

- 2) Secure a small amount of pigmented gelcoat resin matching the color of the area to be repaired. This is available to you from your Bertram dealer.
- 3) Add two drops of catalyst per cubic inch of gelcoat and mix thoroughly; the mixture will gel in 15 minutes.
- 4) Fill scratch with the mixture before it hardens and round off about 1/16 of an inch to 1/8 of an inch above the surrounding surface.
- 5) Lay a piece of wax paper or cellophane on top of the patch and press lightly to remove air. Take off wax paper after 20 minutes and allow patch to cure overnight.
- 6) Sand down patch with 600 grit wet sandpaper.
- 7) Finish by rubbing and buffing with regular buffing compound.

Any repairs to fiberglass that are more extensive than those described here should be made only with the help and advice of your Bertram dealer.

#### 6. . Bottom Blisters.

Regardless of the quality of the materials used and 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.



## 7. Painting Fiberglass Surfaces.

- 1) Thoroughly clean the fiberglass part to be painted removing any wax with mineral spirits, turpentine or other commercial solvents.
- 2) Wash with detergent and rinse.
- 3) After surface is dry, sand lightly with garnet, fine oxide or #220 sandpaper.
- 4) Wipe clean of all dust.
- 5) Apply two thin coats of primer as recommended by marine paint manufacturer.
- 6) Apply a marine paint of good quality as per the manufacturer's recommendations.
- 7) Bottom anti-fouling paint should be applied per the manufacturer's instructions. Bertram's usual procedure is to apply Pettit Trinidad "75" anti-fouling paint, unless an owner requests a different brand. Before repainting the bottom, a check should be made to insure that the brand and type is compatible with the type presently on the bottom.

### NOTE:

Some types of bottom paint are not compatible with Pettit unless a primer is used first.



Distilled water is best for adding to the electrolyte; however, a good grade of drinking water can be used if it is free of minerals, particularly iron. Adding water to a cell will temporarily lower the specific gravity of the electrolyte, but this does not mean that the cell has lost any of its charge.

Fill cells when required; the top of the plate separators should never be exposed. Fill with water until liquid level is about 3/8 inches above the top of separators. Do not overfill. Excessive liquid level will cause acid to spill out the vents when battery is charging and will cause corrosion at the terminals and to the battery cables.

b. Excessive Loss Of Liquid.

Under proper operating conditions, batteries should require only a slight amount of water every few weeks. If an excessive amount of water is required, it is usually a sign that the battery is being overcharged and the engine alternators and converter should be checked.

c. Maximum Charge Voltage.

Use the voltage gauge on the flybridge panel to check the voltage.

12-Volt d.c. System = Maximum Charge Rate: 14.1 Volts



d. Cleaning Batteries.

Be sure battery caps are on tight, then clean battery top with a stiff (non-metallic) brush, being careful not to scatter corrosion products. Wipe off with a cloth wetted with ammonia or baking soda in water. Finally, wipe with a cloth dampened with clear water.

Clean the battery terminals and cable terminals to a bright metal finish whenever the cables are removed. Coat the contact surfaces with petroleum jelly (Vaseline) before the terminals are reconnected.

e. Battery Gases: ARE EXPLOSIVE.

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 d.c. loads have been turned off;
  - c. the converter have been turned off;
  - d. you are not wearing rings or metal watchbands; and,
  - e. you use extreme caution to avoid having wrenches or other tools contact both terminals.

## 9. Spilled Battery Acids

If battery acid is spilled, the following immediate actions are required to check or eliminate its damaging effects.

### a. Acid splashed in the eye:

- 1) should be washed out IMMEDIATELY AND CONTINUOUSLY with plenty of cold, fresh water for at least twenty (20) minutes.
- 2) If cold, fresh water is not available, use milk or any available fresh water based potable liquid to dilute the acid.
- 3) always see a doctor as soon as possible.

### b. Acid splashed on other parts of the body, the clothing, or parts of your vessel should be:

- 1) removed immediately by washing thoroughly with cold water and
- 2) the area neutralized with a solution of baking soda or house-hold ammonia in water.

c. If a considerable amount of acid is spilled from the battery, the battery should be replaced. This is a job for a battery repairman.

## 10. Fuel Tank Replacement

a. Fuel Tank Removal. Removing and replacing the fuel tank requires the removal and replacement of the cockpit sole insert. The tank replacement procedure is as follows:

- 1) Remove the screws around the edge of the cockpit sole

- 2) use wedges from underneath to carefully break the "3M" 5200 adhesive bond between the cockpit sole and the cockpit sole insert;
- 3) carefully pry up and remove the cockpit sole insert;
- 4) disconnect the old tank;
- 5) unfasten the old tank; and,
- 6) remove the old tank.

b. New Tank Installation. Once the old tank is removed from your vessel, the procedure to installing a new tank is as follows:

- 1) Position and fasten down the new tank;
- 2) connect the new tank;
- 3) carefully clean off all remaining traces of the "3M" adhesive;
- 4) repair any cracked wood or broken fiberglass;
- 5) coat the top of the cockpit sole shelf and the bottom of the cockpit sole insert (where they will be in contact) with "3M" type 5200 adhesive;
- 6) reposition the cockpit sole insert ensuring that the screw holes line up; and,
- 7) replace the screws.