TECHNICAL MANUAL

OPERATOR, UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)

FOR

WATER PURIFICATION BARGES (NSN 1930-01-234-2165)

VOLUME 1
NORMAL OPERATIONS

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content requirements normally associated with the Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment.

Approved for public release; distribution Is unlimited

*This manual supersedes TM 55-1930-209-14&P-1, 30 January 1989.

HEADQUARTERS, DEPARTMENT OF THE ARMY
15 OCTOBER 1992

WARNINGS AND SAFETY NOTICES

WARNING

DANGEROUS VOLTAGES AND HAZARDOUS MATERIALS ARE USED IN THIS EQUIPMENT DO NOT TAKE CHANCES!

GENERAL WARNINGS

- Always redtag electrical equipment, controls, circuits, and switches before beginning repairs.
- Do not service or adjust high voltage electrical equipment when alone
- Do not overload circuits
- Always use authorized. insulated tools and lest equipment when working on electrical equipment
- Remove all jewelry before working on or around electrical equipment with exposed current-carrying areas
- Do not wear clothing with exposed metal fasteners when working on electrical equipment
- Always use approved breathing apparatus when working with chemicals
- Avoid chemical contact with eyes, skin, and clothing
- Always wear safety glasses, gloves, and rubber aprons when handling chemicals
- Wear protective clothing and safety glasses as required when working on barge equipment
- Always wear approved ear protection In noise hazard areas

SPECIFIC WARNINGS

- Do not connect any new circuit to an existing circuit
- Do not energize circuits if water condensation is present
- If any sparks are seen, stop operation immediately determine cause and take corrective action
- Never touch radio antennas of fixed-base radio transmitters When transmitting, antennas contain high voltage
- Always use approved breathing apparatus when handling material In multimedia filters and chlorination unit descaling acid crystals Do not breathe dust from these materials
- Avoid breathing vapors from coagulant aid chemicals Use in a well-ventilated area In case of chemical contact with skin, wash with water For eyes, Immediately flush at eyewash station and obtain medical help as soon as possible
- Always wear work gloves and shirts with full length buttoned sleeves when handling fuel oil and gasoline

- Do not smoke or have open flames within 10 feet when handling fuel oil or gas. Only minimum number of personnel necessary to conduct fueling operation are permitted in area.
- Before starting any repairs on compressed air system, always release pressure from air receiver and compressor and open and redtag circuit breakers.
- On air compressor, do not adjust automatic regulator switch (pressure switch) and pilot valve settings.
- To avoid flying particles lodging in eyes, do not use compressed air to "dust-off" clothing or workspace.
- Stay clear of anchor cables when operating anchor winches.
- Always wear safety glasses or face shield when using power tools.
- Always wear lifevests when on weatherdeck and throughout the barge during storm conditions.
- Lifevests are to be worn at all times aboard workboat.
- Only qualified persons will operate and maintain arc and fuel gas welders.
- When welding, always make sure those working with or near the welder wear proper clothing: heavy, hole-free gloves, heavy shirt, cuffless trousers, high shoes, and cap. Keep clothing dry and free of oil and other flammable substances.
- Use dry heavy canvas drop cloth to cover work area and adjacent deck when arc welding.
- Before welding on bulkheads, deck plating and similar surfaces, always check carefully to make sure that the other side of the surface to be welded does not hide fuel or compressed gas tanks, flammable or hazardous materials, or electrical equipment or wiring.
- When welding, keep your head out of the fumes and make sure area is well ventilated.
- Before welding on surfaces which have been cleaned with cleaning solutions containing chlorinated hydrocarbons, always wash with water, dry and ventilate area thoroughly.
- Use shield with proper filter lens when welding. Do not allow others near welding operations to assist or observe without proper eye protection. This must include side shields during slag chipping operations.
- Warn personnel in area during welding operations not to look at arc or expose themselves to hot spatter or metal.
- In an extreme emergency, when welding is required in void 2 port, shut down chlorination system. Close all valves. Cover the parts of chlorination system not being welded with a heavy canvas drop cloth. Turn on vent 8 and, if available, provide additional forced air ventilation.

- Before welding on fuel oil or sludge tank, make sure tank is gas-free by: 1) removing all liquid from tank, 2) cleaning tank thoroughly, 3) seeing that tank is thoroughly dry, and 4) force ventilating tank.
- Connect arc welding work cable as dose to welding area as possible. Work cables connected to barge framework or other locations far from welding site increase the possibility of the welding current passing through lifting chains, crane cables or other possible circuit paths. This can create fire hazards or weaken lifting chains or crane cables until they break or fall.
- Always weld with all doors, portholes, and hatches propped open and necessary ventilation systems operating.
- Take frequent breaks away from the area where you are welding.
- Do not take oxygen and acetylene tanks into confined areas when welding.
- Always use a friction lighter to start oxyacetylene torch.
- Always maintain all welding equipment in proper working condition. If you have any doubts about the safety of any welding equipment, do not use the welder.

ELECTRICAL SHOCK SAFETY STEPS

Five safety steps to follow if someone is the victim of electrical shock.

1. Do not try to pull or grab individual.
2. Turn off electrical power when possible.
3. If you can not turn off electrical power, pull, push, or lift person to safety using a wooden pole, rope, or some other insulating material.
4. Get medical help as soon as possible.
5. After the injured person is free of contact with the source of electrical shock, move the person a short distance away and, if needed, start CPR immediately.

INTRODUCTION TO

TM 55-1930-209-14&P-1

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Troop Support Command, ATTN: AMSTR-MMTS, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

1. SCOPE

TM 55-1930-209-14&P covers the Reverse Osmosis Water Purification Barges, Models 300-WPB-1, 300-WPB-2 and 300-WPB-3, NSN 1930-01-234-2165. This manual consists of twenty-one volumes.

2. REVERSE OSMOSIS WATER PURIFICATION BARGES

The Reverse Osmosis Water Purification Barges provide up to 300,000 gallons of drinking water per 24 hour period. The drinking water, converted from seawater or brackish water, is for use by a Rapid Deployment Force in a forward area. When needed, the drinking water can be pumped to a shore facility or to another vessel. This manual provides operation and maintenance procedures for all the component systems on the barges.

3. VOLUME 1 -- NORMAL OPERATIONS

This volume provides information and procedures on normal Reverse Osmosis Water Purification Barge operations, including barge movement and deployment, communications and electrical power systems, drinking water production, shutdown, and required operational maintenance. Emergency shutdown procedures are also provided.

4. VOLUME 2 -- SEAWATER SYSTEM

This volume describes operation and maintenance of the seawater system which supplies seawater to the Reverse Osmosis Water Purification Units (ROWPUs) for processing to the air conditioning unit for cooling to the ballast tank for barge trimming to the chlorination unit for priming and cooling, and to the diesel generators for cooling.

5. VOLUME 3 -- REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) SYSTEM

Volume 3 provides operation and maintenance procedures for the ROWPU System which processes seawater or brackish water to produce drinking water. Normally, this system processes seawater supplied by the seawater system (TM 55-1930-209-14&P-2) to create product water. Chlorine is then added to this product water by the chlorination system (TM 55-1930-209-14&P-4). The resultant drinking water is discharged into four storage tanks that are part of the drinking water system (TM 55-1930-209-14&P-5).

6. VOLUME 4 -- CHLORINATION SYSTEM

Operation and maintenance procedures for the chlorination system onboard the Water Purification Barges are contained in this volume. This system produces chlorine in a sodium hypochlorite solution, upon demand, to water processed by the ROWPU system just before the water enters the four drinking water storage tanks.

7. VOLUME 5 -- DRINKING WATER SYSTEM

The drinking water system provides storage for water produced by the ROWPUs and includes pumps and valves to move this water from onboard storage tanks to the shore discharge system, to another vessel, or overboard. The drinking water system also provides a pressurized water supply for drinking and washing onboard the barges.

8. VOLUME 6 -- SHORE DISCHARGE SYSTEM

This volume provides operation and maintenance procedures for the shore discharge system which transfers drinking water from barge storage tanks to holding/storage facilities ashore.

9. VOLUME 7 -- COMPRESSED AIR SYSTEM

Volume 7 describes the operation and maintenance of the compressed air system which provides compressed air to five air stations in the ROWPU space, one in the workshop, and one on stem weatherdeck. This system also provides compressed air to two air stations for blowdown of seachests in void 2 starboard and void 4 port. Compressed air is used on the barges to operate air-powered impact tools, to propel air through the shore discharge hose, to blowdown seachest, and for general cleaning blowdown.

10. VOLUME 8 -- FUEL OIL SYSTEM

This volume provides operation and maintenance procedures for the fuel oil system which functions as a centralized receiving storage and distribution system for diesel fuel used for barge operations. This onboard fuel system provides fuel for two 155 kW diesel ship service generators, a 20 kW ship auxiliary generator, two. ROWPU high-pressure pump diesel engines, and a fueling station for the barge workboat.

11. VOLUME 9 -- ELECTRICAL POWER SYSTEMS

Operation and maintenance procedures for the two electrical power systems installed aboard the Water Purification Barges are contained in Volume 9. The normal electrical power system generates, controls and distributes all electrical power for operating the water purification system and its auxiliary systems. The emergency electrical system supplies 24 Vdc from a battery bank to 24 Vdc equipment and converts to 24 Vdc through an inverter to 120 Vac to power emergency lighting and equipment.

12. VOLUME 10 -- LIGHTING SYSTEM

Volume 10 contains operation and maintenance procedures for the onboard lighting systems for the Water Purification Barges. This system supplies interior and exterior lighting. Normal and emergency interior lighting is provided in the deckhouse ROWPU space, dayroom, workshop, and voids. Exterior lighting consists of searchlights and floodlights for use at night or during reduced visibility. Lights on the weatherdecks and standard navigation and status lights are for use during operation and towing.

13. VOLUME 11 -- EQUIPMENT MONITORING SYSTEM

This volume provides operation and maintenance' procedures for the equipment monitoring system which monitors the operation of several equipment components onboard the Water Purification Barges. This system monitors operating conditions such as amount of drinking water in storage tanks and temperature of diesel engine cooling water. Sensors detect unacceptable operating conditions, the main processor flashes at double intensity and remote alarms (horns, strobe lights and buzzer alert crewmembers that corrective action is necessary.

14. VOLUME 12 -- COMMUNICATIONS SYSTEM

Operation and maintenance procedures for the communications system are provided in Volume 12. This system consists of three separate communications methods, radio communications, foghorn and intercom telephones.

15. VOLUME 13 -- HANDLING EQUIPMENT

This volume contains operation and maintenance procedures for handling equipment used for lifting, transporting and repositioning equipment and materials onboard the barges. The system includes a bridge crane, bow crane and a void 4 trolley hoist.

16. VOLUME 14 -- ANCHOR, MOORING, AND TOWING EQUIPMENT

Volume 14 describes the operation and maintenance procedures for the anchor mooring, and towing equipment on the Water Purification Barges. This equipment provides a method to hold (anchor) the barges in a fixed position offshore, at dockside, or next to another vessel and a method to move the barges from one location to another.

17. VOLUME 15 -- MISCELLANEOUS EQUIPMENT (DAYROOM, WORKSHOP, ACCESSES, AND SANITATION SYSTEMS)

Volume 15 addresses operation and maintenance procedures for miscellaneous equipment installed on the Water Purification Barges. This equipment includes the dayroom on the forward starboard side of deckhouse, the workshop on the forward portside of deckhouse, accesses such as deckhouse doors and portholes and various accesses to and from the voids, and two separate sanitation systems (toilets and bilge). Additional equipment addressed in this volume includes: guard rails, rubber fendering, removable rubber floor mats, eyewash stations, component labels, caution, warning and danger signs, and storage areas.

18. VOLUME 16 -- VENTILATION, HEATING, AND AIR CONDITIONING SYSTEMS

This volume contains operation and maintenance procedures for the deckhouse and voids ventilation systems and the heating and air conditioning (HAC) system installed on the Water Purification Barges. The ventilation system provides fresh air circulation in the deckhouse and voids with 17 hatches and 10 ventilation fans. The HAC controls the temperature in the dayroom and deckhouse.

19. VOLUME 17 -- WORKBOAT, LIFESAVING, AND FIREFIGHTING EQUIPMENT

Volume 17 includes procedures for the operation and maintenance of:

a. Workboat provides water transportation for crew members and visitors, small cargo items, transportation of the messenger line for the shore discharge hose and similar work-related tasks associated with operating the Water Purification Barges.
b. Lifesaving Equipment installed on the barges and consisting of 2 liferafts, 15 Type II and 24 Type V lifevests and 4 lifesaving rings.
c. Firefighting Equipment installed on the barges and consisting of Halon 1301 system, 2 CO_2 hose reel units, a smoke detector system, 17 portable CO_2 fire extinguishers, 5 dry chemical fire extinguishers, 5 self-contained breathing apparatuses, and a portable, engine driven firefighting pump. The workboat also has a 1 0-pound, portable, dry chemical fire extinguisher.

20. VOLUME 18 -- SUPPORTING APPENDICES FOR VOLUMES 1-17.

Volume 18 contains the Maintenance Allocation Chart, Components of End Item List, Tools and Test Equipment List, Expendable/Durable Supplies and Materials List and the Repair Parts and Special

All of the information contained in this volume is common to volumes 1-17 and does not appear in each individual volume.

Appendix A in volumes 1-17 provides information unique to each volume Appendix B in volumes 1-17 provides manufacturers manuals and instructions unique to the system described In each volume. Appendixes C-G are located in Volume 18.

21. VOLUME 19 -- PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Volume 19 contains PMCS pertinent to all onboard systems for the Reverse Osmosis Water Punrification Barges.

22. VOLUME 20 -- SUPPLEMENTAL DATA

Volume 20 contains the Basic Issue Items List, and additional Authorization List for all onboard systems for the Reverse Osmosis Water Purification Barges.

23. VOLUME 21 -- WINCH, DOUBLE DRUM, DIESEL

This volume contains operation and maintenance procedures for the 20-ton double drum diesel engine winch used on the Water Purification Barges Appendix B of Volume 21 contains the Maintenance Allocation Chart and the Repair Parts and Special Tools List for the winch.

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NO. 55-1930-209-14&P-1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D.C., 15 OCTOBER 1992

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VOLUME 1

NORMAL OPERATIONS

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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* Supersedes TM 55-1930-209-14&P-1, 30 January 1989

TABLE OF CONTENTS

VOLUME 1

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and Data	1-5
1-7	General	1-5
1-8	Capabilities	1-6
1-8.1	Definitions	1-6
1-9	Special limitations	1-7
1-10	Performance characteristics	1-7
1-11	Equipment specifications	1-7
1-12	Items furnished	1-8
1-13	Items required but not furnished	1-8
1-14	Tools and test equipment	1-8
1-15	Maintenance	1-8
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	General	2-1
2-2	Reverse osmosis process	2-1
2-3	Drinking water production	2-3
2-4	Manual format for operational use	2-4
CHAPTER 3	ELECTRICAL POWER SYSTEMS	3-1
Section I.	General	3-1
3-1	General	3-1
3-1.1	Normal electrical system	3-1
3-1.2	Emergency electrical system	3-1
Section II.	Normal electrical system	3-1
3-2	Description	3-1
3-3	Capabilities	3-2
3-4	Special limitations	3-2
3-5	Performance characteristics	3-2

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
3-6	Description of operation	3-12
3-6.1	Watertight electrical cabling	3-13
3-7	Operating instructions	3-13
3-7.1	Operating controls and indicators	3-13
3-7.1.1	General	3-13
3-7.1.2	Generator control panels	3-13
3-7.1.3	Switchboard distribution panel	3-16
3-7.1.4	Paralleling and control panels	3-16
3-7.1.5	Miscellaneous controls and indicators	3-16
3-7.2	Prestart procedures from switchboard	3-21
3-7.3	Generator set alarm and shutoff systems	3-21
3-7.3.1	Alarm systems	3-21
3-7.3.2	Shutoff systems	3-22
3-7.4	Operating procedures from switchboard	3-23
3-7.5	Paralleling generators and transferring load	3-24
3-7.5.1	Correcting reverse power situation	3-25
3-7.6	Operating procedures using shore power	3-25
3-7.7	Operating other electrical panels and controls	3-25
3-7.8	Normal shutdown procedures from switchboard	3-25
3-7.9	Emergency shutdown	3-26
3-7.9.1	General	3-26
3-7.9.2	Emergency shutdown procedures	3-26
Section III.	Emergency electrical system	3-26
3-8	Description	3-26
3-9	Capabilities	3-27
3-10	Special limitations	3-27
3-11	Performance characteristics	3-27
3-12	Description of operation	3-27
3-12.1	Normal operations	3-27
3-12.2	Emergency operations	3-29
3-12.3	Restoration of normal source of electricity	3-29
Section IV.	Operating instructions	3-29
3-13	Operating controls and indicators	3-29
3-13.1	Prestart checks	3-29

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
3-13.2	Normal operating procedures	3-34
3-13.3	Emergency operating procedures	3-35
3-13.4	Return to normal power source	3-35
3-13.5	Shutdown procedures	3-36
3-13.5.1	Normal shutdown procedures	3-36
3-13.5.2	Emergency shutdown procedures	3-36
Section V.	155 kW ship service generators	3-36
3-14	Description	3-36
3-14.1	3306TA diesel engine	3-36
3-14.2	SR4 generator	3-36
3-15	Capabilities	3-36
3-16	Special limitations	3-37
3-17	Performance characteristics	3-37
3-18	Description of operation	3-37
3-18.1	Remote control and startup requirements	3-37
3-19	Operating controls and indicators	3-37
3-19.1	3306TA diesel engine	3-37
3-19.1.1	Controls for operating engine at the SSG	3-37
3-19.1.2	Engine indicators	3-38
3-19.2	SR4 generator controls	3-38
3-19.3	Prestart procedures	3-39
3-19.4	Starting procedures at the engine	3-40
3-19.5	Operating procedures	3-41
3-19.6	Shutdown procedures	3-41
3-19.6.1	Shutdown procedures from engine location	3-41
3-19.6.2	Emergency shutdown	3-41
Section VI.	20 kW ship auxiliary generator (SAG) set	3-41
3-20	Description	3-41
3-21	Capabilities	3-42
3-22	Special limitations	3-42
3-23	Performance characteristics	3-42
3-24	Description of operation	3-42

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
3-25	Operating instructions	3-43
3-25.1	Operating controls and indicators	3-43
3-25.1.1	4.236M diesel engine	3-43
3-25.1.1.1	Engine instruments	3-43
3-25.1.1.2	Engine indicators	3-43
3-25.1.1.3	Engine controls	3-43
3-25.1.2	SC144E generator	3-44
3-25.2	Prestart procedures	3-44
3-25.3	Starting procedures	3-45
3-25.4	Operating procedures	3-46
3-25.5	Shutdown procedures	3-46
3-25.5.1	Shutdown procedures at engine	3-46
3-25.5.2	Emergency shutdown	3-46
CHAPTER 4	SMOKE DETECTOR SYSTEM	4-1
Section I.	General	4-1
4-1	General	4-1
4-2	Description	4-1
4-3	Capabilities	4-1
4-4	Special limitations	4-1
Section II.	Description of operation	4-1
4-5	General	4-1
Section III.	Operating instructions	4-1
4-6	Controls and indicators	4-1
4-7	Prestart procedures	4-1
4-8	Normal operations	4-3
4-9	Emergency procedures for smoke	4-3
4-10	Emergency procedures for malfunctions	4-3
4-11	Shutdown procedures	4-4
CHAPTER 5	COMMUNICATIONS SYSTEMS	5-1
Section I.	General	5-1
5-1	General	5-1
5-1.1	Radio communications equipment	5-1
5-1.1.1	Army radio	5-1
5-1.1.2	Commercial marine radios	5-1

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
5-1.1.3	Walkie-talkies	5-1
5-1.2	Foghorn equipment	5-1
5-1.3	Telephone system	5-1
Section II.	Radio communications system	5-1
5-2	Description	5-1
5-3	Capabilities	5-2
5-3.1	Army radio	5-2
5-3.2	Commercial marine radios	5-2
5-3.3	Walkie-talkies	5-6
5-4	Special limitations	5-6
5-5	Performance characteristics	5-6
5-6	Description of operation	5-7
5-6.1	General	5-7
5-6.2	Receiving radio messages	5-7
5-6.3	Transmitting radio messages	5-7
5-7	Operating instructions	5-7
5-7.1	Operating controls and indicators	5-7
5-7.2	Prestart procedures	5-7
5-7.3	Operating procedures	5-15
5-7.3.1	Army radio	5-15
5-7.3.2	Commercial marine radios	5-16
5-7.3.3	Walkie-talkies	5-17
5-7.4	Shutdown procedures	5-20
5-7.4.1	Army radio	5-20
5-7.4.2	Marine radio	5-20
5-7.4.3	Walkie-talkies	5-20
Section III.	Foghorn equipment	5-20
5-8	Description	5-20
5-9	Capabilities	5-20
5-10	Special limitations	5-20
5-11	Performance characteristics	5-21
5-12	Description of operation	5-21
5-13	Operating instructions	5-21
5-13.1	Operating controls and indicators	5-21

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
5-13.2	Prestart procedures	5-21
5-13.3	Operating procedures	5-21
5-13.4	Shutdown procedure	5-21
Section IV.	Telephone system	5-23
5-14	Description	5-23
5-15	Capabilities	5-23
5-16	Special limitations	5-23
5-17	Performance characteristics	5-23
5-18	Description of operation	5-27
5-18.1	General	5-27
5-18.1.1	Paging from system operator to crew personnel	5-27
5-18.1.2	Paging from crew personnel to system operator	5-27
5-18.1.3	Two-way communications between crew personnel	5-28
5-19	Operating instructions	5-28
5-19.1	Operating controls and indicators	5-28
5-19.2	Prestart procedures	5-28
5-19.3	Operating procedures	5-29
5-19.3.1	Talking with telephone station from operator station in dayroom	5-29
5-19.3.2	Talking with system operator from crew telephone station	5-29
5-19.3.3	Talking between telephone stations	5-34
5-19.4	Shutdown procedures	5-34
CHAPTER 6	LIGHTING SYSTEM	6-1
Section I.	General	6-1
6-1	General	6-1
Section II.	Interior lighting system	6-1
6-2	Description	6-1
6-3	Description of operation	6-1
6-4	Operating instructions	6-6
6-4.1	Operating controls and indicators	6-6
6-4.2	Prestart procedures	6-6
6-4.3	Operating procedures	6-6
6-4.3.1	Normal lighting	6-6
6-4.3.2	Emergency lighting	6-12

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
6-4.4	Shutdown procedures	6-12
6-4.4.1	Normal lighting	6-12
6-4.4.2	Emergency lighting	6-12
Section III.	Exterior lighting system	6-12
6-5	Description	6-12
6-6	Description of operation	6-12
6-7	Operating instructions	6-15
6-7.1	Operating controls and indicators	6-15
6-7.2	Prestart procedures	6-15
6-7.3	Operating procedures	6-15
6-7.3.1	Exterior side lights	6-15
6-7.3.2	Floodlights	6-15
6-7.3.3	Searchlights	6-15
6-7.3.4	Shore discharge hose deployment status lights	6-16
6-7.3.5	Anchor light	6-16
6-7.3.6	Navigation running lights	6-16
6-7.4	Shutdown procedures	6-16
6-7.4.1	Exterior side lights	6-16
6-7.4.2	Floodlights	6-16
6-7.4.3	Searchlights	6-16
6-7.4.4	Shore discharge hose deployment status lights	6-16
6-7.4.5	Anchor light	6-16
6-7.4.6	Navigation running lights	6-16
6-7.4.7	After operation checks	6-16
Section IV.	Emergency shutdown	6-17
6-8	General	6-17
CHAPTER 7	VENTILATION, HEATING, AND AIR CONDITIONING SYSTEMS	7-1
Section I.	General	7-1
7-1	General	7-1
Section II.	Deckhouse ventilation system	7-1
7-2	Description	7-1
7-3	Capabilities	7-1
7-4	Performance characteristics	7-1

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
7-5	Operating instructions	7-1
7-5.1	Operating controls and indicators	7-1
7-5.2	Prestart procedures	7-1
7-5.3	Operating procedures	7-5
7-5.3.1	Increasing ventilation	7-5
7-5.3.2	Decreasing ventilation	7-5
7-5.4	Shutdown procedures	7-5
7-5.4.1	Normal shutdown for less than 72 hours	7-5
7-5.4.2	Normal shutdown for more than 72 hours	7-6
7-5.4.3	Emergency shutdown	7-6
7-5.4.3.1	General	7-6
7-5.4.3.2	Emergency shutdown procedures	7-6
Section III.	Voids ventilation system	7-8
7-6	Description	7-8
7-7	Capabilities	7-8
7-8	Performance characteristics	7-8
7-9	Operating instructions	7-8
7-9.1	Operating controls and indicators	7-8
7-9.2	Prestart procedures	7-8
7-9.3	Operating procedures	7-14
7-10	Shutdown procedures	7-14
7-10.1	Normal shutdown for less than 72 hours	7-14
7-10.2	Normal shutdown for more than 72 hours	7-14
7-10.3	Emergency shutdown	7-14
7-10.3.1	General	7-14
7-10.3.2	Emergency shutdown procedures	7-14
Section IV.	Heating and air conditioning (HAC) system	7-15
7-11	Description	7-15
7-12	Capabilities	7-15
7-13	Special limitations	7-15
7-14	Performance characteristics	7-15
7-15	Operating instructions	7-15
7-15.1	Operating controls and indicators	7-15
7-15.2	Prestart procedures	7-19

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
7-15.3	Operating procedures	7-19
7-15.3.1	AC unit	7-19
7-15.3.2	Heating unit	7-21
7-15.4	Shutdown procedures	7-21
7-15.4.1	AC unit	7-21
7-15.4.2	Heating unit	7-21
7-15.5	Emergency shutdown	7-21
7-15.5.1	General	7-21
7-15.5.2	Emergency shutdown procedures	7-22
Section V.	ROWPU space and voids heating system	7-22
7-16	Description	7-22
7-17	Capabilities	7-22
.7-18	Special limitations	7-22
7-19	Performance characteristics	7-22
7-20	Operating instructions	7-22
7-20.1	Operating controls and indicators	7-22
7-20.2	Prestart procedures	7-24
7-20.3	Operating procedures	7-24
7-20.4	Shutdown procedures	7-24
7-20.5	Emergency shutdown	7-24
7-20.5.1	General	7-24
7-20.5.2	Emergency shutdown procedures	7-24
CHAPTER 8	EQUIPMENT MONITORING SYSTEM (EMS)	8-1
Section I.	General	8-1
8-1	General	8-1
8-2	Description	8-1
8-3	Capabilities	8-1
8-4	Special limitations	8-1
Section II.	Description of operation	8-1
8-5	General	8-1
8-6	Power supply	8-1

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
Section III.	Operating instructions	8-11
8-7	Operating controls and indicator	8-11
8-8	Prestart procedures	8-11
8-9	Operating procedures	8-11
8-9.1	Startup procedures	8-11
8-9.2	Normal operating procedures	8-17
8-9.3	Alarm acknowledgment	8-17
8-9.3.1	Abnormal conditions are indicated in four ways	8-17
8-9.3.2	To acknowledge alarms sounded by EMS	8-18
8-9.4	System editing	8-18
8-9.4.1	Accessing edit mode	8-18
8-9.4.2	Level 1 editing	8-19
8-9.4.2.1	Using EDIT MENU option 1 to activate/deactivate sensors	8-19
8-9.4.2.2	Using EDIT MENU option 1 to change or set reference markers	8-21
8-9.4.2.3	Using EDIT MENU option 2 to activate/deactivate switches	8-22
8-9.4.2.4	Using EDIT MENU option 3 to activate/deactivate totalizers	8-23
8-9.4.2.5	Using EDIT MENU option 4 to set time and date on EMS dock	8-24
8-9.4.3	Level 2 editing procedures	8-25
8-9.5	Edit termination	8-25
8-9.6	Shutdown procedures	8-26
8-9.7	Operation under extreme conditions	8-26
CHAPTER 9	CHLORINATION SYSTEM	9-1
Section I.	General	9-1
9-1	General	9-1
9-2	Description	9-1
9-3	Capabilities	9-1
9-4	Special limitations	9-1
9-5	Performance characteristics	9-1
Section II.	Description of operation	9-1
9-6	General	9-1
9-7	Preparation for operation	9-7
9-8	Non-operating chlorination system	9-7

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
Section III.	Operating instructions	9-7
9-9	Operating controls and indicators	9-7
9-10	Prestart procedures	9-7
9-11	Operating procedures	9-9
9-12	Normal chlorination system operation	9-20
9-13	Brine tank and holding tank priming	9-23
9-14	Chlorine generation and recirculation	9-24
9-15	Chlorination unit descaling	9-25
9-15.1	Initial flushing with seawater	9-25
9-15.2	Flushing with acid	9-25
9-15.2.1	Acid tank preparation	9-25
9-15.2.2	Acid flush	9-26
9-16	Shutdown procedure	9-27
9-17	Emergency shutdown	9-27
9-17.1	General	9-27
9-17.2	Emergency shutdown procedures	9-28
Section IV.	Operation under extreme conditions	9-28
9-18	Operation under extreme conditions	9-28
9-18.1	Operation in extreme cold	9-28
9-18.2	Operation in extreme heat	9-28
9-18.2.1	Lubricants	9-28
9-18.2.2	Motor	9-28
CHAPTER 10	WORKBOAT AND BOW CRANE	10-1
Section I.	General	10-1
10-1	General	10-1
10-2	Description	10-1
10-3	Capabilities	10-5
10-4	Special limitations	10-5
10-5	Performance characteristics	10-5
Section II.	Operating instructions	10-5
10-6	Controls and indicators	10-5
10-6.1	Searchlight	10-5
10-6.2	Operator's electrical control panel	10-5
10-6.3	Windshield wiper	10-5

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
10-6.4	Boat horn	10-5
10-6.5	Bilge pump switches and indicators	10-7
10-6.6	Outboard drive controls	10-7
10-6.7	Magnetic compass	10-7
10-6.8	Steering pump filler	10-7
10-6.9	Engine hourmeter	10-7
10-6.10	Fuel gauge	10-7
10-6.11	Volvo engine instrument panel	10-7
10-6.12	Master switch	10-8
10-6.13	Ignition/electrical switch	10-8
10-6.14	Throttle and shift control	10-8
10-6.15	Marine band VHF/FM radio	10-8
10-6.16	Depthfinder controls and indicators	10-8
10-6.17	Engine maintenance controls and indicators	10-8
10-7	Prestart procedures	10-11
10-8	Starting procedures	10-11
10-9	Operating procedures	10-15
10-9.1	Radio operations	10-15
10-9.2	Depthfinder operations	10-16
10-9.3	Workboat operations	10-17
10-10	Emergency procedures	10-17
10-10.1	General	10-17
10-10.2	Fire prevention	10-17
10-10.3	Firefighting techniques	10-18
10-10.4	Running aground prevention	10-18
10-10.5	Recovery procedures when aground	10-18
10-11	Operations under unusual conditions	10-19
10-11.1	General	10-19
10-11.2	Being towed by another boat	10-19
10-11.3	Towing another boat	10-19
10-12	Shutdown procedures	10-20
10-13	Deployment and recovery	10-21
10-13.1	General	10-21
10-13.2	Bow crane	10-21

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
10-13.3	Operating controls	10-21
10-13.4	Prestart procedures	10-21
10-13.5	Procedures for deploying workboat	10-25
10-13.6	Bow crane shutdown procedures	10-26
10-13.7	Workboat recovery procedures	10-26
10-14	Operations under extreme conditions	10-30
10-14.1	Operations in extreme heat	10-30
10-14.2	Operations in high humidity conditions	10-30
10-14.3	Operations in extreme cold	10-30
CHAPTER 11	SEAWATER SYSTEM	11-1
Section I.	General	11-1
11-1	General	11-1
11-2	Description	11-1
11-2.1	ROWPU and ballast seawater supply	11-1
11-2.2	Air conditioner cooling seawater and chlorination unit supply	11-1
11-2.3	Diesel engine generator seawater cooling	11-1
11-3	Seawater supply	11-1
11-4	Special limitations	11-1
Section II.	Description of operation	11-9
11-5	ROWPU seawater supply	11-9
11-6	Ballast seawater supply	11-9
11-7	Air conditioning unit seawater supply	11-9
11-8	Chlorination unit seawater supply	11-9
11-9	Diesel generators seawater supply	11-9
Section III.	Operating instructions	11-12
11-10	Operating controls and indicators	11-12
11-11	Prestart procedures	11-12
11-12	Normal and alternate operating procedures	11-12
11-12.1	Supplying seawater to ROWPU's from seachest (deep water) using seawater pump(s) 1 and/or 2	11-21
11-12.1.1	Normal Procedures	11-21
11-12.1.2	Alternate procedures	11-23

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
11-12.2	Supplying seawater to ROWPU's from starboard shell penetration (shallow water) using seawater pump(s) 1 and/or 2	11-23
11-12.2.1	Normal procedures	11-23
11-12.2.2	Alternate procedures	11-24
11-12.3	Supplying seawater from seawater pumps to chlorination and air conditioning units	11-24
11-12.4	Supplying seawater from cooling pump to air conditioning and chlorination units	11-25
11-12.5	Filling ballast tank (to correct a bow high condition)	11-26
11-12.5.1	Filling ballast tank from forward seachest	11-26
11-12.5.2	Filling ballast tank from starboard shell	11-26
11-12.6	Draining ballast tank (to correct a stern high condition)	11-27
11-12.7	Supplying seawater for generator cooling	11-27
11-12.8	Seachest blowdown	11-28
11-12.8.1	Forward seachest blowdown	11-28
11-12.8.2	Aft seachest blowdown	11-29
11-13	Seawater system shutdown procedures	11-29
11-13.1	Shutdown seawater supply to ROWPU's	11-30
11-13.2	Shutdown generator cooling seawater supply	11-30
11-13.3	Shutdown seawater supply to air conditioning and/or chlorination units when using cooling pump	11-30
11-14	Emergency shutdown	11-30
11-14.1	General	11-30
11-14.2	Emergency shutdown procedures	11-31
CHAPTER 12	COMPRESSED AIR SYSTEM	12-1
Section I	General	12-1
12-1	General	12-1
12-2	Description	12-1
12-3	Capabilities	12-1
12-4	Special limitations	12-1
Section II.	Description of operation	12-1
12-5	Activation	12-1
12-6	Air flow	12-1
Section III.	Operating instructions	12-5
12-7	Operating controls and indicators	12-5
12-7.1	Controls	12-5
12-7.2	Indicators	12-9

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
12-8	Prestart procedures	12-10
12-8.1	Startup after extended shutdown	12-10
12-8.2	Startup after temporary shutdown	12-12
12-9	Operating procedures	12-12
12-9.1	General	12-12
12-9.2	Operating compressed air stations 1 thru 5 and 7	12-12
12-9.3	Using air impact wrench with air stations 1 thru 5 and 7	12-13
12-9.3.1	Pre-operational procedures	12-13
12-9.3.2	Operating the air impact wrench	12-14
12-9.4	Operating compressed air station 6 to power the PIG	12-14
12-9.5	Operating compressed air system for seachests blowdown	12-16
12-10	Shutdown procedures	12-16
12-10.1	Temporary shutdown (less than 12 hours)	12-16
12-10.2	Extended shutdown	12-16
12-11	Emergency shutdown	12-17
12-11.1	General	12-17
12-11.2	Emergency shutdown procedures	12-17
CHAPTER 13	ROWPU SYSTEM	13-1
Section I.	General	13-1
13-1	General	13-1
13-2	System description	13-1
13-3	Component description	13-1
13-3.1	Pretreatment skid assembly	13-1
13-3.2	Media filters	13-3
13-3.3	High Pressure (HP) pump skid	13-8
13-3.4	Reverse Osmosis (RO) block assembly	13-8
13-4	System Capabilities	13-8
13-5	Limitations	13-8
13-6	Performance characteristics	13-8
Section II.	Description of operation	13-9
13-7	Reverse Osmosis process	13-9
13-8	ROWPU system operation	13-9

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
Section III.	Operating instructions	13-11
13-9	Operating controls and indicators	13-11
13-10	Prestart procedures	13-12
13-11	Operating procedures	13-26
13-11.1	General	13-26
13-11.2	Startup procedures	13-26
13-11.3	Operating procedures	13-30
13-12	Shutdown procedures	13-32
13-12.1	Normal shutdown	13-32
13-12.2	Emergency shutdown	13-33
13-12.2.1	General	13-33
13-12.2.2	Emergency shutdown procedures	13-34
CHAPTER 14	DRINKING WATER SYSTEM	14-1
Section I.	General	14-1
14-1	General	14-1
14-2	Description	14-1
14-3	Capabilities	14-1
14-4	Limitations	14-1
14-5	Performance characteristics	14-1
Section II.	Description of operation	14-5
14-6	Drinking water supply	14-5
14-7	Drinking water supplied to shore or port discharge valve	14-5
14-8	Drinking water for onboard use	14-8
Section III.	Operating instructions	14-8
14-9	Operating controls and indicators	14-8
14-10	Prestart procedures	14-8
14-11	Operating procedures	14-8
14-11.1	General	14-8
14-11.2	Filling drinking water storage tanks	14-18
14-11.3	Discharging drinking water to shore	14-19
14-11.4	Discharging drinking water through port discharge valve	14-22
14-11.4.1	Discharging drinking water to another vessel	14-22
14-11.4.2	Emptying storage tanks by discharging overboard	14-23
14-11.5	Supplying storage tank drinking water to pressure set for use on barge	14-24

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
14-11.6	Filling drinking water reserve tank	14-24
14-11.6.1	Filling drinking water reserve tank from storage tanks	14-24
14-11.6.2	Filling drinking water reserve tank from other vessel or shore supply	14-25
14-11.7	Supplying drinking water on barge from reserve tank	14-25
14-11.8	Supplying drinking water to dayroom, washdown stations, chlorination unit, and shower	14-26
14-12	Shutdown procedures	14-26
14-12.1	Normal shutdown	14-26
14-12.2	Emergency shutdown	14-27
14-12.2.1	General	14-27
14-12.2.2	Emergency shutdown procedures	14-27
CHAPTER 15	SHORE DISCHARGE SYSTEM	15-1
Section I.	General	15-1
15-1	General	15-1
15-2	Description	15-1
15-3	Capabilities	15-1
15-4	Special limitations	15-1
15-5	Performance characteristics	15-1
Section II.	Description and data	15-1
15-6	Shore winch installation	15-1
15-7	Hose deployment	15-1
15-8	Pumping water to shore	15-1
15-9	Hose retrieval	15-1
Section III.	Operating instructions	15-4
15-10	Operating controls and indicators	15-4
15-11	Prestart procedures	15-4
15-12	Operating procedures	15-4
15-12.1	Discharge hose deployment	15-4
15-12.1.1	Predeployment procedures	15-4
15-12.1.1.1	Shore winch installation	15-4
15-12.1.1.2	Preparation of discharge hose	15-6
15-12.1.1.3	Preparation of shore discharge hose, reel winch, and hydraulic power system	15-6
15-12.1.1.4	Deployment of messenger (tow) line	15-17
15-12.1.2	Deployment of discharge hose (hose out)	15-18
15-12.1.3	Controlling a runaway discharge hose	15-20

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
15-12.1.4	Unpowered discharge hose deployment	15-20
15-12.2	Discharging drinking water to shore	15-21
15-13	Shutdown procedures	15-22
15-13.1	Discharge hose pigging (hose blowout)	15-22
15-13.2	Discharge hose retrieval (hose in)	15-22
15-13.3	Emergency shutdown	15-24
15-13.3.1	General	15-24
15-13.3.2	Emergency shutdown procedures	15-25
CHAPTER 16	BARGE DEPLOYMENT	16-1
Section I.	General	16-1
16-1	General	16-1
Section II.	Considerations in docking	16-1
16-2	General	16-1
Section III.	Towing procedures	16-1
16-3	General	16-1
16-4	Preparation for towing	16-1
16-5	Towing bridle installation	16-3
16-6	Towing operations	16-3
16-7	Towing bridle storage	16-3
Section IV.	Anchoring site selection considerations	16-5
16-8	Barge requirements	16-5
16-9	Beach and shore requirements	16-5
16-10	Oceanographic requirements	16-5
16-11	Support requirements	16-6
16-12	Anchoring site selection	16-6
Section V.	Anchoring methods	16-6
16-13	General	16-6
16-14	Anchoring with four anchors	16-6
16-15	Modified anchoring with four anchors	16-7
16-16	Anchoring with two anchors	16-10
16-17	Anchoring with single anchor	16-10

TABLE OF CONTENTS (Continued)

VOLUME 1

		Page
Section VI.	Retrieving anchors	16-12
16-18	General	16-12
16-18.1	Retrieving an anchor with assistance of auxiliary boat	16-12
16-18.2	Retrieving an anchor with assistance of tug	16-12
Section VII.	Anchor winch procedures	16-12
16-19	Operating controls and indicators	16-12
16-20	Prestart procedures	16-14
16-21	Operating procedures with power	16-17
16-22	Operating procedures without power	16-17
16-23	Shutdown procedures	16-19
16-23.1	Anchors deployed	16-19
16-23.2	Anchors retrieved	16-19
16-24	Emergency shutdown	16-19
16-24.1	General	16-19
16-24.2	Emergency shutdown procedures	16-20

LIST OF APPENDICES

A REFERENCES A-1

B MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS (see applicable volumes)

NOTE

The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.

MAINTENANCE ALLOCATION CHART (MAC)
TOOLS AND TEST EQUIPMENT LIST (TTEL)
EXPENDABLE /DURABLE SUPPLIES AND MATERIALS LIST (ESML)
REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)
REPAIR PARTS LIST TO FIGURE NUMBER CROSS-REFERENCE LIST

NOTE

The following appendices, common to all TM's in this series, are in TM 55-1930-209-14&P-20.

COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BILL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof	1-2
2-1	Reverse Osmosis Demonstration	2-2
2-2	ROWPU and Ballast Seawater Supply Block Diagram	2-5
2-3	ROWPU System Block Diagram	2-6
2-4	Drinking Water System Block Diagram (Barge 1)	2-7

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

Figure		Page
2-5	Drinking Water System Block Diagram (Barges 2 and 3)	2-8
3-1	Switchboard Distribution Circuit Breakers (Barge 1)	3-3
3-2	Switchboard Distribution Circuit Breakers (Barges 2 and 3)	3-4
3-3	Power Panel 1 Circuit Breakers, 440 Vac	3-5
3-4	Power Distribution Panel 2, 440 Vac	3-6
3-5	Power Distribution Panel 3, 120 Vac	3-7
3-6	Power Distribution Panel 4, 440 Vac (Barge 1)	3-8
3-7	Deck Lighting Panel	3-9
3-8	Void Lighting Panel	3-10
3-9	Receptacle Panel	3-11
3-10	Overall View of Switchboard Control Panels	3-14
3-11	Typical Switchboard Generator Control Panel	3-15
3-12	Switchboard Distribution Panel (Barge 1)	3-17
3-13	Switchboard Distribution Panel (Barges 2 and 3)	3-18
3-14	Paralleling and Control Panel	3-19
3-15	Switchboard Miscellaneous Controls and Indicators	3-20
3-16	Location of Controls for Emergency Shutdown Systems	3-28
3-17	Emergency Electrical System Diagram	3-30
3-18	24 Vdc Power Panel	3-31
3-19	Emergency Lighting Panel	3-32
3-20	Battery Charger	3-33
3-21	Battery Bank	3-34
4-1	Front Panel of Marine Smoke Detector Cabinet	4-2
5-1	Radio Communications System Major Components	5-3
5-2	Army Radio Equipment Interface	5-4
5-3	Marine Radio Equipment Interface	5-4
5-4	Walkie-Talkie Equipment Interface	5-5
5-5	Army Radio Power Supply PP-6224 A/U Controls and Indicators (Barge 1)	5-9
5-6	Army Radio Power Supply PP-2953/U Controls and Indicators (Barges 2 and 3)	5-10
5-7	Army Radio Controls and Indicators	5-11
5-8	Marine Radio Controls and Indicators	5-12
5-9	Walkie-Talkie Battery Charger Controls and Indicators	5-13
5-10	Walkie-Talkie Controls and Indicators	5-14
5-11	Foghorn Major Component Location	5-22

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

Figure		Page
5-12	Telephone System Major Component Location	5-25
5-13	Telephone Station Selector Box Controls	5-30
5-14	System Operator Telephone Handset Station	5-31
5-15	Telephone Headset Controls and Plug	5-32
5-16	Telephone Headset Station	5-33
5-17	Telephone Speaker	5-35
6-1	Normal Interior Lighting Arrangement	6-2
6-2	Emergency Interior Lighting Arrangement	6-4
6-3	10A Rotary Snap Switch (Barge 1 only)	6-7
6-4	30A 3-Way Rotary Snap Switch	6-7
6-5	Power Panel 3	6-8
6-6	Deck Lighting Panel	6-9
6-7	Void Lighting Panel	6-10
6-8	Emergency Lighting Panel	6-11
6-9	Exterior Lighting System Arrangement	6-13
6-10	24 Vdc Power Panel	6-18
6-11	Searchlight	6-19
7-1	Example of Light-Proof Louvered Hatches on Deckhouse Port and Starboard Bulkheads	7-2
7-2	Example of Covered Fan Motors on Deckhouse Top	7-3
7-3	Power Panel 2, 440 Vac	7-4
7-4	Ventilation System Operating Controls	7-7
7-5	Voids Ventilation Fan Motors on Port and Starboard Deckhouse Bulkheads (Portside Shown)	7-10
7-6	Example of Vertical Fan Motors near ROWPU Space Aft Bulkhead	7-11
7-7	Example of Round Blower Covers on Port and Starboard Bulkhead Exteriors	7-12
7-8	Voids Ventilation Emergency Shutdown Controls	7-13
7-9	Heating and AC Selector Switch	7-16
7-10	Heating and AC System Controls	7-17
7-11	Location of Seawater Valves Affecting AC Unit	7-20
7-12	Heating Systems Locations (Barge 1)	7-23
7-13	Heater Controls	7-25

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

7-14	Switchboard Distribution Panel (Barge 1)	7-26
7-15	Power Distribution Panel 4, 440 Vac (Barge 1)	7-27
8-1	Equipment Monitoring System Block Diagram	8-3
8-2	Equipment Monitoring System Arrangement	8-4
8-3	Potable Water Tanks Display Page	8-6
8-4	Salinity Display Page	8-6
8-5	System Status Display Page	8-7
8-6	Generator Alarms Display Page	8-8
8-7	High Pressure Water Pumps Display Page .	8-8
8-8	Bilge Alarms Display Page	8-9
8-9	Chlorine Status Display Page	8-10
8-10	Tank Levels Display Page	8-10
8-11	24 Vdc Power Panel .	8-13
8-12	Equipment Monitoring System Main Processor .	8-14
8-13	Equipment Monitoring System Keyboard	8-15
8-14	Main Processor Battery Charger	8-16
9-1	Chlorination System Installation (Barge 1)	9-2
9-2	Chlorination System Installation (Barges 2 and 3)	9-3
9-3	Chlorination System General Working (Block) Diagram	9-5
9-4	Chlorination System Flowchart	9-6
9-5	Chlorination Unit Controls and Indicators	9-10
9-6	Chlorine Metering Pump Controls	9-11
9-7	Chlorine Metering Pump Control Unit Controls and Indicators	9-12
9-8	Chlorine Metering Pump Motor Controller	9-13
9-9	Chlorination Unit Control Cabinet Controls and Indicators	9-14
9-10	Interior of Chlorination Control Unit Cabinet	9-15
9-11	EMS Keyboard	9-16
9-12	EMS Chlorine Status Display Page	9-17
9-13	EMS Status Display Page	9-17
10-1	Workboat Profile	10-2
10-2	Location of Workboat Components	10-3
10-3	Workboat Operator Controls and Indicators	10-6

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

Figure		Page
10-4	VHF/FM Marine Radio Control Panel	10-9
10-5	Depthfinder Controls and Indicators	10-10
10-6	Engine Maintenance Controls and Indicators	10-12
10-7	Messenger Line Reel Unit	10-13
10-8	Bow Crane in Traveling (Stowed) Configuration	10-22
10-9	Bow Crane Control Panel (Barge 1)	10-23
10-10	Bow Crane Control Panel (Barges 2 and 3)	10-24
10-11	Standard Military Hand Signals for Controlling Cranes	10-27
10-12	Workboat Cradle Tie-Down with Ratchet	10-28
10-13	Bow Crane Lifts Workboat with Three-Point Suspension Harness	10-29
11-1	ROWPU and Ballast Seawater Supply	11-2
11-2	ROWPU and Ballast Seawater Supply Block Diagram	11-4
11-3	Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply	11-5
11-4	Air Conditioner and Chlorination Seawater Cooling Block Diagram	11-7
11-5	Diesel Engine Generator Cooling Seawater	11-8
11-6	Diesel Engine Generator Cooling Seawater Block Diagram (Barge 1)	11-10
11-7	Diesel Engine Generator Cooling Seawater Block Diagram (Barges 2 and 3)	11-11
11-8	Seawater System's Electrical Controls	11-14
11-9	ROWPU Control Station (ROWPU 1 Station Shown)	11-15
11-10	Ballast Tank Liquid Level Indicator	11-16
12-1	Location of Compressed Air System Components (Barge 1)	12-2
12-2	Location of Compressed Air System Components (Barges 2 and 3)	12-3
12-3	Air Compressor Electric Controller	12-6
12-4	Barge 1 Air Compressor/Receiver	12-7
12-5	Barges 2 and 3 Air Compressor/Receiver	12-8
12-6	Exterior View of Air Pressure Regulator with Gauge	12-9
12-7	Exterior View of Air Filter 1 and Air Filter 2	12-11
12-8	Air Station Valve and Quick Disconnect	12-13
12-9	PIG Launcher Controls	12-15
13-1	ROWPU 1 Installation	13-4
13-2	ROWPU 2 Installation	13-5
13-3	ROWPU System Block Diagram	13-6

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

Figure		Page
13-4	ROWPU System Flow Diagram	13-7
13-5	Reverse Osmosis Demonstration .	13-10
13-6	ROWPU Control Station (ROWPU 1 Station Shown)	13-13
13-7	HP Pump Diesel Engine Controls and Indicators (Sheet 1 of 2)	13-14
13-7	HP Pump Diesel Engine Controls and Indicators (Sheet 2 of 2)	13-15
13-8	RO Block Valves and Indicators	13-16
13-9	Pretreatment Skid Valves and Temperature Indicator	13-17
13-10	Coagulant and Inhibitor Pump Controls (Sheet 1 of 2)	13-18
13-10	Coagulant and Inhibitor Pump Controls (Sheet 2 of 2)	13-19
13-11	Monitoring System Salinity Display Page	13-20
13-12	Monitoring System High Pressure Water Pumps Display Page	13-20
13-13	High Pressure Diesel Pump Lubrication	13-25
14-1	Drinking Water System Installation (Barge 1)	14-2
14-2	Drinking Water System Installation (Barges 2 and 3)	14-3
14-3	Drinking Water System Block Diagram (Barge 1)	14-6
14-4	Drinking Water System Block Diagram (Barges 2 and 3)	14-7
14-5	Drinking Water System Electrical Controls	14-10
14-6	Tank Liquid Level Indicator	14-11
14-7	Drinking Water Discharge Pressure Gauge, Flow Rate Meter, and Associated Monitoring System Display	14-12
14-8	Drinking Water Salinity Sensor and Monitoring System Display	14-13
14-9	Potable Water Tanks Monitoring System Display	14-14
14-10	Drinking Water Pressure Set Pressure Gauge	14-15
15-1	Shore Discharge System Installation	15-2
15-2	Shore Discharge System Winch Controls and Indicators (Barge 1)	15-7
15-3	Shore Discharge System Winch Controls and Indicators (Barges 2 and 3)	15-8
15-4	Hydraulic Power Unit Control Panel and Remote Start/Stop Switch	15-9
15-5	Hose Winch Hydraulic Power Unit	15-10
15-6	Hydraulic Power Unit Gauges (Barges 2 and 3)	15-11
15-7	Valves and PIG Launcher Controls	15-12
15-8	Hydraulic Disc Brake Release Controls	15-13

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF ILLUSTRATIONS

Figure		Page
15-9	Band Brake Hand Pump Controls and Indicators	15-14
15-10	Levelwind Controls (Barges 2 and 3)	15-15
16-1	Tug with Barge "on the Hip"	16-2
16-2	Towing Equipment Installation	16-4
16-3	Positions of Tug, Barge, Shore Facility, and Anchors	16-8
16-4	Sequence of Movements for Barge and Tug in Normal Anchoring	16-9
16-5	Position of Barge, Shore Facility, and Shore Discharge Hose when Using Only One Anchor	16-11
16-6	Anchor Winch Control Panel	16-13
16-7	Outer Side of Anchor Winch	16-15
16-8	Inner Side of Anchor Winch (handle in)	16-16
16-9	Servicing Points on Anchor Winch Gear Motor Reduction Box	16-18

LIST OF TABLES

Table		Page
1-1	Barge Operation and Maintenance Technical Manuals	1-1
3-1	Electrical Power System Major Components	3-12
3-2	Barge Normal Electrical Power Distribution	3-13
3-3	Major Components of Emergency Electrical System	3-27
5-1	Radio Communications System Major Components	5-2
5-2	Frequency/Channel Chart for Commercial Marine Radios in USA	5-18
5-3	Foghorn Major Components	5-21
5-4	Locations of Telephone Stations and Equipment	5-24
5-5	Telephone System Major Components	5-26
5-6	Circuit Breakers	5-28
6-1	Normal Interior Lighting System Components	6-3
6-2	Emergency Interior Lighting System Components	6-5
6-3	Exterior Lighting System Components	6-14
7-1	Major Components of Deckhouse Ventilation System	7-5
7-2	Major Components of Voids Ventilation System	7-9
7-3	Major Components of Heating and Air Conditioning System	7-18
8-1	Equipment Monitoring System Main Components	8-2

TABLE OF CONTENTS (Continued)

VOLUME 1

LIST OF TABLES

Table		Page
8-2	Equipment Monitoring System Sensor Data	8-5
8-3	EMS Operating Controls and Indicators	8-12
9-1	Major Components of Chlorination System	9-4
9-2	Operating Controls and Indicators	9-8
9-3	Chlorination System Valves	9-18
11-1	Major Components of ROWPU and Ballast Seawater Supply	11-3
11-2	Major Components of Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply	11-6
11-3	Major Components of Diesel Engine Generator Cooling Seawater	11-9
11-4	Operating Controls and Indicators	11-13
11-5	Seawater System Valves	11-17
12-1	Compressed Air System Major Components 12-4	
13-1	ROWPU System Components	13-2
13-2	Operating Controls and Indicators	13-11
13-3	ROWPU System Valves	13-21
14-1	Major Components of Drinking Water System	14-4
14-2	Operating Controls and Indicators	14-9
14-3	Drinking Water System Valve Label Identification	14-16
15-1	Components of Shore Discharge System	15-3
15-2	Operating Controls and Indicators	15-5
15-3	Shore Discharge System Valves	15-16

TABLE OF CONTENTS

VOLUME 2

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-7.1	ROWPU and ballast seawater supply	1-1
1-7.2	Air conditioner cooling seawater and chlorination unit seawater supply	1-1
1-7.3	Diesel engine generator cooling seawater	1-1
1-8	Capabilities	1-11
1-8.1	System capability definitions	1-11
1-9	Special limitations	1-11
1-10	Performance characteristics	1-11
1-11	Equipment specifications	1-11
1-12	Items furnished	1-26
1-13	Items required but not furnished	1-26
1-14	Tools and test equipment	1-26
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	ROWPU seawater supply	2-1
2-2	Ballast seawater supply	2-1
2-3	Air conditioning unit seawater supply	2-1
2-4	Chlorination unit seawater supply	2-1
2-5	Diesel generators seawater supply	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1

TABLE OF CONTENTS (Continued)

VOLUME 2

		Page
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-1
3-3	Normal and alternate operating procedures	3-1
3-3.1	Supplying seawater to ROWPU's from seachest (deep water) using seawater pump(s) 1 and/or 2.	3-10
3-3.1.1	Normal procedures	3-10
3-3.1.2	Alternate procedures	3-11
3-3.2	Supplying seawater to ROWPU's from starboard shell penetration (shallow water) using seawater pump(s) 1 and/or 2	3-11
3-3.2.1	Normal procedures	3-12
3-3.2.2	Alternate procedures	3-12
3-3.3	Supplying seawater from seawater pumps to chlorination and air conditioning units	3-13
3-3.4	Supplying seawater from cooling pump to air conditioning and chlorination units	3-14
3-3.5	Filling ballast tank (to correct a bow high condition)	3-14
3-3.5.1	Filling ballast tank from forward seachest	3-14
3-3.5.2	Filling ballast tank from starboard shell	3-15
3-3.6	Draining ballast tank (to correct a stem high condition)	3-15
3-3.7	Supplying seawater for generator cooling	3-16
3-3.8	Seachest blowdown	3-17
3-3.8.1	Forward seachest blowdown	3-17
3-3.8.2	Aft seachest blowdown	3-17
3-4	Seawater system shutdown procedures	3-18
3-4.1	Shutdown seawater supply to ROWPU's	3-18
3-4.2	Shutdown generator cooling seawater supply	3-18
3-4.3	Shutdown seawater supply to air conditioning and/or chlorination units when using cooling pump	3-18
3-5	Emergency shutdown	3-18
3-5.1	General	3-19
3-5.2	Emergency shutdown procedures	3-19

TABLE OF CONTENTS (Continued)

VOLUME 2

		Page
Section IV.	Operation under extreme conditions	3-19
3-6	Operation under extreme conditions	3-19
3-6.1	Operation in extreme cold	3-19
3-6.2	Operation in extreme heat	3-19
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance instruction	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Component	4-1
4-5	Seawater system	4-1
Section IV.	Maintenance procedures	4-1
4-6	General	4-1
4-7	Seawater system	4-7
4-7.1	Lubrication	4-8
4-7.2	Repair or replacement of system components	4-8
4-7.2.1	Seawater discharge pump assembly	4-8
4-7.2.2	Seachest (Void 2 starboard or Void 4 port)	4-9
4-7.2.3	Seawater strainer	4-9
4-7.2.4	Strainer inlet and outlet pressure gauges	4-11
4-7.2.5	Seawater filter 1 and 2 (Lakos separator)	4-12
4-7.2.6	Seawater discharge pump OFF/ON/START and local START/STOP switches.	4-12
4-7.2.7	Cooling pump motor controller	4-14

TABLE OF CONTENTS (Continued)

VOLUME 2

		Page
4-7.2.8	Cooling pump	4-17
4-7.2.9	Pressure regulator (chlorination unit seawater supply line)	4-18
4-7.2.10	Pressure gauge (chlorination unit seawater supply line)	4-18
4-7.2.11	Seawater to chlorination in-line filter 3	4-19
4-7.2.12	Seachest and ballast tank air escape valve	4-19
4-7.2.13	Generator cooling inlet and outlet temperature gauges	4-20
4-7.2.14	Ballast tank	4-20
4-7.2.15	Ballast tank liquid level indicator	4-21
4-7.2.16	Piping and valves	4-22
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-2	Administrative storage	5-1
5-2.1	Administrative storage procedures, generators in use	5-1
5-2.2	Administrative storage procedures, generators off	5-2
5-2.3	Administrative storage inspection	5-2
5-3	Long-term storage	5-2
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

NOTE

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MAINTENANCE ALLOCATION CHART (MAC)
TOOLS AND TEST EQUIPMENT LIST (TTEL)
EXPENDABLE /DURABLE SUPPLIES AND MATERIALS LIST (ESML)
REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)
REPAIR PARTS LIST TO FIGURE NUMBER CROSS-REFERENCE LIST

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 2

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
1-2	ROWPU and Ballast Seawater Supply	1-5
1-3	ROWPU and Ballast Seawater Supply Block Diagram	1-7
1-4	Air Conditioner Cooling Seawater and Chlorination Unit, Seawater Supply	1-8
1-5	Air Conditioner and Chlorination Unit Cooling Seawater Block Diagram	1-10
1-6	Diesel Engine Generator Cooling Seawater	1-22
1-7	Diesel Engine Generator Cooling Seawater Block Diagram (Barge 1)	1-24
1-8	Diesel Engine Generator Cooling Seawater Block Diagram (Barges 2 and 3)	1-25
3-1	Seawater System's Electrical Controls	3-3
3-2	ROWPU Control Station (ROWPU 1 Station Shown)	3-4
3-3	Ballast Tank Liquid Level Indicator	3-5
3-4	Location of Control Buttons for Emergency Shutdown Systems	3-20
4-1	ROWPU Control Station Schematic	4-2
4-2	Cooling Pump Motor Controller Schematic	4-3

LIST OF TABLES

Table		Page
1-1	Major Components of ROWPU and Ballast Seawater Supply	1-6
1-2	Major Components of Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply	1-9
1-3	Major Components of Diesel Engine Generator Cooling Seawater	1-23
3-1	Operating Controls and Indicators	3-2
3-2	Seawater System Valves	3-6
4-1	Seawater Discharge Pump and Cooling Pump Troubleshooting	4-2
4-2	Cooling Pump Motor Controller Troubleshooting	4-3
4-3	Seawater System Troubleshooting	4-4

TABLE OF CONTENTS

VOLUME 3

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	System description	1-1
1-8	Component description	1-1
1-8.1	Pretreatment skid assembly.	1-1
1-8.2	Media filters	1-5
1-8.3	HP pump skid	1-5
1-8.4	RO block assembly	1-5
1-9	System capabilities	1-7
1-10	Limitations	1-7
1-11	Performance characteristics	1-12
1-12	Equipment specifications	1-12
1-13	Items furnished	1-18
1-14	Items required but not furnished	1-18
1-15	Tools and test equipment	1-18
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	RO process	2-1
2-2	ROWPU system operation	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-13
3-3	General	3-13
3-4	Startup procedures	3-13
3-5	Operating procedures	3-17
3-6	Shutdown	3-19

TABLE OF CONTENTS (Continued)

VOLUME 3

		Page
3-6.1	Normal shutdown	3-19
3-6.2	Emergency shutdown	3-19
3-6.2.1	General	3-19
3-6.2.2	Emergency shutdown procedures	3-20
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance instructions	4-1
Section II.	Preventive maintenance checks and services	4-1
Section Ill.	Troubleshooting	4-1
4-4	ROWPU system	4-1
4-5	Trouble evaluation	4-1
Section IV.	Maintenance procedures	4-1
4-6	General	4-1
4-7	Component servicing	4-5
4-7.1	Pretreatment skid	4-8
4-7.1.1	Changing cartridge cage assembly (filter elements)	4-8
4-7.1.2	Cartridge filter elements replacement	4-11
4-7.1.3	Coagulant or inhibitor drum replacement	4-12
4-7.1.4	Chemical metering pump check valves cleaning	4-13
4-7.1.5	Chemical metering pump priming	4-14
4-7.2	Media filters	4-15
4-7.2.1	Preliminary procedures	4-15
4-7.2.2	Backwashing media filter 1	4-16
4-7.2.3	Backwashing media filter 2	4-17
4-7.2.4	Backwashing media filter 3	4-17
4-7.2.5	Flushing media filters	4-17
4-7.3	HP pump assembly	4-17
4-7.3.1	Diesel engine oil and filter change	4-17
4-7.3.2	Draining water from diesel engine fuel filter	4-18
4-7.3.3	Diesel engine alternator fan belt adjustment	4-18
4-7.3.4	Diesel engine air filter cleaning and replacement	4-19
4-7.3.5	Diesel engine cooling system 500 hour service	4-21
4-7.3.6	Diesel engine cooling system replenishment	4-21
4-7.3.7	Diesel engine coolant (anti-freeze) change	4-22

TABLE OF CONTENTS (Continued)

VOLUME 3

		Page
4-7.3.8	Diesel engine cooling system cleaning	4-22
4-7.3.9	HP pump pedestal bearing oil change	4-23
4-7.3.10	HP pump oil breather cleaning	4-23
4-7.3.11	HP pump V-belt adjustment	4-23
4-7.3.12	HP pump mechanical seal replacement	4-26
4-7.3.13	HP pump belt tensioner bearings lubrication	4-27
4-7.3.14	Power takeoff oil replenishment	4-27
4-7.3.15	Power takeoff oil change	4-27
4-7.3.16	Power takeoff bearings lubrication	4-28
4-7.4	RO block	4-28
4-7.4.1	Preliminary procedures	4-28
4-7.4.2	RO block membrane cleaning procedures	4-29
4-7.4.3	Membrane cleaning agent drum replacement	4-30
4-7.4.4	RO block throttling valve lubrication	4-31
4-8	Component repair or replacement	4-31
4-8.1	Pretreatment skid	4-31
4-8.1.1	Chemical metering pump replacement	4-31
4-8.1.2	Chemical metering pump diaphragm replacement	4-32
4-8.1.3	Chemical metering pump fuse replacement	4-32
4-8.1.4	Chemical metering pump tubing and cap replacement	4-32
4-8.1.5	Flow indicator (F1) replacement	4-32
4-8.1.6	Temperature gauge (T1) and pressure gauge (P1 thru P5) replacement	4-33
4-8.1.7	Control station indicator light bulb replacement	4-33
4-8.1.8	Control station fuse replacement	4-33
4-8.2	Media filters	4-33
4-8.2.1	Media replacement	4-33
4-8.2.2	Air eliminator (air vent) replacement	4-34
4-8.3	HP pump assembly	4-35
4-8.3.1	Diesel engine replacement	4-35
4-8.3.2	Diesel engine alternator testing	4-36
4-8.3.3	Diesel engine alternator replacement	4-36
4-8.3.4	Diesel engine emergency shutdown cable replacement	4-37
4-8.3.5	Diesel engine muffler replacement	4-37
4-8.3.6	Diesel engine fuel filter replacement	4-38
4-8.3.7	Diesel engine fuel system bleeding	4-38
4-8.3.8	Diesel engine starter replacement	4-38

TABLE OF CONTENTS (Continued)

VOLUME 3

		Page
4-8.3.9	Diesel engine throttle cable replacement	4-40
4-8.3.10	HP pump replacement	4-40
4-8.3.11	HP pump V-belt replacement	4-42
4-8.4	RO block	4-43
4-8.4.1	RO block membrane element removal and replacement	4-43
4-8.5	RO block sampling valve repair/replacement	4-44
4-8.6	RO block product tube assembly repair/replacement	4-47
4-8.7	RO block pressure tube seals replacement	4-48
4-8.8	Valve repair/replacement	4-49
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-2	Administrative storage	5-1
5-2.1	Administrative storage procedures	5-2
5-2.2	Administrative storage inspection	5-2
5-3	Long-term storage	5-2

LIST OF APPENDICES

A	REFERENCES	A-1
B	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	B-1
C	MANUFACTURERS' SERVICE MANUAL/INSTRUCTIONS	C-1

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LIST OF ILLUSTRATIONS

Figure		Page
1-1	Location of Barge Major Components	1-2
1-2	ROWPU 1 Installation	1-8
1-3	ROWPU 2 Installation	1-9

TABLE OF CONTENTS (Continued)

VOLUME 3

LIST OF ILLUSTRATIONS

Figure		Page
1-4	ROWPU System Block Diagram	1-10
1-5	ROWPU System Flow Diagram	1-11
2-1	Reverse Osmosis Demonstration	2-2
3-1	ROWPU Control Station (ROWPU 1 Station shown)	3-5
3-2	HP Pump Diesel Engine Controls and Indicators	3-6
3-3	RO Block Valves and Indicators	3- 8
3-4	Pretreatment Skid Valves and Temperature Indicator	3-9
3-5	Coagulant and Inhibitor Pump Controls	3-10
3-6	Monitoring System SALINITY Display Page	3-12
3-7	Monitoring System HIGH PRESSURE WATER PUMPS Display Page	3-12
3-8	Location of Control Buttons for Emergency Shutdown Systems	3-21
4-1	Cartridge Filter Assembly (Sheet 1 of 2)	4-9
4-2	Chemical Metering Pump Maintenance	4-14
4-3	Chemical Metering Pump Priming	4-15
4-4	HP Pump Diesel Engine Oil Filter	4-18
4-5	HP Pump Diesel Engine Fuel Filter	4-19
4-6	HP Pump Diesel Engine Alternator	4-20
4-7	HP Pump Diesel Engine Air Filter	4-20
4-8	HP Pump Diesel Engine Cooling System	4-24
4-9	HP Pump Pedestal Bearing	4-25
4-10	HP Pump Oil Breather	4-25
4-11	HP Pump V-belt	4-26
4-12	HP Pump Mechanical Seal	4-27
4-13	HP Pump Grease Fittings	4-28
4-14	Media Tank Air Vent	4-35
4-15	HP Pump Diesel Engine Muffler	4-39
4-16	HP Pump Diesel Engine Fuel System Bleeding	4-39
4-17	HP Pump Diesel Engine Electric Starter	4-40
4-18	HP Pump V-belt Pulley	4-41
4-20	RO Block Pressure Tube Assembly (sheet 1 of 2)	4-45
4-20	RO Block Membrane Element Removal Tool	4-47
4-21	RO Block Product Tubes	4-47

TABLE OF CONTENTS (Continued)

VOLUME 3

LIST OF TABLES

Table		Page
1-1	ROWPU System Components	1-6
3-1	Operating Controls and Indicators	3-1
3-2	ROWPU System Valves	3-2
4-1	ROWPU System Troubleshooting	4-2
4-2	Trouble Evaluation	4-5
4-3	Torque Values for Fasteners	4-6

TABLE OF CONTENTS

VOLUME 4

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-8	Capabilities	1-9
1-9	Special limitations	1-9
1-10	Performance characteristics	1-9
1-11	Equipment specifications	1-9
1-12	Items furnished	1-14
1-13	Items required but not furnished	1-14
1-14	Tools and test equipment	1-14
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	General	2-1
2-2	Preparation for operation	2-1
2-3	Non-operating chlorination system	2-2
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-15
3-3	Operating procedures	3-15
3-4	Normal chlorination system operation	3-15
3-5	Brine tank and holding tank priming	3-18

TABLE OF CONTENTS (Continued)

VOLUME 4

		Page
3-6	Chlorine generation and recirculation	3-20
3-7	Chlorination unit descaling	3-21
3-7.1	Initial flushing with seawater	3-21
3-7.2	Flushing with acid	3-22
3-7.2.1	Acid tank preparation	3-22
3-7.2.2	Acid flush	3-22
3-8	Shutdown procedure	3-23
3-9	Emergency shutdown	3-23
3-9.1	General	3-23
3-9.2	Emergency shutdown procedures	3-24
Section IV.	Operation under extreme conditions	3-24
3-10	Operation under extreme conditions	3-24
3-10.1	Operation in extreme cold	3-24
3-10.2	Operation in extreme heat	3-24
3-10.2.1	Lubricants	3-24
3-10.2.2	Motors	3-24
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance procedures	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Major components	4-1
4-4.1	Metering pump	4-1
4-4.2	Chlorination unit	4-1
4-4.3	Metering pump control unit	4-1
4-5	Chlorination system	4-1

TABLE OF CONTENTS (Continued)

VOLUME 4

		Page
Section IV.	Maintenance procedures	4-4
4-6	General	4-4
4-7	Chlorination system	4-5
4-7.1	Repair or replacement of system components	4-5
4-7.1.1	Chlorination unit	4-5
4-7.1.2	Chlorination unit brine pump assembly	4-5
4-7.1.3	Chlorination unit circulation pump assembly	4-6
4-7.1.4	Chlorination unit control cabinet	4-7
4-7.1.5	Sump pump	4-8
4-7.1.6	Sump pump switch	4-9
4-7.1.7	Drip pan and sump	4-10
4-7.1.8	Metering pump	4-10
4-7.1.9	Metering pump motor controller	4-11
4-7.1.10	Metering pump control unit (Analyzer/XMTR)	4-12
4-7.1.11	Chlorine sensor	4-12
4-7.1.12	Portable eyewash	4-13
4-7.1.13	Flow switch	4-13
4-7.1.14	Chlorination unit holding tank air escape valve	4-14
4-7.1.15	Piping and valves	4-14
4-7.1.16	Electrical wiring and cables	4-14
4-7.1.17	Hoses	4-14
CHAPTER 5	STORAGE	5-1
Section I.	Short-term storage	5-1
5-1	Short-term storage	5-1
Section II.	Administrative storage.	5-1
5-2	Administrative storage	5-1
5-2.1	Administrative storage procedures	5-1
5-2.2	Administrative storage inspection	5-2
Section III.	Long-term storage	5-2
5-3	Long-term storage	5-2

TABLE OF CONTENTS (Continued)

VOLUME 4

		Page
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Location of Barge Major Components	1-2
1-2	Chlorination System Installation (Barge 1)	1-5
-3	Chlorination System Installation (Barges 2 and 3)	1-6
1-4	Chlorination System General Working (Block) Diagram	1-8
3-1	Chlorination Unit Controls and Indicators	3-6
-2	Chlorine Metering Pump Controls	3-7

TABLE OF CONTENTS (Continued)

VOLUME 4

LIST OF ILLUSTRATIONS

Figure		Page
3-3	Chlorine Metering Pump Control Unit Controls and Indicators	3-8
3-4	Chlorine Metering Pump Motor Controller	3-9
3-5	Chlorination Unit Control Cabinet Controls and Indicators	3-10
3-6	Interior of Chlorination Unit Control Cabinet	3-11
3-7	EMS Keyboard	3-12
3-8	EMS Chlorine Status Display Page	3-13
3-9	EMS Status Display Page	3-14
3-10	Location of Controls for Emergency Shutdown Systems	3-25
4-1	Replacement of Crimped Terminals	4-5

LIST OF TABLES

Table		Page
1-1	Major Components of Chlorination System	1-7
3-1	Operating Controls and Indicators	3-2
3-2	Chlorination System Valves	3-3
4-1	Chlorination System Troubleshooting	4-2

TABLE OF CONTENTS

VOLUME 5

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-8	Capabilities	1-12
1-9	Limitations	1-12
1-10	Performance characteristics	1-12
1-11	Equipment specifications	1-12
1-12	Items furnished	1-20
1-13	Items required but not furnished	1-20
1-14	Tools and test equipment	1-20
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	Drinking water supply	2-1
2-2	Drinking water supplied to shore or port discharge valve	2-1
2-3	Drinking water for onboard use	2-2
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-1
3-3	Normal operating procedures	3-1
3-4	Filling drinking water storage tanks	3-9

TABLE OF CONTENTS (Continued)

VOLUME 5

		Page
3-5	Discharging drinking water to shore	3-10
3-6	Discharging drinking water through port discharge valve	3-13
3-6.1	Discharging drinking water to another vessel	3-13
3-6.2	Emptying storage tanks by discharging overboard	3-14
3-7	Supplying storage tank drinking water to pressure set for use on barge	3-14
3-8	Filling drinking water reserve tank	3-15
3-8.1	Filling drinking water reserve tank from storage tanks	3-15
3-8.2	Filling drinking water reserve tank from other vessel or shore supply	3-16
3-9	Supplying drinking water on barge from reserve tank	3-16
3-10	Supplying drinking water to dayroom, washdown stations, chlorination unit, and shower	3-16
3-11	Shutdown procedures	3-17
3-12	Emergency shutdown	3-17
3-12.1	General	3-17
3-12.2	Emergency shutdown procedures	3-18
Section IV.	Operation under extreme conditions	3-18
3-13	Operation under extreme conditions	3-18
3-13.1	Operation in extreme cold	3-18
3-13.2	Operation in extreme heat	3-18
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance instructions	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Components	4-1
4-4.1	Discharge pump	4-1
4-4.2	Pressure set	4-1
4-5	Drinking water system	4-1
Section IV.	Maintenance procedures	4-2
4-6	General	4-2
4-6.1	General maintenance practices	4-2
4-7	Drinking water system	4-6
4-7.1	Lubrication	4-6
4-7.2	Repair or replacement of system components	4-6

TABLE OF CONTENTS (Continued)

VOLUME 5

		Page
4-7.2.1	Discharge pump assembly	4-6
4-7.2.2	Pressure set	4-9
4-7.2.3	Water filter	4-11
4-7.2.4	Salinity cell sensor	4-11
4-7.2.5	Turbine flow meter	4-13
4-7.2.6	Pressure sensor	4-14
4-7.2.7	Pressure gauge	4-15
4-7.2.8	Storage tanks	4-15
4-7.2.9	Reserve tank	4-15
4-7.2.10	Storage tank liquid level indicator	4-15
4-7.2.11	Reserve tank liquid level indicator	4-16
4-7.2.12	Washdown stations	4-16
4-7.2.13	Shower.	4-17
4-7.2.14	Discharge pump motor controller.	4-17
4-7.2.15	Discharge pump remote switch	4-19
4-7.2.16	Pressure set motor controller	4-20
4-7.2.17	Pump and storage tank selector switch	4-22
4-7.2.18	Water and chlorine mixer	4-23
4-7.2.19	Tank air escape valve	4-23
4-7.2.20	Piping and valves	4-23
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-2	Administrative storage	5-1
5-2.1	Administrative storage procedures	5-1
5-2.2	Administrative storage inspection	5-2
5-3	Long-term storage	5-2
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

		Page
A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

TABLE OF CONTENTS (Continued)

VOLUME 5

NOTE

The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.
MAINTENANCE ALLOCATION CHART (MAC)
TOOLS AND TEST EQUIPMENT LIST (TTEL)
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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF FIGURES

Figure		Page
1-1	Barge Major Components	1-2
1-2	Drinking Water System Installation (Barge 1)	1-5
1-3	Drinking Water System Installation (Barges 2 and 3)	1-6
1-4	Drinking Water System Block Diagram (Barge 1)	1-10
1-5	Drinking Water System Block Diagram (Barges 2 and 3)	1-11
3-1	Drinking Water System Electrical Controls	3-4
3-2	Tank Liquid Level Indicator	3-5
3-3	Drinking Water Discharge Pressure Gauge, Flow Rate Meter and Associated Monitoring System Display	3-6
3-4	Drinking Water Salinity Sensor and Monitoring System Display	3-7
3-5	Potable Water Tanks Monitoring System Display	3-8
3-6	Drinking Water Pressure Set Pressure Gauge	3-8
3-7	Location of Control Buttons for Emergency Shutdown Systems	3-19
4-1	Pressure Set Pump Assembly, Exploded View	4-19
4-2	Drinking Water Discharge Pump No. 1 and No. 2	4-30
4-3	Drinking Water Pressure Motor Controller	4-34

LIST OF TABLES

Table		Page
1-1	Major Components of Drinking Water System	1-7
3-1	Operating Controls and Indicators	3-1
3-2	Drinking Water System	3-2
4-1	Drinking Water System Troubleshooting	4-5

TABLE OF CONTENTS

VOLUME 6

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1.-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-8	Capabilities	1-1
1-9	Special limitations	1-1
1-10	Performance characteristics	1-1
1-11	Equipment specifications	1-6
1-12	Items furnished	1-8
1-13	Items required but not furnished	1-8
1-14	Tools and test equipment	1-8
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
Section I.	Description and data	2-1
2-1	Shore winch installation	2-1
2-2	Hose deployment	2-1
2-3	Pumping water to shore	2-1
2-4	Hose retrieval	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-1
3-3	Discharge hose deployment	3-1
3-3.1	Predeployment procedures	3-1
3-3.1.1	Shore winch installation	3-1
3-3.1.2	Preparation of discharge hose	3-1
3-3.1.3	Preparation of shore discharge hose reel winch and hydraulic power system	3-1
3-3.1.4	Deployment of messenger (tow) line	3-13

TABLE OF CONTENTS (Continued)

VOLUME 6

		Page
3-3.2	Deployment of discharge hose (hose out)	3-15
3-3.3	Controlling a runaway discharge hose	3-17
3-3.4	Unpowered discharge hose deployment	3-17
3-4	Discharging drinking water to shore	3-18
3-5	Shutdown procedures	3-18
3-5.1	Discharge hose pigging (hose blowout)	3-19
3-5.2	Discharge hose retrieval (hose in)	3-21
3-5.3	Emergency shutdown	3-21
3-5.3.1	General	3-21
3-5.3.2	Emergency shutdown procedures	3-21
Section IV.	Operation under extreme conditions	3-21
3-6	Operation under extreme conditions	3-21
3-6.1	Operation in extreme cold	3-21
3-6.2	Operation in extreme heat	3-21
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance procedures	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Component	4-1
4-4.1	Winch hydraulic drive motor	4-1
4-4.2	Levelwind hydraulic drive motor	4-1
4-5	Shore discharge system	4-1
Section IV.	Maintenance procedures	4-3
4-6	General	4-3
4-7	Component	4-4
4-8	Shore discharge system	4-4
4-9	Lubrication	4-4
4-9.1	Hydraulic power unit	4-4
4-9.1.1	Adding fluid	4-4
4-9.1.2	Changing fluid	4-5
4-9.2	Levelwind reduction gear box	4-5

TABLE OF CONTENTS (Continued)

VOLUME 6

Page

4-9.2.1	Adding oil	4-5
4-9.2.2	Changing oil	4-5
4-9.3	Levelwind secondary reduction gear box (Barge 1 only)	4-6
4-9.3.1	Adding oil	4-6
4-9.3.2	Changing oil	4-6
4-9.4	Main winch reduction gear box	4-6
4-9.4.1	Adding oil	4-6
4-9.4.2	Changing oil	4-6
4-9.5	Bearings	4-6
4-9.6	Hydraulic power unit electric motor	4-6
4-9.7	Swivel joint	4-7
4-9.8	Motor/pump coupling	4-7
4-10	Hydraulic winch repair	4-7
4-10.1	Discharge hose repair	4-7
4-10.2	Winch hydraulic motor repair	4-7
4-10.3	Handpump replacement	4-7
4-10.3.1	Removal	4-7
4-10.3.2	Installation	4-7
4-10.4	Winch disc brake	4-9
4-11	Hydraulic power unit repair	4-9
4-11.1	Suction filter replacement	4-9
4-11.2	Return filter replacement	4-9
4-11.3	Gear pump coupling replacement	4-9
4-11.3.1	Removal	4-9
4-11.3.2	Installation	4-9
4-11.4	Gear pump repair	4-10
4-11.4.1	Removal	4-10
4-11.4.2	Disassembly, repair, and assembly	4-10
4-11.4.3	Installation	4-10
4-11.5	Motor/heater control panel repair	4-10
4-11.6	Counterbalance valve cartridge replacement	4-10
4-12	Levelwind repair	4-10
4-12.1	Levelwind coupling replacement	4-10
4-12.1.1	Removal	4-10
4-12.1.2	Installation	4-10

TABLE OF CONTENTS (Continued)

VOLUME 6

Page

4-12.2	Levelwind hydraulic motor repair	4-10
4-12.2.2	Disassembly, inspection, repair, and assembly	4-10
4-12.2.3	Installation	4-10
4-12.3	Levelwind primary reduction gear box repair	4-10
4-12.4	Levelwind secondary reduction gear box repair	4-10
4-12.5	Swivel joint seal replacement	4-10
4-13	Valve replacement	4-10
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-1.1	Discharge hose deployed	5-1
5-1.2	Discharge hose retrieved	5-1
5-2	Administrative storage	5-2
5-2.1	Processing for administrative storage	5-2
5-2.2	Administrative storage inspection	5-2
5-3	Long-term storage	5-2
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

Page

A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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TABLE OF CONTENTS (Continued)

VOLUME 6

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
1-2	Shore Discharge System Installation	1-5
3-1	Shore Discharge System Winch Controls and Indicators (Barge 1)	3-3
3-2	Shore Discharge System Winch Controls and Indicators (Barges 2 and 3)	3-4
3-3	Hydraulic Power Unit Control Panel and Remote Start/Stop Switch	3-5
3-4	Hose Winch Hydraulic Power Unit	3-6
3-5	Hydraulic Power Unit Gauges (Barges 2 and 3)	3-7
3-6	Valves and PIG Launcher Controls	3-8
3-7	Hydraulic Disc Brake Release Controls	3-9
3-8	Band Brake Hand Pump Controls and Indicators	3-10
3-9	Levelwind Controls (Barges 2 and 3)	3-11
3-10	Location of Circuit Breaker P12 on Switchboard	3-14
3-11	Emergency System Shutoff Buttons	3-22
4-1	Replacement of Crimped Terminals	4-4
4-2	Repair of Outer Jacket Damage on Discharge Hose	4-8
4-3	Typical Stainless Steel Band Installation on Discharge Hose	4-9

LIST OF TABLES

Table		Page
1-1	Components of Shore Discharge System	1-6
3-1	Operating Controls and Indicators	3-2
3-2	Shore Discharge System Valves	3-12
4-1	Shore Discharge System Troubleshooting	4-2

TABLE OF CONTENTS

VOLUME 7

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-7.1	System capabilities defined	1-1
1-8	Capabilities	1-1
1-9	Special limitations	1-1
1-10	Performance characteristics	1-1
1-11	Equipment specifications	1-8
1-12	Items furnished	1-11
1-13	Items required but not furnished	1-11
1-14	Tools and test equipment	1-11
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	Activation	2-1
2-2	Air flow	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
3-1.1	Controls	3-1
3-1.2	Indicators	3-1
Section II.	Prestart procedures	3-5
3-2	Prestart	3-5
3-2.1	Startup after extended shutdown	3-5
3-2.2	Startup after temporary shutdown	3-7
Section III.	Operating procedures	3-7
3-3	General	3-7
3-4	Operating compressed air stations 1 thru 5 and 7	3-8
3-5	Using air impact wrench with air stations 1 thru 5 and 7	3-8

TABLE OF CONTENTS (Continued)

VOLUME 7

		Page
3-5.1	Pre-operational procedures	3-8
3-5.2	Operating the air impact wrench	3-8
3-6	Operating compressed air station 6 to power the PIG	3-9
3-7	Operating compressed air system for seachests blowdown	3-10
3-8	Shutdown procedures	3-10
3-8.1	Temporary shutdown	3-10
3-8.2	Extended shutdown	3-12
3-9	Emergency shutdown	3-12
3-9.1	General	3-12
3-9.2	Emergency shutdown procedures	3-13
Section IV.	Operation under extreme conditions	3-13
3-10	General	3-13
3-10.1	Operating in extreme heat	3-13
3-10.2	Operating in high humidity	3-13
3-10.3	Operating in extreme cold	3-13
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance procedures	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Troubleshooting procedures	4-1
Section IV.	Maintenance procedures	4-3
4-5	General	4-3
4-5.1	Air pressure regulators 1 and 2	4-3
4-5.1.1	Repair	4-3
4-5.1.2	Replacement	4-4
4-5.2	Air filter 1	4-4
4-5.2.1	Repair	4-4
4-5.2.2	Replacement	4-6
4-5.3	Air filter 2	4-6
4-5.3.1	Repair	4-6
4-5.3.2	Replacement	4-9
4-5.4	Safety valve	4-9
4-5.5	Automatic air pressure regulator (pressure switch)	4-9
4-5.6	Compressor oil change (Barge 1)	4-10

TABLE OF CONTENTS (Continued)

VOLUME 7

		Page
4-5.7	Compressor oil change (Barges 2 and 3)	4-10
4-5.8	Compressor air filter change (Barge 1)	4-10
4-5.9	Compressor air filters change (Barges 2 and 3)	4-11
4-5.10	Pulleys and belts	4-11
4-5.10.1	Pulleys and belts inspections (Barges 2 and 3)	4-11
4-5.10.2	Compressor pulley replacement (Barges 2 and 3)	4-12
4-5.10.3	Motor pulley replacement (Barges 2 and 3)	4-13
4-5.11	Air compressor - general	4-13
4-5.12	Valve replacement	4-13
CHAPTER 5	STORAGE	5-1
Section I.	Short-term storage	5-1
5-1	General	5-1
Section II.	Administrative storage	5-1
5-2	General	5-1
5-2.1	Administrative storage procedures	5-1
5-2.2	Administrative storage inspection	5-1
Section III.	Long-term storage	5-1
5-3	General	5-1
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

TABLE OF CONTENTS (Continued)

VOLUME 7

LIST OF APPENDICES

		Page
A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BILL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
1-2	Location of Compressed Air System Components - Barge 1	1-5
1-3	Location of Compressed Air System Components - Barges 2 and 3	1-6
3-1	Air Compressor Electric Controller	3-2
3-2	Barge 1 Air Compressor/Receiver	3-3
3-3	Barges 2 and 3 Air Compressor/Receiver	3-4
3-4	Exterior View of Air Pressure Regulator with Gauge	3-5
3-5	Exterior View of Air Filter 1 and Air Filter 2	3-6
3-6	Air Station Air Valve and Quick Disconnect	3-9
3-7	PIG Launcher Controls	3-11
3-8	Location of Controls for Emergency Shutdown Systems	3-14
4-1	Air Pressure Regulators 1 and 2, Exploded View	4-5
4-2	Air Filter 1, Exploded View	4-8
4-3	Air Filter 2, Exploded View	4-9

LIST OF TABLES

Table		Page
1-1	Compressed Air System Major Components	1-7
4-1	Troubleshooting Procedures for Compressed Air System	4-2

TABLE OF CONTENTS

VOLUME 8

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-7.1	System Capabilities	1-1
1-8	Capabilities	1-1
1-9	Performance characteristics	1-6
1-10	Equipment specifications	1-7
1-11	Items furnished	1-10
1-12	Items required but not furnished	1-10
1-13	Tools and test equipment	1-10
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	General	2-1
2-1.1	Storage tanks	2-1
2-1.2	Day tank	2-1
2-1.3	Draining tanks	2-1
2-1.4	Workboat fueling	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1

TABLE OF CONTENTS (Continued)

VOLUME 8

		Page
Section III.	Operating procedures	3-1
3-3	Operating procedures	3-1
3-3.1	Filling fuel oil storage tanks	3-8
3-3.2	Transferring fuel oil from storage tanks to day tank	3-9
3-3.3	Transferring fuel oil from day tank to diesel engines	3-10
3-3.4	Fueling workboat	3-10
3-3.5	Transferring fuel oil from storage tank to storage tank	3-11
3-3.6	Draining day tank to storage tanks or sludge tank	3-12
3-3.7	Draining storage tanks to off-barge facility	3-12
3-4	Shutdown	3-13
3-4.1	General	3-13
3-4.1.1	Shutdown procedures	3-13
3-4.2	Emergency shutdown	3-13
3-4.2.1	General	3-13
3-4.2.2	Emergency shutdown procedures	3-14
Section IV.	Operation under extreme conditions	3-14
3-5	Operation under extreme conditions	3-14
3-5.1	Operation in extreme heat	3-14
3-5.2	Operation in extreme cold	3-14
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
Section I.	General	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance procedures	4-1
Section II.	Preventive maintenance checks and services	4-1
Section III.	Troubleshooting	4-1
4-4	Component	4-1
4-5	Fuel oil system	4-1

TABLE OF CONTENTS (Continued)

VOLUME 8

		Page
Section IV.	Maintenance instructions	4-1
4-6	General	4-1
4-7	Fuel oil system	4-9
4-7.1	Fuel transfer pump adjustment	4-9
4-7.2	Repair	4-10
4-7.3	Fuel filter element replacement	4-10
4-7.4	Valve replacement	4-10
4-7.5	Liquid level indicator	4-10
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-2	Administrative storage	5-1
5-3	Long-term storage	5-2
CHAPTER 6	MANUFACTURER'S SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

		Page
A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 8

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
1-2	Fuel Oil System Block Diagram	1-5
3-1	Tank Liquid Level Indicator	3-2
3-2	Monitoring System Generator Alarms Display	3-3
3-3	Fuel Oil Transfer Pump Motor Controller	3-4
3-4	Location of Fuel Oil System Valves	3-5
3-5	Monitoring System Fuel Oil and Ballast Tank Page Display	3-8
3-6	Location of Controls for Emergency Shutdown Systems	3-15
4-1	Fuel Oil Filter	4-2
4-2	Replacement of Crimped Terminals	4-9

LIST OF TABLES

Table		Page
1-1	Major Components of Fuel Oil System	1-6
3-1	Fuel Oil System Valves	3-6
4-1	Fuel Oil System Troubleshooting	4-2

TABLE OF CONTENTS

VOLUME 9-1

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-2.1	Normal electrical system	1-1
1-2.2	Emergency electrical system	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	NORMAL ELECTRICAL SYSTEM	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Capabilities	2-7
2-3	Special limitations	2-7
2-4	Performance characteristics	2-7
2-5	Equipment specifications	2-12
2-6	Items furnished	2-15
2-7	Items required but not furnished	2-15
2-8	Tools and test equipment	2-15
Section II.	Description of operation	2-15
2-9	Description of operation	2-15
Section III.	Operating instructions	2-15
2-10	Operating controls and indicators	2-15
2-10.1	General	2-15
2-10.2	Generator control panels	2-16
2-10.3	Switchboard distribution panel	2-16
2-10.4	Paralleling and control panels	2-16
2-10.5	Miscellaneous controls and indicators	2-17
2-11	Prestart procedures from switchboard	2-17
2-12	Generator set alarm and shutoff systems	2-24

TABLE OF CONTENTS (Continued)

VOLUME 9-1

		Page
2-12.1	Alarm systems	2-24
2-12.2	Shutoff systems	2-24
2-13	Operating procedures from switchboard	2-25
2-14	Paralleling generators and transferring load	2-26
2-14.1	Correcting reverse power situation	2-27
2-15	Operating procedures using shore power	2-27
2-16	Operating other electrical panels and controls	2-27
2-17	Normal shutdown procedures from switchboard	2-28
2-18	Emergency shutdown	2-28
2-18.1	General	2-28
2-18.2	Emergency shutdown procedures	2-28
2-18.3	Electrical power emergency shutdown procedures	2-30
2-19	Operation under extreme conditions	2-30
2-19.1	General	2-30
2-19.2	Extreme humidity	2-30
Section IV.	Maintenance instructions	2-30
2-20	General	2-30
2-20.1	Maintenance concept	2-30
2-20.2	Maintenance procedures	2-30
2-21	Preventive maintenance checks and services	2-31
2-22	Troubleshooting	2-31
2-23	Maintenance procedures	2-31
2-23.1	Cleaning	2-31
2-23.2	Inspection	2-31
Section V.	Storage	2-32
2-24	Short-term storage	2-32
2-25	Administrative storage	2-32
2-25.1	Administrative storage procedures	2-32
2-26	Long-term storage	2-32

TABLE OF CONTENTS (Continued)

VOLUME 9-1

		Page
CHAPTER 3	EMERGENCY ELECTRICAL SYSTEM	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Capabilities	3-1
3-3	Special limitations	3-1
3-4	Performance characteristics	3-1
3-5	Equipment specifications	3-3
3-6	Items furnished	3-5
3-7	Items required but not furnished	3-5
3-8	Tools and test equipment	3-5
Section II.	Description of operation	3-5
3-9	Description of operation	3-5
3-9.1	Normal operations	3-5
3-9.2	Emergency operations	3-5
3-9.3	Restoration of normal source of electricity	3-6
Section III.	Operating instructions	3-6
3-10	Operating controls and indicators	3-6
3-11	Prestart checks	3-6
3-12	Normal operating procedures	3-8
3-13	Emergency operating procedures	3-10
3-14	Return to normal power source	3-11
3-15	Shutdown procedures	3-11
3-15.1	Normal shutdown procedures	3-11
3-15.2	Emergency shutdown procedures	3-11
3-16	Operation under extreme conditions	3-11

TABLE OF CONTENTS (Continued)

VOLUME 9-1

		Page
Section IV.	Maintenance instructions	3-12
3-17	General	3-12
3-17.1	Maintenance concept	3-12
3-17.2	Maintenance procedures	3-12
3-18	Preventive maintenance checks and services	3-12
3-19	Troubleshooting	3-12
3-20	Maintenance procedures	3-12
3-20.1	Cleaning	3-12
3-20.2	Inspection	3-13
Section V.	Storage	3-13
3-21	Short-term storage	3-13
3-22	Administrative storage	3-13
3-22.1	Administrative storage procedures	3-13
3-23	Long-term storage	3-13
CHAPTER 4	155 KW SHIP SERVICE GENERATORS	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-1.1	3306TA diesel engine	4-1
4-1.2	SR4 generator	4-1
4-2	Capabilities	4-1
4-3	Special limitations	4-1
4-4	Performance characteristics	4-1
4-5	Equipment specifications	4-1
4-5.1	3306TA diesel engine data	4-2
4-5.2	SR4 generator data	4-2
4-6	Items furnished	4-2
4-7	Items required but not furnished	4-2
4-8	Tools and test equipment	4-2
Section II.	Description of operation	4-2
4-9	Description of operation	4-2
4-9.1	Remote control and startup requirements	4-3

TABLE OF CONTENTS (Continued)

VOLUME 9-1

Section III.	Operating instructions	4-3
4-10	Operating controls and indicators	4-3
4-10.1	3306TA diesel engine	4-3
4-10.1.1	Controls for operating engine at the SSG	4-3
4-10.1.2	Engine indicators	4-3
4-10.2	SR4 generator controls	4-4
4-11	Prestart procedures	4-4
4-12	Starting procedures at the engine	4-5
4-13	Operating procedures	4-6
4-14	Shutdown procedures	4-6
4-14.1	Shutdown procedures at engine	4-6
4-14.2	Emergency shutdown	4-7
4-15	Operation under extreme conditions	4-7
4-15.1	Temperature extremes	4-7
4-15.2	High humidity	4-7
Section IV.	Maintenance instructions	4-7
4-16	General	4-7
4-16.1	Maintenance concept	4-7
4-16.2	Maintenance procedures	4-7
4-17	Preventive maintenance checks and services	4-7
4-18	Troubleshooting	4-8
4-18.1	3306TA engine	4-8
4-18.2	SR4 generator	4-8
4-19	Maintenance procedures	4-8
Section V.	Storage	4-8
4-20	Short-term storage	4-8
4-21	Administrative storage	4-8
4-21.1	Administrative storage procedures	4-8
4-21.1.1	3306TA engine	4-8
4-21.1.2	SR4 generator	4-8
4-22	Long-term storage	4-8

TABLE OF CONTENTS (Continued)

VOLUME 9-1

		Page
Section VI.	Manufacturers' service manuals/instructions	4-9
4-23	General	4-9
Section VII.	Manufacturers' warranties/guarantees	4-10
4-24	General	4-10
CHAPTER 5	20 KW SHIP AUXILIARY GENERATOR SET	5-1
Section I.	Description and data	5-1
5-1	Description	5-1
5-2	Capabilities	5-1
5-3	Special limitations	5-1
5-4	Performance characteristics	5-1
5-5	Equipment specifications	5-2
5-6	Items furnished	5-2
5-7	Items required but not furnished	5-2
5-8	Tools and test equipment	5-2
Section II.	Description of operation	5-2
5-9	Description of operation	5-2
Section III.	Operating instructions	5-3
5-10	Operating controls and indicators	5-3
5-10.1	4.236M diesel engine	5-3
5-10.1.1	Engine instruments	5-3
5-10.1.2	Engine indicators	5-3
5-10.1.3	Engine controls	5-3
5-10.2	SC144E generator	5-4
5-11	Prestart procedures	5-4
5-12	Starting procedures	5-5
5-13	Operating procedures	5-6
5-14	Shutdown procedures	5-6
5-14.1	Shutdown procedures at engine	5-6
5-14.2	Emergency shutdown	5-6
5-15	Operation under extreme conditions	5-7
5-15.1	Temperature extremes	5-7
5-15.2	High humidity	5-7

TABLE OF CONTENTS (Continued)

VOLUME 9-1

		Page
Section IV.	Maintenance instructions	5-7
5-16	General	5-7
5-16.1	Maintenance concept	5-7
5-16.2	Maintenance procedures	5-7
5-17	Preventive maintenance checks and services	5-7
5-18	Troubleshooting	5-7
5-18.1	4.236M diesel engine	5-7
5-18.2	SC144E generator	5-7
5-19	Maintenance procedures	5-7
Section V.	Storage	5-8
5-20	Short-term storage	5-8
5-21	Administrative storage	5-8
5-21.1	Administrative storage procedures	5-8
5-22	Long-term storage	5-8
Section VI.	Manufacturers' service manuals/instructions	5-8
5-23	General	5-8
Section VII.	Manufacturers' warranties/guarantees	5-10
5-24	General	5-10

LIST OF APPENDICES

Appendix		Page
APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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TABLE OF CONTENTS (Continued)

VOLUME 9-1

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Major ROWPU Barge Components - Deckhouse Roof (Sheet 1 of 3)	1-2
1-1	Major ROWPU Barge Components - Deckhouse (Sheet 2 of 3)	1-3
1-1	Major ROWPU Barge Components - Voids (Sheet 3 of 3)	1-4
2-1	Switchboard Distribution Circuit Breakers (Barge 1)	2-2
2-2	Switchboard Distribution Circuit Breakers (Barges 2 and 3)	2-3
2-3	Power Panel 1 Circuit Breakers, 440 Vac	2-4
2-4	Power Distribution Panel 2, 440 Vac	2-5
2-5	Power Distribution Panel 3, 120 Vac	2-6
2-6	Power Distribution Panel 4 (Barge 1)	2-8
2-7	Deck Lighting Panel	2-9
2-8	Void Lighting Panel	2-10
2-9	Receptacle Panel	2-11
2-10	Overall View of Switchboard Control Panels	2-18
2-11	Typical Switchboard Generator Control Panel	2-19
2-12	Switchboard Distribution Panel (Barge 1)	2-20
2-13	Switchboard Distribution Panel (Barges 2 and 3)	2-21
2-14	Paralleling and Control Panels	2-22
2-15	Switchboard Miscellaneous Controls and Indicators	2-23
2-16	Location of Controls for Emergency Shutdown Systems	2-29

TABLE OF CONTENTS (Continued)

VOLUME 9-1

LIST OF ILLUSTRATIONS (Continued)

Figure		Page
3-1	Emergency Electrical System Diagram	3-2
3-2	24 Vdc Power Panel	3-7
3-3	Emergency Lighting Panel	3-8
3-4	Battery Charger	3-9
3-5	Battery Bank	3-10

LIST OF TABLES

Table		Page
2-1	Electrical Power System Major Components	2-7
2-2	Barge Normal Electrical Power Distribution	2-15
3-1	Major Components of Emergency Electrical System	3-3

VOLUME 9-2

		Page
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1

VOLUME 9-3

		Page
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS Continued from TM 55-1903-209-14&P-9-2	B-1

VOLUME 9-4

APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS Continued from TM 55-1903-209-14&P-9-3	B-1

TABLE OF CONTENTS

VOLUME 10

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	INTERIOR LIGHTING SYSTEM	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Equipment specifications	2-1
2-3	Items furnished	2-3
2-4	Items required but not furnished	2-3
2-5	Tools and test equipment	2-3
Section II.	Description of operation	2-3
2-6	General	2-3
Section III.	Operating instructions	2-7
2-7	Operating controls and indicators	2-7
2-8	Prestart procedures	2-9
2-9	Operating procedures	2-9
2-9.1	Normal lighting	2-9
2-9.2	Emergency lighting	2-9
2-10	Shutdown procedures	2-14
2-10.1	Normal lighting	2-14
2-10.2	Emergency lighting	2-14
Section IV.	Maintenance instructions	2-14
2-11	General	2-14
2-11.1	Maintenance concept	2-14
2-11.2	Maintenance procedures	2-14
2-12	Preventive maintenance checks and services	2-14
2-13	Troubleshooting	2-15

TABLE OF CONTENTS (Continued)

VOLUME 10

		Page
Section V.	Storage	2-18
2-14	Short-term storage	2-18
2-15	Administrative storage	2-18
2-16	Long-term storage	2-18
CHAPTER 3	EXTERIOR LIGHTING SYSTEM	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Equipment specifications	3-1
3-3	Items furnished	3-5
3-4	Items required but not furnished	3-6
3-5	Tools and test equipment	3-6
Section II.	Description of operation	3-6
3-6	General	3-6
Section III.	Operating instructions	3-6
3-7	Operating controls and indicators	3-6
3-8	Prestart procedures	3-6
3-9	Operating procedures	3-6
3-9.1	Exterior side lights	3-6
3-9.2	Floodlights	3-6
3-9.3	Searchlights	3-8
3-9.4	Shore discharge hose deployment status lights	3-8
3-9.5	Anchor light	3-8
3-9.6	Navigation running lights	3-8
3-10	Shutdown procedures	3-8
3-10.1	Exterior side lights	3-8
3-10.2	Floodlights	3-8
3-10.3	Searchlights	3-8
3-10.4	Shore discharge hose deployment status lights	3-10
3-10.5	Anchor light	3-10
3-10.6	Navigation running lights	3-10

TABLE OF CONTENTS (Continued)

VOLUME 10

		Page
Section IV.	Maintenance instructions	3-10
3-11	General	3-10
3-11.1	Maintenance concept	3-10
3-11.2	Maintenance procedures	3-10
3-12	Preventive maintenance checks and services	3-10
3-13	Troubleshooting	3-10
3-14	Maintenance procedures	3-10
3-14.1	General	3-10
3-14.2	Cleaning and replacing bulbs	3-10
3-14.2.1	Exterior side lights	3-12
3-14.2.2	Floodlights	3-12
3-14.2.3	Searchlights	3-13
3-14.2.4	Shore discharge hose deployment status lights	3-13
3-14.2.5	Anchor light	3-13
3-14.2.6	Navigation lights	3-14
Section V.	Storage	3-14
3-15	Short-term storage	3-14
3-16	Administrative storage	3-14
3-17	Long-term storage	3-14
CHAPTER 4	EMERGENCY SHUTDOWN	4-1
4-1	General	4-1
CHAPTER 5	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	5-1
5-1	General	5-1
CHAPTER 6	MANUFACTURERS' WARRANTIES/GUARANTEES	6-1
6-1	General	6-1

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

TABLE OF CONTENTS (Continued)

VOLUME 10

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MAINTENANCE ALLOCATION CHART (MAC)
TOOLS AND TEST EQUIPMENT LIST (TTEL)
EXPENDABLE /DURABLE SUPPLIES AND MATERIALS LIST (ESML)
REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)
REPAIR PARTS LIST TO FIGURE NUMBER CROSS-REFERENCE LIST

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
2-1	Normal Interior Lighting Arrangement	2-4
2-2	Emergency Interior Lighting Arrangement	2-6
2-3	10A Rotary Snap Switch (Barge 1 only)	2-8
2-4	30A 3-Way Rotary Snap Switch	2-8
2-5	Power Panel 3	2-10
2-6	Deck Lighting Panel	2-11
2-7	Void Lighting Panel	2-12
2-8	Emergency Lighting Panel	2-13
3-1	Exterior Lighting System Arrangement	3-4
3-2	24 Vdc Power Panel	3-7
3-3	Searchlight	3-9

LIST OF TABLES

Table		Page
2-1	Normal Interior Lighting System Components	2-5
2-2	Emergency Interior Lighting System Components	2-7
2-3	Normal Interior Lighting System Troubleshooting	2-15
2-4	Emergency Interior Lighting System Troubleshooting	2-16
3-1	Exterior Lighting System Components	3-5
3-2	Exterior Lighting System Troubleshooting	3-12

TABLE OF CONTENTS

VOLUME 11

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
Section II.	Description and data	1-1
1-7	Description	1-1
1-8	Capabilities	1-1
1-9	Special limitations	1-1
1-10	Performance characteristics	1-1
1-11	Equipment specifications	1-9
1-12	Items furnished	1-10
1-13	Items required but not furnished	1-10
1-14	Tools and test equipment	1-10
CHAPTER 2	DESCRIPTION OF OPERATION	2-1
2-1	General	2-1
2-2	Power supply	2-1
CHAPTER 3	OPERATING INSTRUCTIONS	3-1
Section I.	Operating controls and indicators	3-1
3-1	Operating controls and indicators	3-1
Section II.	Prestart procedures	3-1
3-2	Prestart procedures	3-1
Section III.	Operating procedures	3-1
3-3	Startup procedures	3-1
3-4	Normal operating procedures	3-2
3-5	Alarm acknowledgment	3-13
3-5.1	Abnormal conditions are indicated in four ways	3-13
3-5.2	To acknowledge alarms sounded by EMS	3-13

TABLE OF CONTENTS (Continued)

VOLUME 11

		Page
3-6	System editing	3-13
3-6.1	Accessing edit mode	3-14
3-6.2	Level 1 editing	3-14
3-6.2.1	Using EDIT MENU option 1 to activate/deactivate sensors	3-15
3-6.2.2	Using EDIT MENU option 1 to change or set reference markers	3-16
3-6.2.3	Using EDIT MENU option 2 to activate/deactivate switches	3-17
3-6.2.4	Using EDIT MENU option 3 to activate/deactivate totalizers	3-18
3-6.2.5	Using EDIT MENU option 4 to set time and date on EMS clock	3-19
3-6.3	Level 2 editing procedures	3-20
3-7	Edit termination	3-21
3-8	Shutdown procedures	3-21
Section IV.	Operation under extreme conditions	3-21
3-9	General	3-21
CHAPTER 4	MAINTENANCE INSTRUCTIONS	4-1
4-1	Maintenance concept	4-1
4-2	Maintenance instructions	4-1
4-3	Preventive maintenance checks and services	4-1
4-4	General	4-1
4-5	General	4-3
4-6	Main processor	4-3
4-7	Keyboard	4-5
4-8	Video monitor	4-6
4-9	Alarm relay module	4-7
4-10	Bilge alarm module	4-8
4-11	Main power switch	4-9
4-12	Horn	4-10
4-13	Strobe light	4-11
4-14	Buzzer	4-13
4-15	Inverter/Battery Charger	4-13
4-16	Battery	4-14
4-17	Electrical wiring and cables	4-15
4-18	Terminal box	4-15

TABLE OF CONTENTS (Continued)

VOLUME 11

		Page
CHAPTER 5	STORAGE	5-1
5-1	Short-term storage	5-1
5-2	Administrative storage	5-1
5-2.1	Administrative storage procedures	5-1
5-2.2	Administrative storage inspection	5-1
5-3	Long-term storage	5-1
CHAPTER 6	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	6-1
6-1	General	6-1
CHAPTER 7	MANUFACTURERS' WARRANTIES/GUARANTEES	7-1
7-1	General	7-1

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 11

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Major ROWPU Barge Components - Deckhouse Roof (Sheet 1 of 3)	1-2
1-1	Major ROWPU Barge Components - Deckhouse (Sheet 2 of 3)	1-3
1-1	Major ROWPU Barge Components - Voids (Sheet 3 of 3)	1-4
1-2	Equipment Monitoring System Block Diagram	1-6
1-3	Equipment Monitoring System Arrangement	1-7
3-1	24 Vdc Power Panel	3-4
3-2	Equipment Monitoring System Main Processor	3-5
3-3	Equipment Monitoring System Keyboard	3-6
3-4	Main Processor Battery Charger	3-7
3-5	Potable Water Tanks Display Page	3-8
3-6	Salinity Display Page	3-8
3-7	System Status Display Page	3-9
3-8	Generator Alarms Display Page	3-10
3-9	High Pressure Water Pumps Display Page	3-10
3-10	Bilge Alarms Display Page	3-11
3-11	Chlorine Status Display Page	3-12
3-12	Tank Levels Display Page	3-12

LIST OF TABLES

Table		Page
1-1	Equipment Monitoring System Main Components	1-5
1-2	Equipment Monitoring System Sensor Data	1-8
3-1	EMS Operating Controls and Indicators	3-3
4-1	Troubleshooting Procedures	4-1

TABLE OF CONTENTS

VOLUME 12

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-2.1	Radio communications equipment	1-1
1-2.1.1	Army radio	1-1
1-2.1.2	Commercial marine radios	1-1
1-2.1.3	Walkie-talkies	1-1
1-2.2	Foghorn equipment	1-1
1-2.3	Telephone system	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	RADIO COMMUNICATIONS SYSTEM	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Capabilities	2-1
2-2.1	Army radio	2-1
2-2.2	Commercial marine radios	2-1
2-2.3	Walkie-talkies	2-1
2-3	Special limitations	2-1
2-4	Performance characteristics	2-6
2-5	Equipment specifications	2-6
2-6	Items furnished	2-8
2-7	Items required but not furnished	2-8
2-8	Tools and test equipment	2-8
Section II.	Description of operation	2-8
2-9	General	2-8
2-9.1	Receiving radio messages	2-8
2-9.2	Transmitting radio messages	2-8

TABLE OF CONTENTS (Continued)

VOLUME 12

		Page
Section III.	Operating instructions	2-8
2-10	Operating controls and indicators	2-8
2-11	Prestart procedures	2-8
2-12	Operating procedures	2-9
2-12.1	Army radio	2-9
2-12.2	Commercial marine radios	2-10
2-12.3	Walkie-talkies	2-11
2-13	Shutdown procedures	2-12
2-13.1	Army radio	2-12
2-13.2	Marine radio	2-12
2-13.3	Walkie-talkies	2-12
2-14	Operation under extreme conditions	2-12
Section IV.	Maintenance instructions	2-21
2-15	General	2-21
2-15.1	Maintenance concept	2-21
2-15.2	Maintenance instructions	2-21
2-16	Preventive maintenance checks and services	2-21
2-17	Troubleshooting	2-21
2-17.1	Army radio	2-21
2-17.2	Commercial marine radios	2-21
2-17.3	Walkie-talkies	2-21
2-18	General maintenance	2-21
2-18.1	Cleaning	2-22
2-18.2	Fuse replacement	2-22
2-18.3	Indicator lamps	2-22
2-18.4	Cable replacement	2-22
2-18.5	Equipment	2-24
2-18.5.1	Army radio	2-24
2-18.5.2	Commercial marine radios	2-24
2-18.5.3	Walkie-talkies	2-24
2-18.5.4	Battery charger	2-24

TABLE OF CONTENTS (Continued)

VOLUME 12

		Page
Section V.	Storage	2-24
2-19	Short-term storage	2-24
2-20	Administrative storage	2-25
2-21	Long-term storage	2-25
Section VI.	Manufacturers' service manuals/instructions	2-25
2-22	General	2-25
Section VII.	Manufacturers' warranties/guarantees	2-26
2-23	General	2-26
CHAPTER 3	FOGHORN EQUIPMENT	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Capabilities	3-1
3-3	Special limitations	3-1
3-4	Performance characteristics	3-1
3-5	Equipment specifications	3-1
3-6.	Items furnished	3-1
3-7	Items required but not furnished	3-3
3-8	Tools and test equipment	3-3
Section II.	Description of operation	3-3
Section III.	Operating instructions	3-3
3-9	Operating controls and indicators	3-3
3-10	Prestart procedures	3-3
3-11	Operating procedures	3-3
3-12	Shutdown procedure	3-3
3-13	Operation under extreme conditions	3-3

TABLE OF CONTENTS (Continued)

VOLUME 12

		Page
Section IV.	Maintenance instructions	3-4
3-14	General	3-4
3-14.1	Maintenance concept	3-4
3-14.2	Maintenance instructions	3-4
3-15	Preventive maintenance checks and services	3-4
3-16	Troubleshooting	3-4
3-17	Maintenance procedures	3-5
3-17.1	General maintenance	3-5
3-17.2	Equipment maintenance	3-5
3-17.3	Foghorn remote control assembly circuit test	3-5
3-17.4	Foghorn remote control assembly switch replacement	3-8
3-17.5	Regulator converter assembly replacement	3-8
3-17.6	Foghorn replacement	3-8
Section V.	Storage	3-8
3-18	Short-term storage	3-8
3-19	Administrative storage	3-8
3-20	Long-term storage	3-8
Section VI.	Manufacturers' service manuals/instructions	3-9
3-21	General	3-9
Section VII.	Manufacturers' warranties/guarantees	3-9
3-22	General	3-9
CHAPTER 4	TELEPHONE SYSTEM	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-2	Capabilities	4-1
4-3	Special limitations	4-1
4-4	Performance characteristics	4-1
4-5	Equipment specifications	4-4
4-6	Items furnished	4-5
4-7	Items required but not furnished	4-5
4-8	Tools and test equipment	4-5

TABLE OF CONTENTS (Continued)

VOLUME 12

		Page
Section II.	Description of operation	4-6
4-9	General	4-6
4-9.1	Paging from system operator to crew personnel	4-6
4-9.2	Paging from crew personnel to system operator	4-6
4-9.3	Two-way communications between crew personnel	4-6
Section III.	Operating instructions	4-6
4-10	Operating controls and indicators	4-6
4-11	Prestart procedures	4-6
4-12	Operating procedures	4-7
4-12.1	Talking with telephone station from operator station in dayroom	4-7
4-12.2	Talking with system operator from crew telephone station	4-10
4-12.3	Talking between telephone stations	4-10
4-13	Shutdown procedures	4-10
4-14	Operation under extreme conditions	4-14
Section IV.	Maintenance instructions	4-14
4-15	General	4-14
4-15.1	Maintenance concept	4-14
4-15.2	Maintenance procedures	4-14
4-16	Preventive maintenance checks and services	4-14
4-17	Troubleshooting	4-14
4-18	Maintenance procedures	4-16
4-18.1	General maintenance	4-16
4-18.2	Equipment maintenance	4-16
4-18.2.1	Handset station (desk telephone)	4-16
4-18.2.2	Handset adapter module	4-17
4-18.2.3	Indoor speaker monitor	4-17
4-18.2.4	Station selector box assembly	4-18
4-18.2.5	Power control module and power amplifier	4-20
4-18.2.6	Headset	4-24
4-18.2.7	Headset station	4-24
4-18.2.8	Strobe light	4-25
4-18.2.9	Station buzzer	4-27
4-18.2.10	Electrical wiring and cables	4-28

TABLE OF CONTENTS (Continued)

VOLUME 12

		Page
Section V.	Storage	4-28
4-19	Short-term storage	4-28
4-20	Administrative storage	4-28
4-21	Long-term storage	4-29
Section VI.	Manufacturers' service manuals/instructions	4-29
4-22	General	4-29
Section VII.	Manufacturer's warranties/guarantees	4-29
4-23	General	4-30

LIST OF APPENDICES

		Page
A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 12

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
2-1	Radio Communications System Major Components	2-2
2-2	Army Radio Equipment Interface	2-4
2-3	Marine Radio Equipment Interface	2-4
2-4	Walkie-Talkie Equipment Interface	2-5
2-5	Army Radio Power Supply PP-6224 A/U Controls and Indicators (Barge 1)	2-13
2-6	Army Radio Power Supply PP-2953/U Controls and Indicators (Barges 2 and 3)	2-14
2-7	Army Radio Controls and Indicators	2-15
2-8	Marine Radio Controls and Indicators	2-16
2-9	Walkie-Talkie Battery Charger Controls and Indicators	2-17
2-10	Walkie-Talkie Controls and Indicators	2-18
2-11	Replacement of Crimped Terminals	2-22
3-1	Foghorn Major Component Location	3-2
3-2	Foghorn Wiring Diagram	3-7
4-1	Telephone System Major Component Location	4-2
4-2	Telephone Station Selector Box Controls	4-8
4-3	System Operator Telephone Handset Station	4-9
4-4	Telephone Headset Controls and Plug	4-11
4-5	Telephone Headset Station	4-12
4-6	Telephone Speaker	4-13
4-7	Station Selector Switch	4-19
4-8	Schematic Diagram, Model M3116, Power Control Module	4-22
4-9	Schematic Diagram, Model M3131, Power Amplifier	4-23
4-10	Schematic Diagram, Model M3141, Headset Station	4-26

TABLE OF CONTENTS (Continued)

VOLUME 12

LIST OF TABLES

Table		Page
2-1	Radio Communications System Major Components	2-3
2-2	Frequency/Channel Chart for Commercial Marine Radios in USA	2-19
2-3	Commercial Marine Radio Troubleshooting	2-23
2-4	VHF/FM Marine Handheld Transceiver Troubleshooting	2-23
3-1	Foghorn Major Components	3-3
3-2	Foghorn Equipment Troubleshooting	3-4
4-1	Telephone System Major Components	4-3
4-2	Circuit Breaker Safety Guide	4-7
4-3	Telephone System Troubleshooting	4-14

TABLE OF CONTENTS

VOLUME 13

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	BRIDGE CRANE SYSTEM	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Capabilities	2-1
2-3	Limitations	2-1
2-4	Performance characteristics	2-1
2-5	Equipment specifications	2-1
2-6	Items furnished	2-6
2-7	Items required but not furnished	2-6
2-8	Tools and test equipment	2-6
2-8.1	Special devices	2-6
Section II.	Description of operation	2-9
2-9	General	2-9
Section III.	Operating instructions	2-9
2-10	Operating controls	2-9
2-11	Operating procedures	2-9
2-11.1	Using portside or starboardside crane	2-9
2-11.2	Using crossover for trolley transfer	2-14
2-11.3	Using jib rail for moving loads through sliding door	2-14
2-11.4	Placing jib rail in stowed position	2-14
2-12	Operation under extreme conditions	2-14
Section IV.	Maintenance instructions	2-17
2-13	General	2-17
2-13.1	Maintenance concept	2-17
2-13.2	Maintenance instructions	2-17
2-14	Preventive maintenance	2-17

TABLE OF CONTENTS (Continued)

VOLUME 13

		Page
2-15	Troubleshooting	2-17
2-16	Maintenance procedures	2-17
2-16.1	General	2-18
2-16.2	Repair or replacement of bridge crane system components	2-20
2-16.2.1	5-ton geared trolley hoist	2-20
2-16.2.2	Cleaning and inspection	2-21
2-16.3	Cable reel	2-21
2-16.3.1	Cleaning and inspection	2-21
2-16.3.2	Test	2-22
2-16.3.3	Repair	2-22
2-16.3.4	Replacement	2-22
2-16.4	Bridge crane assembly	2-22
2-16.4.1	Cleaning and inspection	2-23
2-16.4.2	Testing	2-23
2-16.4.2.1	Load proof and function test and safety inspection	2-23
2-16,4.2.2	Electrical test and repair	2-23
2-16.5	Bridge crane trolley brake	2-26
2-16.5.1	Cleaning and inspection .	2-26
2-16.5.2	Repair	2-29
2-16.5.2.1	Friction disk replacement	2-29
2-16.5.2.2	Magnet assembly replacement	2-29
2-16.5.3	Adjustment	2-29
2-16.5.3.2	Torque adjustment	2-29
2-16.5.4	Replacement	2-29
2-16.6	Lifting slings and rigs	2-29
2-16.6.1	Cleaning and inspection	2-30
2-16.6.2	Test	2-30
2-16.6.3	Repair	2-30
2-16.6.3.1	Shackles	2-30
2-16.6.3.2	Hook	2-30
2-16.6.3.3	Wire Rope	2-30

TABLE OF CONTENTS (Continued)

VOLUME 13

		Page
2-16.7	Electrical wiring and cables	2-30
2-16.7	Electrical wiring and cables	2-30
2-16.7.1	Cleaning and inspection	2-30
2-16.7.2	Repair and replacement	2-30
2-16.8	Threaded parts	2-30
Section V.	Storage	2-30
2-17	Short-term storage	2-30
2-18	Administrative storage	2-31
2-19	Long-term storage	2-31
Section VI.	Manufacturers' service manuals/instructions	2-31
2-20	General	2-31
Section VII.	Manufacturers' warranties/guarantees	2-32
2-21	General	2-32
CHAPTER 3	BOW CRANE SYSTEM	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Capabilities	3-1
3-3	Limitations	3-7
3-4	Performance characteristics	3-7
3-5	Equipment specifications	3-7
3-6	Items furnished	3-7
3-7	Items required but not furnished	3-8
3-8	Tools and test equipment	3-8
Section II.	Description of operation	3-8
3-9	General	3-8
3-9.1	Workboat	3-8
3.9.2	Bow Crane	3-9
Section III.	Operating instructions	3-9
3-10	Operating controls	3-9
3-11	Bow crane prestart procedures	3-9
3-12	Bow crane procedures for deploying workboat	3-10
3-13	Workboat recovery procedures	3-11
3-14	Bow crane shutdown procedures	3-15
3-15	Operation under extreme conditions	3-15

TABLE OF CONTENTS (Continued)

VOLUME 13

		Page
Section IV.	Maintenance instructions	3-15
3-16	General	3-15
3-16.1	Maintenance concept	3-15
3-16.2	Maintenance instructions	3-16
3-17	Preventive maintenance checks and services	3-16
3-18	Troubleshooting	3-16
3-19	Maintenance procedures	3-17
3-19.1	General	3-17
3-19.2	Bow crane system	3-18
3-19.2.1	Lubrication	3-18
3-19.2.2	Repair or replacement of system components	3-18
3-19.2.2.1	Bow Crane	3-18
3-19.2.2.1.1	Cleaning and Inspection	3-18
3-19.2.2.1.2	Test	3-18
3-19.2.2.1.3	Repair .	3-19
3-19.2.2.2	Bow crane anti-2-block control panel	3-19
3-19.2.2.2.1	Cleaning and inspection	3-19
3-19.2.2.2.2	Test	3-19
3-19.2.2.2.3	Repair	3-21
3-19.2.2.2.4	Switch replacement	3-21
3-19.2.2.3	Bow crane remote station 1 and 2 START/STOP switches	3-21
3-19.2.2.3.1	Cleaning and inspection	3-22
3-19.2.2.3.2	Test and repair	3-22
3-19.2.2.3.3	Replacement	3-23
3-19.2.2.4	Hydraulic power unit motor controller	3-23
3-19.2.2.4.1	Cleaning and inspection	3-23
3-19.2.2.4.2	Test and repair	3-24
3-19.2.2.4.3	Replacement	3-25
3-19.2.2.5	Hydraulic power unit	3-27
3-19.2.2.5.1	Cleaning and inspection	3-27
3-19.2.2.5.2	Repair	3-27
3-19.2.2.5.3	Replacement	3-28

TABLE OF CONTENTS (Continued)

VOLUME 13

		Page
Section V.	Storage	3-29
3-20	Short-term storage	3-29
3-21	Administrative storage	3-29
3-21.1	Administrative storage inspection	3-29
3-22	Long-term storage	3-29
Section VI.	Manufacturers' service manuals/instructions	3-29
3-23	General	3-29
Section VII.	Manufacturers' warranties/guarantees	3-30
3-24	General	3-30
CHAPTER 4	VOID 4 TROLLEY HOIST	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-2	Capabilities	4-1
4-3	Performance characteristics	4-1
4-4	Equipment specifications	4-1
4-5	Items furnished	4-1
4-6	Items required but not furnished	4-1
4-7	Tools and test equipment	4-1
Section II.	Description of operation	4-1
4-8	General	4-1
Section III.	Operating instructions	4-3
4-9	Operating controls	4-3
4-10	Prestart procedures	4-3
4-11	Operating procedures	4-3
4-12	Shutdown procedures	4-3
4-13	Operation under extreme conditions	4-3
Section IV.	Maintenance instructions	4-3
4-14	General	4-3
4-14.1	Maintenance concept	4-3
4-14.2	Maintenance instructions	4-4
4-15	Preventive maintenance checks and services	4-4

TABLE OF CONTENTS (Continued)

VOLUME 13

		Page
4-16	Troubleshooting	4-4
4-17	Maintenance procedures	4-4
4-17.1	General	4-4
4-17.2	Lubrication	4-4
4-17.3	Cleaning and inspection	4-4
4-17.4	Test	4-5
4-17.5	Repair	4-5
4-17.6	Replacement	4-5
Section V.	Storage	4-6
4-18	Short-term storage	4-6
4-19	Administrative storage	4-6
4-20	Long-term storage	4-6
Section VI.	Manufacturers' service manuals/instructions	4-6
4-21	General	4-6
Section VII.	Manufacturers' warranties/guarantees	4-6
4-22	General	4-6

LIST OF APPENDICES

A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 13

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
2-1	Bridge Crane	2-4
2-2	Bridge Crane Route Diagram (Typical Layout)	2-5
2-3	Hoisting Rigs and Lifting Slings	2-7
2-4	Bridge Crane Jib Rail (Stowed Toward Aft)	2-11
2-5	Bridge Crane Hand-Held Control	2-12
2-6	Two-Ton Hoist Hand-Held Control	2-13
2-7	Bridge Crane Crossover Assembly	2-15
2-8	Bridge Crane Jib Rail (Deployed)	2-16
2-9	Replacement of Crimped Terminals	2-18
2-10	Bridge Crane System Schematic	2-27
3-1	Bow Crane in Traveling (Stowed) Position	3-2
3-2	Bow Crane Operating Controls (Barge 1)	3-3
3-3	Bow Crane Operating Controls (Barges 2 and 3)	3-4
3-4	Hydraulic Power Unit Motor Controller	3-5
3-5	Standard Military Hand Signals	3-6
3-6	START/STOP Control Station and Anti-2-Block Control Box on Deckhouse Top	3-12
3-7	Bow Crane Base	3-13
3-8	Workboat Cradle Tie-Down with Ratchet	3-14
3-9	Replacement of Crimped Terminals	3-17
3-10	Anti-2-Block Control Panel	3-20
3-11	Hydraulic Power Unit Motor Controller Schematic	3-26
4-1	Void 4 Trolley Hoist	4-2

TABLE OF CONTENTS (Continued)

VOLUME 13

LIST OF TABLES

Table		Page
2-1	Weights, Measurements, and Locations of Movable Equipment in Voids and Deckhouse	2-10
2-2	Bridge Crane Troubleshooting	2-19
3-1	Bow Crane Performance Characteristics and Load Limitations with Barge on an Even Keel	3-8
3-2	Bow Crane Troubleshooting	3-16
4-1	Void 4 Trolley Hoist Troubleshooting	4-5

TABLE OF CONTENTS

VOLUME 14

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army material to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	ANCHORING AND MOORING EQUIPMENT	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Capabilities	2-1
2-3	Limitations	2-1
2-4	Performance characteristics	2-2
2-5	Equipment specifications	2-2
2-6	Items furnished	2-4
2-7	Items required but not furnished	2-4
2-8	Tools and test equipment	2-4
Section II.	Operating Instructions	2-4
2-9	Operating controls and indicators	2-4
2-10	Prestart procedures	2-8
2-11	Operating procedures with power	2-10
2-12	Operating procedures without power	2-11
2-13	Shutdown procedures	2-11
2-13.1	Anchors deployed	2-11
2-13.2	Anchors retrieved	2-11
2-14	Emergency shutdown	2-12
2-14.1	General	2-12
2-14.2	Emergency shutdown procedures	2-12
2-15	Operations under extreme conditions	2-12

TABLE OF CONTENTS (Continued)

VOLUME 14

		Page
Section III.	Maintenance instructions	2-14
2-16	General	2-14
2-16.1	Maintenance concept	2-14
2-16.2	Maintenance instructions	2-14
2-17	Preventive maintenance checks and services.	2-14
2-18	Troubleshooting	2-14
2-19	Maintenance procedures	2-16
2-19.1	General	2-16
2-19.2	Lubrication	2-17
2-19.3	Repair or replacement of anchor winch components	2-17
2-19.3.1	Anchor winch electric brake repair and replacement	2-17
2-19.3.2	Anchor winch roller chain adjustment	2-22
2-19.3.3	Manual brake system repair	2-22
2-19.3.4	Anchor cable replacement	2-22
2-19.3.5	Anchor winch control panel repair and replacement	2-22
2-19.3.6	Anchor winch heater test and repair	2-26
2-19.4	Fairlead maintenance	2-26
2-19.5	Anchor replacement	2-28
Section IV.	Storage	2-28
2-20	Short-term storage	2-28
2-21	Administrative storage	2-28
2-22	Administrative storage inspections	2-29
2-23	Long-term storage	2-29
Section V.	Manufacturers' service manuals/instructions	2-29
2-24	General	2-29
Section VI.	Manufacturers' warranties/guarantees	2-30
2-25	General	2-30

TABLE OF CONTENTS (Continued)

VOLUME 14

		Page
CHAPTER 3	TOWING EQUIPMENT	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Capabilities	3-1
3-3	Limitations	3-1
3-4	Equipment specifications	3-1
3-5	Items furnished	3-3
3-6	Items required but not furnished	3-3
3-7	Tools and test equipment	3-3
Section II.	Description of operation	3-3
3-8	General	3-3
Section III.	Operating instructions	3-3
3-9	Towing bridle installation	3-3
3-10	Preparation for towing	3-4
3-11	Towing operations	3-4
3-12	Towing bridle storage	3-4
Section IV.	Maintenance instructions	3-5
3-13	General	3-5
3-13.1	Maintenance concept	3-5
3-13.2	Maintenance instructions	3-5
3-14	Preventive maintenance	3-6
3-15	Maintenance procedures	3-6
Section V.	Storage	3-6
3-16	General	3-6

LIST OF APPENDICES

		Page
A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 14

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
2-1	Anchor Winch Control Panel	2-5
2-2	Outer Side of Anchor Winch	2-6
2-3	Inner Side of Anchor Winch	2-7
2-4	Servicing Points on Anchor Winch Gear Motor Reduction Box	2-9
2-5	Location for Controls for Emergency Shutdown Systems	2-13
2-6	Replacement of Crimped Terminals	2-17
2-7	Spring Set Disc Brake	2-20
2-8	Self-Adjust Maintenance	2-21
2-9	Tensioning of Roller Chain	2-23
2-10	Anchor Winch Control Panel	2-27
3-1	Towing Equipment Installation	3-2

LIST OF TABLES

Table		Page
2-1	Anchoring Components	2-2
2-2	Mooring Components	2-2
2-3	Anchor Winch Troubleshooting	2-15

TABLE OF CONTENTS

VOLUME 15

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-5
1-4	Maintenance forms and records	1-5
1-5	Destruction of Army materiel to prevent enemy use	1-5
1-6	Storage	1-5
CHAPTER 2	DAYROOM EQUIPMENT	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Equipment specifications	2-1
2-3	Items furnished	2-4
2-4	Items required but not furnished	2-4
2-5	Tools and test equipment	2-4
Section II.	Operating instructions	2-4
2-6	Operating controls and indicators	2-4
2-7	Prestart procedures	2-4
2-8	Operating procedures	2-4
2-8.1	Hotplate	2-4
2-8.2	Drinking fountain	2-4
2-8.3	Coffeemaker	2-6
2-8.4	Refrigerator	2-6
2-8.5	Range hood	2-6
2-9	Shutdown procedures	2-6
2-9.1	Emergency shutdown	2-6
2-9.1.1	General	2-6
2-9.1.2	Emergency shutdown procedures	2-8
2-10	Operation under extreme conditions	2-8
Section III.	Maintenance instructions	2-8
2-11	General	2-8
2-11.1	Maintenance concept	2-8
2-11.2	Maintenance procedures	2-8
2-12	Preventive maintenance	2-8
2-13	Troubleshooting	2-9
2-13.1	Drinking fountain	2-9
2-13.2	Refrigerator	2-9

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
2-14	Maintenance procedures	2-9
2-14.1	Hotplate	2-9
2-14.2	Drinking fountain	2-9
2-14.2.1	Installation	2-9
2-14.2.2	Adjustments to drinking water temperature and flow	2-9
2-14.2.3	Maintenance	2-9
2-14.2.4	Repair	2-9
2-14.3	Refrigerator	2-9
2-14.3.1	Installation	2-9
2-14.3.2	Maintenance	2-9
2-14.3.3	Repair	2-9
2-14.4	Range hood	2-11
2-14.4.1	Installation	2-11
2-14.4.2	Maintenance	2-11
2-14.4.3	Repair	2-11
Section IV.	Storage	2-11
2-15	Short-term storage	2-11
2-16	Administrative storage	2-11
2-17	Long-term storage	2-11
Section V.	Manufacturers' service manuals/instructions	2-13
2-18	General	2-13
Section VI.	Manufacturers' warranties/guarantees	2-14
2-19	General	2-14
CHAPTER 3	WORKSHOP EQUIPMENT AND ROWPU SPACE ARC WELDER	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Equipment specifications	3-1
3-3	Items furnished	3-3
3-4	Items required but not furnished	3-3
3-5	Tools and test equipment	3-3
Section II.	Operating instructions	3-4
3-6	Operating controls and indicators	3-4
3-6.1	Drill press	3-4
3-6.2	Grinder with dust collector	3-4
3-6.3	Arc welder	3-4

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
3-7	Prestart procedures	3-4
3-7.1	Drill press and grinder	3-4
3-7.2	Arc welder	3-4
3-8	Operating procedures	3-4
3-8.1	Drill press	3-4
3-8.2	Grinder with dust collector	3-5
3-8.3	Arc welder	3-9
3-8.3.1	Operating procedures for arc welder	3-10
3-9	Shutdown procedures	3-11
3-9.1	Jaw vise.	3-11
3-9.2	Arbor press	3-11
3-9.3	Drill press	3-11
3-9.4	Grinder with dust collector	3-11
3-9.5	Emergency shutdown	3-11
3-10	Operation under extreme conditions	3-11
Section III.	Maintenance instructions	3-11
3-11	General	3-11
3-11.1	Maintenance concept	3-11
3-11.2	Maintenance procedures	3-11
3-12	Preventive maintenance	3-11
3-13	Maintenance procedures	3-11
3-13.1	Drill press	3-12
3-13.1.1	Installation	3-12
3-13.1.2	Adjustments and calibrations	3-12
3-13.1.3	Repair	3-12
3-13.2	Grinder with dust collector	3-12
3-13.2.1	Installation	3-12
3-13.2.2	Repair	3-12
3-13.3	Arc welder	3-12
Section IV.	Storage	3-12
3-14	Short-term storage	3-12
3-15	Administrative storage	3-13
3-16	Long-term storage	3-13
Section V.	Manufacturers' service manuals/instructions	3-13
3-17	General	3-13

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
Section VI.	Manufacturers' warranties/guarantees	3-14
3-18	General	3-14
CHAPTER 4	ACCESSES AND GUARD RAILS	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-1.1	Deckhouse doors and portholes	4-1
4-1.2	Accesses to voids and doors between voids	4-1
4-1.3	Guard rails	4-1
4-2	Equipment specifications	4-1
4-3	Items furnished	4-5
4-4	Items required but not furnished	4-5
4-5	Tools and test equipment	4-5
Section II.	Maintenance instructions	4-5
4-6	General	4-5
4-6.1	Maintenance concept	4-5
4-6.2	Maintenance procedures	4-5
4-7	Preventive maintenance checks and services	4-5
4-8	Maintenance instructions	4-6
4-8.1	Insulation	4-6
4-8.2	Exterior doors	4-6
Section III.	Storage	4-6
4-9	Short-term storage	4-6
4-10	Administrative storage	4-6
4-11	Long-term storage	4-6
Section IV.	Manufacturer's service manuals/instructions	4-6
4-12	General	4-6
CHAPTER 5	SANITATION SYSTEMS	5-1
Section I.	Description and data	5-1
5-1	Description	5-1
5-1.1	Ship's toilet functions	5-1
5-1.2	Bilge system functions	5-1
5-2	Special limitations	5-5
5-3	Performance characteristics	5-5
5-4	Equipment specifications	5-5

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
5-5	Items furnished	5-9
5-6	Items required but not furnished	5-9
5-7	Tools and test equipment	5-9
Section II.	Operating instructions	5-9
5-8	Operating controls and indicators for bilge system and ship's toilets	5-9
5-9	Prestart procedures	5-18
5-9.1	Ship's toilets	5-18
5-9.2	Bilge system	5-18
5-10	Operating procedures	5-18
5-10.1	Ship's toilets	5-18
5-10.2	Bilge system	5-18
5-10.2.1	Transferring bilge water from voids to sludge tank	5-19
5-10.2.2	Transferring void bilge water to sludge facility	5-19
5-10.2.3	Sludge tank draining to off board sludge facility	5-20
5-10.2.4	Draining diesel generator crankcase oil using bilge pump	5-21
5-10.2.5	Draining ROWPU HP pump crankcase using bilge pump	5-21
5-10.2.6	Draining spillage catchments with ball valve	5-22
5-10.2.7	Transferring bilge water from void to void	5-22
5-11	Shutdown procedures for bilge system	5-22
5-11.1	Emergency shutdown	5-22
5-12	Operation under extreme conditions	5-22
Section III.	Maintenance instructions	5-23
5-13	General	5-23
5-13.1	Maintenance concept for sanitation systems	5-23
5-14	Preventive maintenance	5-23
5-15	Troubleshooting ship's sanitation systems	5-23
5-15.1	Ship's toilets	5-23
5-15.2	Bilge system	5-23
5-16	Maintenance procedures	5-23
5-16.1	General	5-23
5-16.2	Ship's toilet repair	5-28
5-16.3	Bilge system repair	5-29
5-16.3.1	Bilge pump repair	5-29
5-16.3.2	Strainer basket cleaning or replacement	5-29

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
Section IV.	Storage	5-30
5-17	Short-term storage	5-30
5-18	Administrative storage	5-30
5-19	Long-term storage	5-31
Section V.	Manufacturers' service manuals/instructions	5-32
5-20	General	5-32
Section VI.	Manufacturers' warranties/guarantees	5-32
5-21	General	5-32
CHAPTER 6	ADDITIONAL MISCELLANEOUS EQUIPMENT	6-1
Section I.	Description and data	6-1
6-1	Description	6-1
6-1.1	Eyewash stations	6-1
6-1.2	Guard rails	6-1
6-1.3	Fendering system	6-1
6-1.4	Removable deck covering	6-1
6-1.5	Storage areas	6-1
6-1.6	Component identification and functional labels	6-1
6-1.7	Operational instruction placards	6-1
6-1.8	Notice, caution, warning, and danger signs	6-1
6-2	Equipment specifications	6-1
6-3	Items furnished	6-4
6-4	Items required but not furnished	6-4
6-5	Tools and test equipment	6-4
Section II.	Operating instructions	6-4
6-6	Eyewash station	6-4
6-7	Removable floor	6-4
6-8	Storage areas	6-4
6-9	Operation under extreme conditions	6-5
Section III.	Maintenance instructions	6-5
6-10	General	6-5
6-10.1	Maintenance concept	6-5
6-10.2	Maintenance procedures	6-5
6-11	Preventive maintenance checks and services	6-5

TABLE OF CONTENTS (Continued)

VOLUME 15

		Page
Section IV.	Storage	6-5
6-12	Short-term storage	6-5
6-13	Administrative storage	6-5
6-14	Long-term storage	6-5

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.
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LIST OF ILLUSTRATIONS

Figure		Page
1-1	Location of Barge Major Components	1-2
2-1	Deckhouse Dayroom Arrangement	2-2
2-2	Dayroom Equipment Controls/Indicators	2-5
2-3	Location of Controls for Emergency Shutdown Systems	2-7
2-4	Drinking Fountain Adjustments	2-10
2-5	Drinking Fountain - Rear View	2-12
3-1	Deckhouse Workshop Arrangement	3-2
3-2	Drill Press	3-6
3-3	Grinder with Dust Collector	3-7
3-4	Arc Welder Controls and Indicators	3-8
4-1	Deckhouse Doors and Portholes and Doors between Voids	4-2
5-1	Bilge System Major Components	5-2

TABLE OF CONTENTS (Continued)

VOLUME 15

LIST OF ILLUSTRATIONS

Figure		Page
5-2	Bilge System Flowchart	5-3
5-3	Bilge Pump Motor Controller	5-12
5-4	Tank Visual Level Indicator	5-13
5-5	EMS Bilge Alarms Page Key	5-14
5-6	EMS Bilge Alarms Display Page	5-15
5-7	EMS System Status Display Page	5-16
5-8	Ship's Toilets	5-17

LIST OF TABLES

Table		Page
4-1	Deckhouse Doors and Portholes	4-3
4-2	Accesses to Voids and Doors Between Voids	4-3
5-1	Major Components of Bilge System	5-4
5-2	Bilge System Valves	5-10
5-3	Bilge System Troubleshooting	5-24

TABLE OF CONTENTS

VOLUME 16

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	DECKHOUSE VENTILATION SYSTEM	2-1
Section I.	Description and data	2-1
2-1	Description	2-1
2-2	Capabilities	2-1
2-3	Performance characteristics	2-1
2-4	Equipment specifications	2-1
2-5	Items furnished	2-6
2-6	Items required but not furnished	2-6
2-7	Tools and test equipment	2-6
Section II.	Operating instructions	2-6
2-8	Operating controls and indicators	2-6
2-9	Prestart procedures	2-6
2-10	Operating procedures	2-6
2-10.1	Increasing ventilation	2-6
2-10.2	Decreasing ventilation	2-6
2-11	Shutdown procedures	2-7
2-11.1	Normal shutdown for less than 72 hours	2-7
2-11.2	Normal shutdown for more than 72 hours	2-7
2-12	Emergency shutdown	2-7
2-12.1	General	2-7
2-12.2	Emergency shutdown procedures	2-9

TABLE OF CONTENTS (Continued)

VOLUME 16

		Page
Section III.	Maintenance instructions	2-9
2-13	General	2-9
2-13.1	Maintenance concept	2-9
2-13.2	Maintenance instructions	2-9
2-14	Preventive maintenance checks and services	2-9
2-15	Troubleshooting	2-9
2-16	Maintenance procedures	2-12
2-16.1	Servicing ventilation systems fans and motors	2-12
2-16.2	Replacing ventilation systems fans and motors	2-12
2-16.3	Replacing gaskets on ventilation watertight hatches	2-13
Section IV.	Storage	2-13
2-17	Short-term storage	2-13
2-18	Administrative storage	2-13
2-18.1	Administrative storage procedures	2-13
2-18.2	Administrative storage inspection	2-13
2-19	Long-term storage	2-13
Section V.	Manufacturers' service manuals/instructions	2-13
2-20	General	2-13
Section VI.	Manufacturers' warranties/guarantees	2-14
2-21	General	2-14
CHAPTER 3	VOIDS VENTILATION SYSTEM	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-2	Capabilities	3-1
3-3	Performance characteristics	3-1
3-4	Equipment specifications	3-1
3-5	Items furnished	3-7
3-6	Items required but not furnished	3-7
3-7	Tools and test equipment	3-7

TABLE OF CONTENTS (Continued)

VOLUME 16

		Page
Section II.	Operating instructions	3-7
3-8	Operating controls and indicators	3-7
3-9	Prestart procedures	3-7
3-10	Operating procedures	3-8
3-11	Shutdown procedures	3-8
3-11.1	Normal shutdown for less than 72 hours	3-8
3-11.2	Normal shutdown for more than 72 hours	3-8
3-12	Emergency shutdown	3-8
3-12.1	General	3-8
3-12.2	Emergency shutdown procedures	3-11
Section III.	Maintenance instructions	3-11
3-13	General	3-11
3-13.1	Maintenance concept	3-11
3-13.2	Maintenance instructions	3-11
3-14	Preventive maintenance checks and services	3-11
3-15	Troubleshooting	3-11
3-16	Maintenance procedures	3-11
Section IV.	Storage	3-11
3-17	Short-term storage	3-11
3-18	Administrative storage	3-11
3-18.1	Administrative storage procedures	3-12
3-18.2	Administrative storage inspection	3-12
3-19	Long-term storage	3-12
Section V.	Manufacturers' service manuals/instructions	3-12
3-20	General	3-12
Section VI.	Manufacturers' warranties/guarantees	3-12
3-21	General	3-12

TABLE OF CONTENTS (Continued)

VOLUME 16

		Page
CHAPTER 4	HEATING AND AIR CONDITIONING (HAC) SYSTEM	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-2	Capabilities	4-1
4-3	Special limitations	4-1
4-4	Performance characteristics	4-1
4-5	Equipment specifications	4-4
4-6	Items furnished	4-4
4-7	Items required but not furnished	4-4
4-8	Tools and test equipment	4-4
Section II.	Operating instructions	4-5
4-9	Operating controls and indicators	4-5
4-10	Prestart procedures	4-5
4-11	Operating procedures	4-6
4-11.1	AC unit	4-6
4-11.2	Heating unit	4-6
4-12	Shutdown procedures	4-8
4-12.1	AC unit	4-8
4-12.2	Heating unit	4-8
4-13	Emergency shutdown procedures	4-8
4-13.1	General	4-8
4-13.2	Emergency shutdown procedures	4-8
Section III.	Maintenance instructions	4-8
4-14	General	4-8
4-14.1	Maintenance concept	4-8
4-14.2	Maintenance instructions	4-9
4-15	Preventive maintenance checks and services	4-9
4-16	Troubleshooting	4-9
4-17	Maintenance procedures	4-9
4-17.1	Air conditioning unit	4-9

TABLE OF CONTENTS (Continued)

VOLUME 16

		Page
4-17.2	Air filter replacement	4-9
4-17.3	Fan belt replacement	4-9
4-17.4	Condenser servicing	4-11
4-17.5	Heater element	4-11
4-17.5.1	Repair	4-11
4-17.5.2	Replacement	4-11
Section IV.	Storage	4-12
4-18	Short-term storage	4-12
4-19	Administrative storage	4-12
4-19.1	Administrative storage procedures	4-12
4-19.2	Administrative storage inspection	4-12
4-20	Long-term storage	4-12
Section V.	Manufacturers' service manuals/instructions	4-12
4-21	General	4-12
Section VI.	Manufacturers' warranties/guarantees	4-12
4-22	General	4-12
CHAPTER 5	ROWPU SPACE AND VOIDS HEATING SYSTEMS	5-1
Section I.	Description and data	5-1
5-1	Description	5-1
5-2	Capabilities	5-1
5-3	Special limitations	5-1
5-4	Performance characteristics	5-1
5-5	Equipment specifications	5-1
5-6	Items furnished	5-1
5-7	Items required but not furnished	5-1
5-8	Tools and test equipment	5-1

TABLE OF CONTENTS (Continued)

VOLUME 16

		Page
Section II.	Operating instructions	5-3
5-9	Operating controls and indicators	5-3
5-10	Prestart procedures	5-4
5-11	Operating procedures	5-4
5-12	Shutdown procedures	5-4
5-13	Emergency shutdown procedures	5-4
5-13.1	General	5-4
5-13.2	Emergency shutdown procedures	5-4
Section III.	Maintenance instructions	5-7
5-14	General	5-7
5-14.1	Maintenance concept	5-7
5-15	Preventive maintenance checks and services	5-7
5-16	Troubleshooting	5-7
5-17	Maintenance procedures	5-8
5-17.1	Fuses	5-8
5-17.2	Heater replacement	5-8
Section IV.	Storage	5-8
5-18	Short-term storage	5-8
5-19	Administrative storage	5-8
5-19.1	Administrative storage procedures	5-8
5-19.2	Administrative storage inspection	5-9
5-20	Long-term storage	5-9
Section V.	Manufacturers' service manuals/instructions	5-9
5-21	General	5-9
Section VI.	Manufacturers' warranties/guarantees.	5-9
5-22	General	5-9

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
APPENDIX C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

TABLE OF CONTENTS (Continued)

VOLUME 16

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The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Major Components of ROWPU Barge Systems and Equipment	1-2
2-1	Example of Light-proof Louvered Hatches on Deckhouse Port and Starboard Bulkheads	2-2
2-2	Example of Covered Fan Motors on Deckhouse Top	2-3
2-3	Power Panel No. 2, 440 Vac	2-4
2-4	Ventilation System Operating Controls	2-8
2-5	Location of Controls for Emergency Shutdown Systems	2-10
3-1	Voids Ventilation Fan Motors on Port and Starboard Deckhouse Bulkhead (Portside Shown)	3-5
3-2	Example of Vertical Fan Motors Near ROWPU Space Aft Bulkhead	3-6
3-3	Example of Round Blower Covers On Port and Starboard Bulkhead Exteriors	3-9
3-4	Voids Ventilation Emergency Shutdown Controls	3-10
4-1	Heating and AC Selector Switch	4-2
4-2	Heating and AC System Controls	4-3
4-3	Location of Seawater Valves Affecting AC Unit	4-7
5-1	Heating Systems Locations and Operating Controls	5-2
5-2	Heater Controls	5-3
5-3	Switchboard Distribution Panel (Barge 1)	5-5
5-4	Power Distribution Panel No. 4	5-6

TABLE OF CONTENTS (Continued).

VOLUME 16

LIST OF TABLES

Table		Page
2-1	Major Components of Deckhouse Ventilation System	2-5
2-2	Troubleshooting Procedures for Deckhouse and Voids Ventilation Systems	2-11
3-1	Major Components of Voids Ventilation System	3-4
4-1	Major Components of Heating and Air Conditioning System	4-1
4-2	Troubleshooting Procedures for HAC System	4-10
5-1	Troubleshooting Procedures for Forced Air Space Heaters	5-7

TABLE OF CONTENTS

VOLUME 17

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Warranties and guarantees	1-1
1-4	Maintenance forms and records	1-1
1-5	Destruction of Army materiel to prevent enemy use	1-1
1-6	Storage	1-1
CHAPTER 2	WORKBOAT	2-1
Section I.	Description and data	2-1
2-1	Purpose	2-1
2-2	Description and components	2-1
2-3	Capabilities	2-2
2-4	Special limitations	2-2
2-5	Performance characteristics	2-5
2-6	Equipment specifications	2-5
2-7	Items furnished	2-5
2-8	Items required but not furnished	2-5
2-9	Tools and test equipment	2-5
Section II.	Operating instructions	2-6
2-10	Controls and indicators	2-6
2-10.1	Searchlight	2-6
2-10.2	Operator's electrical control panel	2-6
2-10.3	Windshield wiper	2-6
2-10.4	Boat horn	2-6
2-10.5	Bilge pump switches and indicators	2-7
2-10.6	Outboard drive controls	2-7
2-10.7	Magnetic compass	2-7
2-10.8	Steering pump filler	2-7
2-10.9	Engine hourmeter	2-7
2-10.10	Fuel gauge	2-7
2-10.11	Volvo engine instrument panel	2-7
2-10.12	Master switch	2-9
2-10.13	Ignition/electrical switch	2-9
2-10.14	Throttle and clutch controls	2-10
2-10.15	Marine band VHF/FM radio	2-10
2-10.16	Depthfinder controls and indicators	2-11

TABLE OF CONTENTS (Continued)

VOLUME 17

		Page
2-10.17	Engine maintenance controls and indicators	2-11
2-11	Prestart procedures	2-11
2-12	Starting procedures	2-12
2-13	Operating procedures	2-15
2-13.1	Radio operations	2-15
2-13.2	Depthfinder operations	2-18
2-13.3	Workboat operations	2-19
2-14	Emergency procedures .	2-20
2-14.1	General	2-20
2-14.2	Fire prevention	2-20
2-14.3	Firefighting techniques	2-20
2-14.4	Running aground prevention	2-21
2-14.5	Recovery procedures when aground	2-21
2-15	Operations under unusual conditions	2-21
2-15.1	General	2-21
2-15.2	Being towed by another boat	2-21
2-15.3	Towing another boat	2-22
2-16	Shutdown procedures	2-22
2-17	Deployment and recovery	2-23
2-17.1	General	2-23
2-17.2	Bow crane procedures	2-23
2-17.2.1	Bow crane operating procedures	2-23
2-17.2.2	Bow crane prestart procedures	2-23
2-17.3	Workboat deployment procedures	2-28
2-17.4	Workboat recovery procedures	2-31
2-17.5	Bow crane shutdown procedures	2-31
2-18	Operations under extreme conditions	2-33
2-18.1	Operations in extreme heat	2-33
2-18.2	Operations in high humidity conditions	2-33
2-18.3	Operations in extreme cold	2-33
Section III.	Maintenance instructions	2-33
2-19	Maintenance concept	2-33
2-20	Preventive maintenance checks and services	2-33
2-21	Troubleshooting	2-34
2-22	Maintenance instructions	2-34

TABLE OF CONTENTS (Continued)

VOLUME 17

		Page
Section IV.	Storage	2-34
2-23	Short-term storage	2-34
2-24	Administrative storage	2-34
2-24.1	Administrative storage procedures	2-34
2-24.2	Administrative storage inspection	2-34
2-25	Long-term storage	2-34
Section V.	Manufacturers' manuals/instructions	2-35
2-26	General	2-35
Section VI.	Warranties/guarantees	2-36
2-27	General	2-36
CHAPTER 3	LIFESAVING EQUIPMENT	3-1
Section I.	Description and data	3-1
3-1	Description	3-1
3-1.1	Life rafts	3-1
3-1.2	Life vests	3-1
3-1.3	Lifesaving ring buoys	3-1
3-2	Capabilities	3-1
3-3	Special limitations	3-1
3-4	Performance characteristics	3-1
3-5	Equipment specifications	3-3
3-6	Items furnished	3-4
3-7	Items required but not furnished	3-4
3-8	Tools and test equipment	3-4
Section II.	Operating instructions	3-4
3-9	Manual operation of eight-person liferaft	3-4
3-10	Automatic deployment of eight-person liferaft	3-4
3-11	Using life buoys	3-5
3-12	Using lifevests	3-5
Section III.	Maintenance instructions	3-5
3-13	General	3-5
3-13.1	Maintenance concept	3-5
3-13.2	Maintenance instructions	3-5
3-14	Preventive maintenance checks and services	3-5

TABLE OF CONTENTS (Continued)

VOLUME 17

		Page
Section IV.	Storage	3-8
3-15	Short-term storage	3-8
3-15.1	Administrative storage	3-8
3-15.2	Administrative storage procedures	3-8
3-16	Long-term storage	3-8
Section V.	Warranties/guarantees	3-8
3-17	General	3-8
CHAPTER 4	FIREFIGHTING EQUIPMENT	4-1
Section I.	Description and data	4-1
4-1	Description	4-1
4-1.1	Halon 1301 system	4-1
4-1.2	CO2 hose/reel units	4-1
4-1.3	Marine smoke detector system	4-1
4-1.4	Portable fire extinguishers	4-1
4-1.4.1	CO2 fire extinguishers	4-1
4-1.4.2	Dry chemical fire extinguishers	4-1
4-1.5	Self-contained breathing apparatus (SCBA)	4-7
4-1.6	Portable firefighting pump, PE-250	4-7
4-2	Capabilities	4-7
4-2.1	Halon 1301 system	4-7
4-2.2	CO2 hose/reel units	4-7
4-2.3	Marine smoke detector system	4-7
4-2.4	Portable fire extinguishers	4-7
4-2.5	Self-contained breathing apparatus (SCBA)	4-7
4-2.6	Portable firefighting pump, PE-250	4-9
4-3	Special limitations	4-9
4-3.1	Halon 1301 system	4-9
4-3.2	CO2 system	4-9
4-3.3	Marine smoke detector system	4-9
4-3.4	Portable fire extinguishers	4-9
4-3.5	Hazardous fumes and chemicals from fires	4-9

TABLE OF CONTENTS (Continued)

VOLUME 17

		Page
4-3.6	Self-contained breathing apparatus (SCBA)	4-9
4-3.7	Portable firefighting pump, PE-250	4-9
4-4	Equipment specifications	4-11
4-4.1	Halon 1301 system	4-11
4-4.2	CO2 hose/reel unit	4-13
4-4.3	Marine smoke detector system	4-13
4-4.4	Portable fire extinguisher, CO02	4-14
4-4.5	Portable fire extinguisher, dry chemical	4-14
4-4.6	Fireman's axe	4-14
4-4.7	Self-contained breathing apparatus in carrying case	4-14
4-4.8	Self-contained breathing apparatus (SCBA)	4-15
4-4.9	Portable firefighting pump, PE-250	4-15
4-4.10	Smoke detector alarm bell	4-15
4-5	Items furnished	4-15
4-6	Items required but not furnished	4-15
4-7	Tools and test equipment	4-15
Section II.	Operating instructions	4-15
4-8	Halon 1301 system	4-15
4-9	CO2 hose/reel units	4-16
4-10	Marine smoke detector system	4-17
4-10.1	Prestart procedures	4-17
4-10.2	Normal operations	4-21
4-10.3	Emergency procedures for smoke	4-21
4-10.4	Emergency procedures for malfunctions	4-21
4-11	Portable fire extinguishers	4-22
4-11.1	General	4-22
4-11.2	Dry chemical portable extinguishers	4-22
4-11.3	C02 portable extinguishers	4-23
4-12	Self-contained breathing apparatus (SCBA)	4-23
4-12.1	Preparing and putting on SCBA	4-23
4-12.2	Using SCBA	4-25
4-12.3	Removing SCBA	4-25
4-13	Portable firefighting pump, PE-250	4-25
4-14	Recovery from fire	4-25
4-15	Operations under extreme conditions	4-26

TABLE OF CONTENTS (Continued)

VOLUME 17

		Page
Section III.	Maintenance instructions	4-26
4-16	General	4-26
4-16.1	Maintenance concept	4-26
4-16.2	Maintenance instructions	4-26
4-17	Preventive maintenance checks and services	4-26
4-18	Troubleshooting	4-26
4-19	Maintenance procedures	4-27
Section IV.	Storage	4-27
4-20	Short-term storage	4-27
4-21	Administrative storage	4-27
4-21.1	Administrative storage procedures	4-27
4-22	Long-term storage	4-27
Section V.	Manufacturers' service manuals/instructions	4-27
4-23	General	4-27
Section VI.	Warranties/guarantees	4-28
4-24	General	4-28

LIST OF APPENDICES

A	REFERENCES	A-1
B	MANUFACTURERS' SERVICE MANUALS/INSTRUCTIONS	B-1
C	PREVENTIVE MAINTENANCE CHECKS AND SERVICES	C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 17

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Major ROWPU Barge Components - Deckhouse Roof (Sheet 1 of 3)	1-2
1-1	Major ROWPU Barge Components - Deckhouse (Sheet 2 of 3)	1-3
1-1	Major ROWPU Barge Components - Voids (Sheet 3 of 3)	1-4
2-1	Workboat Profile	2-3
2-2	Location of Workboat Components	2-4
2-3	Typical Workboat Operator Controls and Indicators	2-6
2-4	Workboat Instrument Panel and Operating Controls	2-8
2-5	Ignition/Electrical Switch Operating Positions	2-9
2-6	VHF/FM Marine Radio Control Panel	2-10
2-7	Depthfinder Controls and Indicators	2-11
2-8	Engine Maintenance Controls and Indicators	2-13
2-9	Messenger Line Reel Unit	2-14
2-10	Bow Crane in Traveling (Stowed) Configuration	2-25
2-11	Bow Crane Control Panel (Barges 2 and 3)	2-26
2-12	Bow Crane Control Panel (Barge 1)	2-27
2-13	Standard Military Hand Signals for Controlling Cranes	2-29
2-14	Workboat Cradle Tie-Down with Ratchet	2-30
2-15	Bow Crane Lifts Workboat with Three-Point Suspension Harness	2-32
3-1	Location of Lifesaving Equipment	3-2
3-2	Eight-Man Liferafts - Manual and Automatic Operation	3-6
4-1	Location of Firefighting Equipment	4-2
4-2	Halon 1301 System Weighing Bar	4-3
4-3	Sketch of Halon Manifold Assembly	4-4
4-4	CO2 Hose/Reel Units	4-5
4-5	Front Panel of Marine Smoke Detector Cabinet	4-6
4-6	Self-Contained Breathing Apparatus (SCBA)	4-8
4-7	Portable Firefighting Pump, PE-250	4-10
4-8	Halon System Remote Control Box	4-18
4-9	Halon System Cylinder Activation Station	4-19
4-10	Operation of CO2 Hose/Reel Unit	4-20

TABLE OF CONTENTS (Continued)

VOLUME 17

LIST OF TABLES

Table		Page
2-1	Frequency/Channel Chart for Commercial Marine Radio in USA	2-16

TABLE OF CONTENTS

VOLUME 18

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Maintenance forms and records	1-1
1-4	Reporting equipment improvement recommendations (EIRs)	1-1
1-5	Destruction of army material to prevent enemy use	1-1
1-6	Abbreviations and terms	1-1
1-7	Warranty information	1-1
Section II.	Equipment Description and Data	1-6
1-8	Equipment description, safety, case, and handling	1-6
CHAPTER 2	OPERATING INSTRUCTIONS	2-1
CHAPTER 3	PREVENTIVE MAINTENANCE INSTRUCTIONS	3-1

LIST OF APPENDICES

APPENDIX A	REFERENCES	A-1
APPENDIX B	MAINTENANCE ALLOCATION CHART (MAC)	B-1
APPENDIX C	TOOLS AND TEST EQUIPMENT LIST (TTEL)	C-1
APPENDIX D	REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)	D-1
APPENDIX E	EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST (ESML)	E-1

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The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.
MAINTENANCE ALLOCATION CHART (MAC)
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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

VOLUME 18

Figure		Page
1-1	Tug With Barge On Its Hip	1-2
1-2	Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof (Sheet 1 of 3)	1-3
1-2	Major Components of ROWPU Barge Systems and Equipment - Deckhouse (Sheet 2 of 3)	1-4
1-2	Major Components of ROWPU Barge Systems and Equipment - Voids (Sheet 3 of 3)	1-5

TABLE OF CONTENTS

VOLUME 19

		Page
CHAPTER 1	INTRODUCTION	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Maintenance forms and records	1-1
1-4	Destruction of Army materiel to prevent enemy use	1-1
1-5	PMCS definitions	1-1
1-6	Maintenance concept	1-1
1-7	Introduction to PMCS	1-5
CHAPTER 2	SEAWATER SYSTEM PMCS	2-1
2-1	Introduction	2-1
2-2	Major components	2-1
2-3	Seawater system description	2-2
CHAPTER 3	REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) PMCS	3-1
3-1	Introduction	3-1
3-2	Major components	3-1
3-3	ROWPU system description	3-5
CHAPTER 4	CHLORINATION SYSTEM PMCS	4-1
4-1	Introduction	4-1
4-2	Major components	4-1
4-3	Chlorination system description	4-2
CHAPTER 5	DRINKING WATER SYSTEM	5-1
5-1	Introduction	5-1
5-2	Major components	5-1
5-3	Drinking water system description	5-2
CHAPTER 6	SHORE DISCHARGE SYSTEM	6-1
6-1	Introduction	6-1
6-2	Major components	6-1
6-3	Shore discharge system description	6-1

TABLE OF CONTENTS (Continued)

VOLUME 19

		Page
CHAPTER 7	COMPRESSED AIR SYSTEM	7-1
7-1	Introduction	7-1
7-2	Major components	7-1
7-3	Compressed air system description	7-8
CHAPTER 8	FUEL OIL SYSTEM	8-1
8-1	Introduction	8-1
8-2	Major components	8-1
8-3	Fuel oil system description	8-2
CHAPTER 9	ELECTRICAL POWER SYSTEMS	9-1
9-1	Introduction	9-1
9-2	Major components	9-1
9-3	System description	9-2
9-3.1	Normal electrical system description	9-2
9-3.2	Emergency electrical system	9-2
9-3.3	155 kW ship service generators	9-3
9-3.4	20 kW service auxiliary generator	9-3
CHAPTER 10	LIGHTING SYSTEM	10-1
10-1	Introduction	10-1
10-2	Major components	10-1
10-3	Interior lighting system description	10-3
CHAPTER 11	EQUIPMENT MONITORING SYSTEM	11-1
11-1	Introduction	11-1
11-2	Major components	11-1
11-3	Equipment monitoring system description	11-2

TABLE OF CONTENTS (Continued)

VOLUME 19

		Page
CHAPTER 12	COMMMUNCATIONS SYSTEM	12-1
12-1	Introduction	12-1
12-2	Major components	12-1
12-3	Communications system description	12-3
12-3.1	Radio communications equipment	12-3
12-3.2	Army radio	12-3
12-3.3	Commercial marine radios	12-3
12-3.4	Walkie-talkies	12-3
12-3.5	Foghorn equipment	12-3
12-3.6	Telephone system	12-3
CHAPTER 13	HANDLING EQUIPMENT	13-1
13-1	Introduction	13-1
13-2	Major components	13-1
13-3	Handling equipment description	13-1
13-3.1	Bridge crane system	13-1
13-3.2	Bow crane system	13-1
13-3.3	Void 4 trolley hoist	13-4
CHAPTER 14	ANCHOR, MOORING, AND TOWING EQUIPMENT SYSTEM	14-1
14-1	Introduction	14-1
14-2	Major components	14-1
14-3	Anchor mooring and towing equipment system description	14-2
CHAPTER 15	MISCELLANEOUS EQUIPMENT	15-1
15-1	Introduction	15-1
15-2	Major components	15-1
15-3	Miscellaneous equipment description	15-1
15-3.1	Dayroom equipment	15-1
15-3.2	Workshop equipment	15-1
15-3.3	Accesses system	15-1
15-3.4	Sanitation systems	15-1
15-3.4.1	Ship's toilet	15-1
15-3.4.2	Bilge system	15-6

TABLE OF CONTENTS (Continued)

VOLUME 19

		Page
CHAPTER 16	VENTILATION, HEATING, AND AIR CONDITIONING SYSTEMS	16-1
16-1	Introduction	16-1
16-2	Major components	16-1
16-2.1	Deckhouse ventilation system	16-1
16-2.2	Voids ventilation system	16-2
16-2.3	Heating and air conditioning system	16-3
16-3	Systems description	16-3
16-3.1	Deckhouse ventilation system description	16-3
16-3.2	Voids ventilation system description	16-6
16-3.3	Heating and air conditioning system	16-8
CHAPTER 17	WORKBOAT, LIFESAVING, AND FIREFIGHTING EQUIPMENT SYSTEM	17-1
17-1	Introduction	17-1
17-2	Major components	17-1
17-3	Workboat, lifesaving and firefighting equipment system description	17-7
CHAPTER 18	DOUBLE DRUM WINCH PMCS	18-1
18-1	Introduction .	18-1
18-2	Major components	18-1
18-3	System description	18-1

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The following appendices, common to all TM's in this series, are in TM-55-1930-209-14&P-18.
MAINTENANCE ALLOCATION CHART (MAC)
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REPAIR PARTS LIST TO FIGURE NUMBER CROSS-REFERENCE LIST

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COMPONENTS OF END ITEM LIST (COEIL) AND BASIC ISSUE ITEMS LIST (BIIL)
ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

TABLE OF CONTENTS (Continued)

VOLUME 19

LIST OF ILLUSTRATIONS

Figure		Page
1-1	Barge Major Components	1-2
2-1	ROWPU and Ballast Seawater Supply	2-3
2-2	ROWPU and Ballast Seawater Supply Block Diagram	2-4
2-3	Air Conditioner Seawater Cooling and Chlorination Unit Supply	2-5
2-4	Air Conditioner and Chlorination Seawater Cooling Block Diagram	2-6
2-5	Diesel Engine Generator Seawater Cooling	2-7
2-6	Diesel Generator Seawater Cooling Block Diagram	2-8
4-1	Chlorination System (Barge 1)	4-3
4-2	Chlorination System (Barges 2 and 3)	4-4
5-1	Drinking Water System	5-3
6-1	Shore Discharge System	6-2
7-1	Barge 1 Air Compressor/Receiver	7-2
7-2	Barges 2 and 3 Air Compressor/Receiver	7-3
7-3	Exterior View of Air Filter 1 and Air Filter 2	7-4
7-4	Air Station Air Valve and Quick Disconnect	7-6
7-5	PIG Launcher Controls	7-7
7-6	Location of Compressed Air System Components - Barge 1	7-9
7-7	Location of Compressed Air System Components - Barges 2 and 3	7-10
8-1	Fuel Oil System	8-2

LIST OF ILLUSTRATIONS (Continued)

VOLUME 19

Figure		Page
10-1	Normal Interior Lighting Arrangement	10-3
10-2	Emergency Interior Lighting	10-4
11-1	Equipment Monitoring System Block Diagram	11-3
13-1	Bridge Crane	13-2
13-2	Bow Crane in Traveling (Stowed) Position	13-3
13-3	Void 4 Trolley Hoist	13-5
15-1	Dayroom Arrangement	15-2
15-2	Workshop Arrangement	15-3
15-3	Accesses System	15-4
15-4	Ship's Toilet	15-5
15-5	Bilge System	15-6
16-1	Example of Light-proof Louvered Hatches on Deckhouse Port and Starboard Bulkheads	16-4
16-2	Example of Covered Fan Motors on Deckhouse Top	16-5
16-3	Voids Ventilation Fan Motors on Port and Starboard Deckhouse Bulkheads (Portside Shown)	16-6
16-4	Example of Vertical Fan Motors near ROWPU Space Aft Bulkhead	16-7
16-5	Heating Systems Locations and Operating Controls	16-9
17-1	Workboat Components and Location	17-2
17-2	Lifesaving Equipment and Location	17-4
17-3	Firefighting Equipment and Location	17-6
18-1	Winch Assembly Top View	18-1
18-2	Winch Assembly Side View	18-2

LIST OF TABLES

VOLUME 19

Table		Page
2-1	Major Components of ROWPU and Ballast Seawater Supply	2-1
2-2	Major Components of Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply	2-2
2-3	Major Components of Diesel Engine Generator Cooling Seawater	2-3
2-4	Preventive Maintenance Checks and Services for Seawater System	2-9
3-1	ROWPU System Components	3-1
3-2	ROWPU System Valves	3-3
3-3	Preventive Maintenance Checks and Services for ROWPU System	3-5
4-1	Major Components of Chlorination System	4-1
4-2	Preventive Maintenance Checks and Services for Chlorination System	4-5
5-1	Major Components of Drinking Water System	5-1
5-2	Preventive Maintenance Checks and Services for Drinking Water System	5-4
6-1	Major Components of Shore Discharge System	6-1
6-2	Preventive Maintenance Checks and Services for Shore Discharge System	6-2
7-1	Major Components of Compressed Air System	7-1
7-2	Preventive Maintenance Checks and Services for Compressed Air System	7-11
8-1	Major Components of Fuel Oil System	8-1
8-2	Preventive Maintenance Checks and Services for Fuel Oil System	8-3
9-1	Major Components of Electrical Power System	9-1
9-2	Major Components of Emergency Electrical System	9-2
9-3	Preventive Maintenance Checks and Services for Electrical Power Systems	9-4
10-1	Major Components of Interior Lighting System	10-1
10-2	Major Components of Exterior Lighting System	10-2
10-3	Preventive Maintenance Checks and Services for Lighting System	10-5
11-1	Major Components of Equipment Monitoring System	11-1
11-2	Equipment Monitoring System Sensor Data	11-2
11-3	Preventive Maintenance Checks and Services for Equipment Monitoring System	11-4

LIST OF TABLES

VOLUME 19

Table		Page
12-1	Major Components of Radio System	12-1
12-2	Major Components of Foghorn	12-2
12-3	Major Components of Telephone System	12-2
12-4	Preventive Maintenance Checks and Services for Communications Systems	12-4
13-1	Preventive Maintenance Checks and Services for Handling Equipment	13-6
14-1	Anchoring Components	14-1
14-2	Mooring Components	14-1
14-3	Towing Components	14-2
14-4	Preventive Maintenance Checks and Services for Anchor, Mooring, & Towing Equipment	14-3
15-1	Preventive Maintenance Checks and Services for Miscellaneous Equipment	15-7
16-1	Major Components of Deckhouse Ventilation System	16-1
16-2	Major Components of Voids Ventilation System	16-2
16-3	Major Components of Heating and Air Conditioning System	16-3
16-4	Preventive Maintenance Checks and Services for Ventilation, Heating and Air Conditioning System	16-10
17-1	Workboat Components	17-1
17-2	Lifesaving Components	17-3
17-3	Firefighting Components	17-3
17-4	Preventive Maintenance Checks and Services for Workboat, Lifesaving, and Firefighting Systems	17-8
18-1	Preventive Maintenance Checks and Services for Double Drum Winch	18-3

TABLE OF CONTENTS

VOLUME 20

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Maintenance forms and records	1-1
1-4	Reporting equipment improvement recommendations (EIRs)	1-1
1-5	Destruction of Army material to prevent enemy use	1-1
1-6	Abbreviations and terms	1-1
1-7	Warranty information	1-1
Section II.	Equipment Description and Data	1-5
1-8	Equipment description, safety, case, and handling	1-5
CHAPTER 2	OPERATING INSTRUCTIONS	2-1
CHAPTER 3	PREVENTIVE MAINTENANCE INSTRUCTIONS	3-1

LIST OF APPENDICES

A	REFERENCES	A-1
B	COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS LIST (BIIL)	B-1
C	ADDITIONAL AUTHORIZATION LIST (AAL)	C-1
D	GLOSSARY	D-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)

LIST OF ILLUSTRATIONS

VOLUME 20

Figure		Page
1-1	Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof (Sheet 1 of 3)	1-2
1-1	Major Components of ROWPU Barge Systems and Equipment - Deckhouse (Sheet 2 of 3)	1-3
1-1	Major Components of ROWPU Barge Systems and Equipment - Voids (Sheet 3 of 3)	1-4

TABLE OF CONTENTS

VOLUME 21

		Page
CHAPTER 1	INTRODUCTION	1-1
Section I.	General Information	1-1
1-1	Purpose	1-1
1-2	Scope	1-1
1-3	Maintenance forms and records	1-1
1-4	Destruction of Army materiel to prevent enemy use	1-1
1-5	Administrative storage of equipment	1-1
1-6	Equipment serviceability criteria	1-1
1-7	Calibration	1-1
Section II.	Description and data	1-5
1-8	Description	1-5
1-9	Identification and tabulated data	1-5
1-10	Differences in models	1-10
1-11	Repair and replacement standards	1-10
1-12	Spring specifications	1-10
1-13	Torque data	1-10
CHAPTER 2	OPERATING INSTRUCTIONS	
Section I.	Operating procedure	2-1
2-1	General	2-1
2-2	Controls and instruments	2-1
2-3	Preparation for operation	2-1
2-4	Starting the diesel engine	2-1
2-5	Stopping the diesel engine	2-4
2-6	Operation of the winch	2-4
Section II.	Operation Under Unusual Conditions	2-7
2-7	Operation in extreme cold (below 0 °F)	2-7
2-8	Operation in extreme heat	2-7
2-9	Operation at high altitudes	2-8
2-10	Operation in dusty or sandy areas	2-8
2-11	Operation in rainy or humid conditions	2-8
2-12	Operation in salt areas	2-8

TABLE OF CONTENTS(Continued)

VOLUME 21

		Page
CHAPTER 3	OPERATOR/CREW MAINTENANCE INSTRUCTIONS	
3-1	Detailed lubrication information	3-1
3-2	Points of lubrication	3-1
Section I.	Lubrication Instructions	3-1
Section II.	Preventive Maintenance Checks and Services	3-1
3-3	General	3-1
Section III.	Operator/Crew Troubleshooting	3-6
3-4	General	3-6
3-5	Troubleshooting table	3-6
Section IV.	Maintenance Procedures	3-11
3-6	General	3-11
3-7	Air cleaner	3-11
3-8	Fuel filter	3-12
3-9	Oil filter service	3-13
3-10	Fan drive belt	3-14
3-11	Front and rear winch drum brake adjustment	3-15
3-12	Drum clutch adjustment	3-17
CHAPTER 4	ORGANIZATIONAL MAINTENANCE INSTRUCTIONS	
Section I.	Service Upon Receipt of Equipment	4-1
4-1	Inspection and servicing equipment	4-1
4-2	Installation and setting up instructions	4-1
Section II.	Movement to a New Worksite	4-5
4-3	Dismantling for movement	4-5
4-4	Reinstallation after movement	4-5
Section III.	Preventive Maintenance Checks and Services	4-5
4-5	Preventive maintenance checks and services .	4-5
Section IV.	Organizational Maintenance Troubleshooting	4-7
4-6	Organizational maintenance troubleshooting chart	4-7
Section V.	Maintenance of the Diesel Engine	4-11
4-7	General	4-11
4-8	Thermostat	4-11
4-9	Engine fan guard	4-13
4-10	Alternator fan drive belts	4-13
4-11	Battery	4-13

TABLE OF CONTENTS (Continued)

VOLUME 21

4-12	Engine oil pressure switch	4-14
4-13	Engine cooling water overheat switch	4-14
Section VI.	Maintenance of Winch	4-14
4-14	General	4-14
4-15	Winch gear and brake drum guard	4-14
4-16	Drive chain case	4-14
4-17	Drive chain adjustment	4-14
Section VII.	Maintenance of Brake	4-18
4-18	Brake system	4-18
4-19	Brake assembly removal	4-18
4-20	Drum brake installation	4-20
CHAPTER 5	DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS	
Section I.	Special Tools and Equipment	5-1
5-1	Special tools and equipment	5-1
Section II.	Direct Support Troubleshooting	5-1
5-2	General	5-1
5-3	Direct support maintenance troubleshooting	5-1
Section III.	General Maintenance Instructions	5-4
5-4	General	5-4
5-5	General cleaning instructions	5-4
5-6	General inspection instructions	5-5
5-7	General repair instructions	5-6
Section IV.	Removal and Installation of Major Components and Assemblies	5-6
5-8	General	5-6
5-9	Engine assembly removal and installation	5-7
5-10	Torque converter removal	5-7
5-11	Torque converter installation	5-9
5-12	Engine removal	5-9
5-13	Engine installation	5-10
Section V.	Removal, Repair and Installation of Chain Drive Components	5-10
5-14	Chain drive housing removal	5-10
5-15	Chain drive assembly repair	5-10
5-16	Chain drive assembly installation	5-12
Section VI.	Winch Shafts Removal and Installation	5-12
5-17	General	5-12
5-18	Winch drive shaft removal	5-12

TABLE OF CONTENTS (Continued) ·

VOLUME 21

5-19	Winch drive shaft installation	5-13
5-20	Winch drum and drum shaft removal	5-13
5-21	Winch drum assembly removal	5-13
5-22	Drum and drum shaft installation	5-16
5-23	Winch head shaft removal	5-16
5-24	Winch head shaft installation	5-16
Section VII.	Alternator and Voltage Regulator	5-17
5-25	General	5-17
5-26	Alternator and voltage regulator inspection and repair	5-22
5-27	Alternator reassembly and reinstallation	5-23
Section VIIII.	Starting Motor and Solenoid	5-23
5-28	General	5-23
5-29	Starting motor cleaning, inspection and repair	5-25
5-30	Starting motor reassembly and installation	5-27
Section IX.	Fuel-Injectors	5-27
5-31	General	5-27
5-32	Fuel injector timing	5-30
5-33	Fuel injector removal, test and disassembly	5-30
5-34	Fuel injector cleaning, inspection and repair	5-37
5-35	Fuel injector reassembly and installation	5-40
Section X.	Fuel Pump and Fuel Filters	5-44
5-36	General	5-44
5-37	Fuel pump removal and disassembly	5-44
5-38	Fuel pump cleaning, inspection and repair	5-49
5-39	Fuel pump reassembly and installation	5-49
Section XI.	Variable Speed Governor	5-50
5-40	General	5-50
5-41	Governor operation check	5-50
5-42	Governor adjustment	5-53
5-43	Governor removal and assembly	5-56
Section XII.	Radiator and Hood	5-58
5-44	Radiator assembly inspection and repair	5-58
5-45	Radiator assembly test and installation	5-58
Section XIII.	Water Pump and Fan	5-60
5-46	General	5-60
5-47	Water pump disassembly	5-60

TABLE OF CONTENTS (Continued)

VOLUME 21

5-48	Water pump cleaning, inspection and repair	5-60
5-49	Water pump reassembly and installation	5-61
5-50	Fan assembly, disassembly	5-62
5-51	Fan assembly, cleaning, inspection and repair	5-62
5-52	Fan assembly, reassembly and installation	5-63
Section XIV.	Oil Cooler and Oil Filter	5-63
5-53	General	5-63
5-54	Oil cooler, removal and disassembly	5-63
5-55	Oil cooler cleaning, test, inspection, and repair	5-64
5-56	Oil cooler reassembly and installation	5-66
Section XV.	Air Shutdown Housing and Blower	5-67
5-57	General	5-67
5-58	Blower inspection (blower installed)	5-67
5-59	Blower removal and disassembly	5-69
5-60	Blower drive coupling, removal and disassembly	5-70
5-61	Blower drive coupling, cleaning, inspection, and repair	5-70
5-62	Blower drive coupling, reassembly and installation	5-70
Section XVI.	Rocker Arms and Cylinder Head	5-70
5-63	General	5-70
5-64	Rocker arm and cam follower removal and disassembly	5-72
5-65	Rocker arm and cam follower cleaning, inspection, and repair	5-72
5-66	Rocker arm and cam follower reassembly and installation	5-76
5-67	Rocker arm and valve adjustment	5-77
5-68	Cylinder head, removal and disassembly	5-79
5-69	Cylinder head installation	5-79
Section XVII.	Oil Pan	5-82
5-70	General	5-82
5-71	Oil pan removal 5	5-82
5-72	Oil pan cleaning, inspection, and repair	5-83
5-73	Oil pan installation	5-83
Section XVIII.	Flywheel and Flywheel Housing	5-83
5-74	General	5-83
5-75	Flywheel removal and disassembly	5-83
5-76	Flywheel cleaning, inspection, and repair	5-85
5-77	Flywheel reassembly and installation	5-85
5-78	Flywheel housing, removal and disassembly	5-86
5-79	Flywheel housing cleaning, inspection and repair	5-86
5-80	Flywheel housing reassembly and installation	5-86

TABLE OF CONTENTS (Continued)

VOLUME 21

Section XIX.	Torque Converter Assembly	5-90
5-81	General	5-90
5-82	Torque converter removal and inspection	5-90
5-83	Torque converter installation	5-90
5-84	Clutch assembly removal and inspection	5-94
5-85	Clutch assembly inspection and repair	5-96
5-86	Clutch assembly reassembly	5-100
Section XX.	Winch Drive Shaft and Drum Assembly Repair Instructions	5-100
5-87	Heavy components	5-100
Section XXI.	Drive Shafts and Drums	5-101
5-88	Winch drive shaft removal	5-101
5-89	Drive shaft inspection and repair	5-103
5-90	Winch drive shaft reassembly and installation	5-103
5-91	Winch drum removal	5-104
Section XXII.	Drum Brakes	5-107
5-92	Drum brake assemblies	5-107
Section XXIII.	Clutches	5-112
5-93	Clutch assemblies	5-112
5-94	Drum reassembly and installation	5-115
Section XXIV.	Winch Head Drive and Guide Removal, Inspection, Repair and Installation	5-116
5-95	General	5-116
5-96	Winch head assembly removal	5-116
5-97	Winch head disassembly inspection and repair	5-116
5-98	Winch head shaft assembly installation	5-118
5-99	Winch head guide	5-118
5-100	Winch head guide removal, repair and reassembly	5-119
CHAPTER 6	GENERAL SUPPORT MAINTENANCE INSTRUCTIONS	
Section I.	Repair Parts, Special Tools and Equipment	6-1
6-1	Special tools and equipment	6-1
Section II.	General Support Troubleshooting	6-1
6-2	General	6-1
6-3	General support maintenance troubleshooting	6-1
Section III.	General Maintenance Instructions	6-1
6-4	General	6-1
6-5	General cleaning instructions	6-1

TABLE OF CONTENTS (Continued)

VOLUME 21

Section IV.	Variable Speed Governor	6-3
6-6	General	6-3
6-7	Governor disassembly	6-4
6-8	Governor cleaning, inspection and repair	6-9
6-9	Governor reassembly and installation	6-12
Section V.	Air Shutdown Housing and Blower	6-16
6-10	General	6-16
6-11	Air shutdown housing disassembly	6-16
6-12	Blower cleaning, inspection and repair	6-19
6-13	Blower reassembly and installation	6-19
Section VI.	Rocker Arms and Cylinder Head	6-27
6-14	General	6-27
6-15	Cylinder head maintenance	6-27
6-16	Cylinder head cleaning test, inspection and repair	6-32
6-17	Cylinder head reassembly and installation	6-32
Section VII.	Oil Pan and Oil Pump	6-41
6-18	General	6-41
6-19	Oil pump removal and disassembly	6-41
6-20	Oil pump cleaning, inspection and repair	6-44
6-21	Oil pump reassembly and installation	6-46
Section VIII.	Engine Front Cover, Camshaft, Balance Shaft and Timing Gears	6-46
6-22	General	6-46
6-23	Camshaft and balance shaft removal and disassembly	6-48
6-24	Camshaft and balance shaft cleaning, inspection and repair	6-49
6-25	Camshaft and balance shaft bearing removal and repair	6-50
6-26	Camshaft and balance shaft bearing installation	6-53
6-27	Camshaft and balance shaft reassembly and installation	6-53
6-28	Gear train removal and disassembly	6-54
6-29	Gear train cleaning, inspection and repair	6-55
6-30	Gear train reassembly and installation	6-56
Section IX.	Pistons, Connecting Rod and Cylinder Liners	6-57
6-31	General	6-57
6-32	Piston and connecting rod removal and disassembly	6-58
6-33	Piston and connecting rod cleaning, inspection and repair	6-59
6-34	Piston and connecting rod, reassembly and installation	6-63
6-35	Cylinder liner removal	6-65

TABLE OF CONTENTS (Continued)

VOLUME 21

6-36	Cylinder liner cleaning, inspection and repair	6-65
6-37	Cylinder liner installation	6-66
Section X.	Crankshaft and Main Bearing	6-69
6-38	General	6-69
6-39	Crankshaft and main bearing removal and disassembly	6-69
6-40	Crankshaft and main bearing cleaning, inspection and repair	6-70
6-41	Crankshaft and main bearing reassembly and installation	6-73
Section XI.	Cylinder Block and Engine End Plates	6-75
6-42	General	6-75
6-43	Cylinder block and end plates removal and disassembly	6-76
6-44	Cylinder block and end plates, cleaning, inspection and repair	6-76
6-45	Cylinder block and end plates reassembly and installation	6-78
Section XII.	Torque Converter Disassembly, Inspection and Repair	6-80
6-46	Torque converter disassembly	6-80
6-47	Torque converter inspection	6-82
6-48	Torque converter reassembly	6-84
Section XIIII.	Winch Frame	6-88
6-49	General	6-88
6-50	Winch frame disassembly, inspection and repair	6-88
Section XIV.	Air System	6-88
6-52	General	6-88
6-53	Air compressor	6-89
6-54	Air distribution	6-91
6-55	Controls	6-91

TABLE OF CONTENTS (Continued)

VOLUME 21

LIST OF APPENDICES

Page

A REFERENCES A-1
B MAINTENANCE ALLOCATION CHART B-1
C REPAIR PARTS AND SPECIAL TOOLS LIST C-1

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ADDITIONAL AUTHORIZED ITEMS LIST (AAL)
LIST OF ILLUSTRATIONS

Figure Page

1-1 Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof (Sheet 1 of 3) 1-2
1-1 Major Components of ROWPU Barge Systems and Equipment - Deckhouse (Sheet 2 of 3) 1-3
1-1 Major Components of ROWPU Barge Systems and Equipment - Voids (Sheet 3 of 3) 1-4
1-2 Winch Assembly Right Side View 1-6
1-3 Winch Assembly Top View 1-7
2-1 Engine Instruments 2-2

LIST OF ILLUSTRATIONS (Continued)

VOLUME 21

Figure		Page
2-2	Winch Controls	2-3
2-3	Fleet Angle	2-6
3-1	Lubrication Chart	3-2
3-2	Engine Air Cleaner Service	3-11
3-3	Fuel Filter and Fuel Strainer Inspect	3-12
3-4	Engine Oil Filter Service	3-13
3-5	Fan Drive Belt Adjustment	3-14
3-6	Front and Rear Brake Drum Covers	3-15
3-7	Front and Rear Brake Drum Adjustment	3-16
3-8	Drum Clutch Adjustments	3-17
4-1	Mounting Dimensions-Winch to Skid	4-2
4-2	Battery Installation	4-4
4-3	Hoisting Sling	4-6
4-4	Thermostat Removal and Installation	4-12
4-5	Gear Guard Removal and Installation	4-15
4-6	Drive Chain Case Removal and Installation	4-17
4-7	Drum Brake Assembly	4-19
5-1	Torque Converter Removal and Installation	5-8
5-2	Chain Drive Mechanism	5-11
5-3	Winch Drive Shaft	5-14
5-4	Winch Drum Assembly	5-15
5-5	Delcotron Alternator Cross Section	5-18
5-6	Delcotron Alternator Internal Wiring Diagram	5-19
5-7	Delcotron Alternator Illustrated Parts	5-21
5-8	Starting Motor	5-24
5-9	Starting Motor Illustrated Parts	5-26
5-10	Fuel Injector	5-28
5-11	Fuel Injector Timing	5-31
5-12	Fuel Injector Removal and Installation	5-32
5-13	Fuel Injector Installed in Tester	5-34
5-13	Fuel Injector High Pressure Tests	5-34
5-13	Fuel Injector in Calibrator	5-34
5-14	Checking Injector Spray Tip Concentricity	5-42
5-15	Fuel Pump Removal and Installation	5-45
5-16	Fuel Pump Disassembly and Reassembly	5-46

LIST OF ILLUSTRATIONS (Continued)

VOLUME 21

Figure		Page
5-17	Fuel Pump Seal Removal	5-47
5-17	Fuel Pump Seal Installation	5-48
5-18	Variable Speed Mechanical Governor	5-51
5-18	Variable Speed Governor Mount	5-52
5-19	Governor Cover Details	5-54
5-20	Governor Control Housing	5-57
5-21	Radiator Disassembly and Reassembly	5-59
5-22	Water Pump Disassembly and Reassembly	5-61
5-23	Fan Disassembly and Reassembly	5-62
5-24	Oil Cooler Disassembly and Reassembly	5-65
5-25	Blower Installation	5-68
5-26	Cam Followers and Cylinder Head	5-71
5-27	Rocker Arm Shaft Bracket	5-73
5-28	Cam Follower Disassembly and Reassembly	5-74
5-29	Valve Adjustment	5-78
5-30	Cylinder Head Plugs and Studs	5-80
5-31	Cylinder Head Bolt Tightening Sequence	5-81
5-32	Fuel Injector Control Tube Removal	5-82
5-33	Flywheel Removal and Installation	5-84
5-34	Flywheel Housing Removal and Installation	5-87
5-35	Flywheel Housing Bolt Tightening Sequence	5-89
5-36	Diesel Fuel Piping System	5-91
5-37	Torque Converter Assembly	5-92
5-38	Fluid Line Installation	5-95
5-39	Clutch Assembly Removal	5-97
5-40	Clutch Assembly	5-98
5-41	Clutch Assembly Disassembly and Reassembly	5-99
5-42	Drive Shaft Disassembly and Reassembly	5-102
5-43	Winch Drum Disassembly and Reassembly	5-105
5-44	Drum Brake Assembly	5-108
5-45	Brake Band Assembly	5-109
5-46	Brake Actuating Arm Assembly and Disassembly	5-111
5-47	Drum Clutch	5-114
5-48	Winch Head Disassembly and Reassembly	5-117

LIST OF ILLUSTRATIONS (Continued)

VOLUME 21

Figure		Page
6-3	Removing Variable Speed Spring Plunger Guide	6-7
6-4	Governor Weight Housing Details	6-8
6-5	Remove Governor Weight and Shaft Assembly	6-9
6-6	Variable Speed Spring Housing and Shaft Details	6-10
6-7	Install Speed Control Shaft Bearings in Spring Housing	6-12
6-8	Blower Assembly and Disassembly	6-17
6-9	Installing Oil Sealring Carrier On Rotor	6-21
6-10	Blower Rotor Clearances	6-25
6-11	Cam Followers and Cylinder Head	6-28
6-12	Fuel Injector Control Tube Removal	6-29
6-13	Exhaust Valve Guide Removal	6-30
6-14	Exhaust Valve Seat Removal	6-31
6-15	Cylinder Head Plugs and Studs	6-34
6-16	Valve Guide Installation	6-35
6-17	Valve Seat Grinding Specifications	6-37
6-18	Cam Follower Disassembly and Reassembly	6-38
6-19	Injector Tube Clearance/Reaming	6-40
6-20	Rocker Arm Shaft Bracket	6-42
6-21	Engine Oil Pump Disassembly and Reassembly	6-43
6-22	Engine Front Cover Installation	6-45
6-23	Gear Train	6-47
6-24	Loosening Nut on Camshaft or Balance Shaft	6-49
6-25	Camshaft and Balance Shaft Assembly	6-52
6-26	Idler Gear Assembly	6-54
6-27	Piston Assembly	6-58
6-28	Connecting Rod Magnetic Particle Inspection Lines	6-61
6-29	Cylinder Liner Dimensional Inspection	6-67
6-30	Crankshaft Assembly	6-71
6-31	Crankshaft Critical Loading Zones	6-73
6-32	Crankshaft End Play	6-75
6-33	Cylinder Block End Plates	6-79
6-34	Torque Converter Assembly	6-81
6-35	Seal Carrier Assembly	6-83
6-36	Fluid Line Installation	6-87

LIST OF ILLUSTRATIONS (Continued)

VOLUME 21

Figure		Page
6-37	Air Compressor Disassembly and Reassembly	6-90
6-38	Air Distribution Compression and Storage	6-92
6-39	Winch Control Panel	6-93

LIST OF TABLES

Table		Page
1-1	Specifications, New Clearances and Wear Units	1-8
1-2	Diesel Engine Spring Specifications	1-14
1-3	Torque Data	1-15
1-4	Pipe Plug Torque Data	1-20
2-1	Anti-Freeze Mixture	2-9
3-1	Operator Preventive Maintenance Checks and Services	3-6
3-2	Operator/Crew Troubleshooting	3-15
4-1	Organizational Preventive Checks and Services	4-2
4-2	Organizational Maintenance Troubleshooting	4-10
5-1.	Direct and General Support Maintenance Instructions	5-2
6-1	Fuel Check Chart	6-1

CHAPTER 1 INTRODUCTION
Section I. General Information

1-1 Purpose. This Technical Manual (TM) describes normal operations of the Water Purification Barges. It provides information and procedures on normal barge operations including barge movement and deployment, communications and electrical power systems, drinking water production, shutdown, and required operational maintenance. Emergency shutdown procedures are also provided. Detailed information about barge systems and equipment, including equipment specifications, operation under extreme conditions, maintenance, periodic inspections and services, troubleshooting, and manufacturers' service manuals is contained in TM 55-1930-209-14&P-2 thru TM 55-1930-209-14&P-17. TM 55-1930-209-14&P-18 contains supporting appendices and the remaining TM's contain information on preventive maintenance, supplemental data, and the shore winch system. A list of TM's in this series is contained in Table 1-1. Location of major barge components is shown in Figure 1-1. Onboard installation is shown on drawings referenced in Appendix A. To assist barge crewmen, barge components are labeled, operational placards are located throughout the barge, and signs (notices, cautions, warnings, and danger) are posted to ensure crew safety and prevent damage to equipment.

1-2 Scope. The barge mounted POWPU is capable of pumping 30,000 gallons of fresh or brackish water in a twenty four hour period and 225,000 gallons of seawater if the seawater total dissolved solids does not exceed 45,000 PPM. Processed water is used by a Rapid Deployment Force in a forward area. When needed, the water can be pumped to a shore facility or to another vessel.

1-3 Warranties and guarantees. Applicable warranty and guarantee information for system equipment is given in the applicable volume for the system to which it refers.

1-4 Maintenance forms and records. These are explained in DA PAM 738-750, The Army Maintenance Management System (TAMMS).

1-5 Destruction of Army materiel to prevent enemy use. This shall be as directed in TM 750-244-3.

1-6 Storage. For storage of barge equipment, refer to storage information contained in each applicable volume of TM 55-1930-209-14&P-2 thru P-17.

Table 1-1. Barge Operation and Maintenance Technical Manuals

TM	Title
TM 55-1930-209-14&P-1	Normal Operations
TM 55-1930-209-14&P-2	Seawater System
TM 55-1930-209-14&P-3	Reverse Osmosis Water Purification Unit (ROWPU) System
TM 55-1930-209-14&P-4	Chlorination System
TM 55-1930-209-14&P-5	Drinking Water System
TM 55-1930-209-14&P-6	Shore Discharge System
TM 55-1930-209-14&P-7	Compressed Air System
TM 55-1930-209-14&P-8	Fuel Oil System
TM 55-1930-209-14&P-9	Electrical Power Systems
TM 55-1930-209-14&P-10	Lighting System
TM 55-1930-209-14&P-11	Equipment Monitoring System
TM 55-1930-209-14&P-12	Communications System
TM 55-1930-209-14&P-13	Handling Equipment
TM 55-1930-209-14&P-14	Anchoring, Mooring, and Towing Equipment
TM 55-1930-209-14&P-15	Miscellaneous Equipment: Dayroom, Workshop, Accesses, and Sanitation Systems
TM 55-1930-209-14&P-16	Ventilation, Heating, and Air Conditioning Systems
TM 55-1930-209-14&P-17	Workboat, Lifesaving, and Firefighting Equipment
TM 55-1930-209-14&P-18	Supporting Appendices
TM 55-1930-209-14&P-19	Preventive Maintenance Checks and Services
TM 55-1930-209-14&P-20	Supplemental Data
TM 55-1930-209-14&P-21	Shore Winch

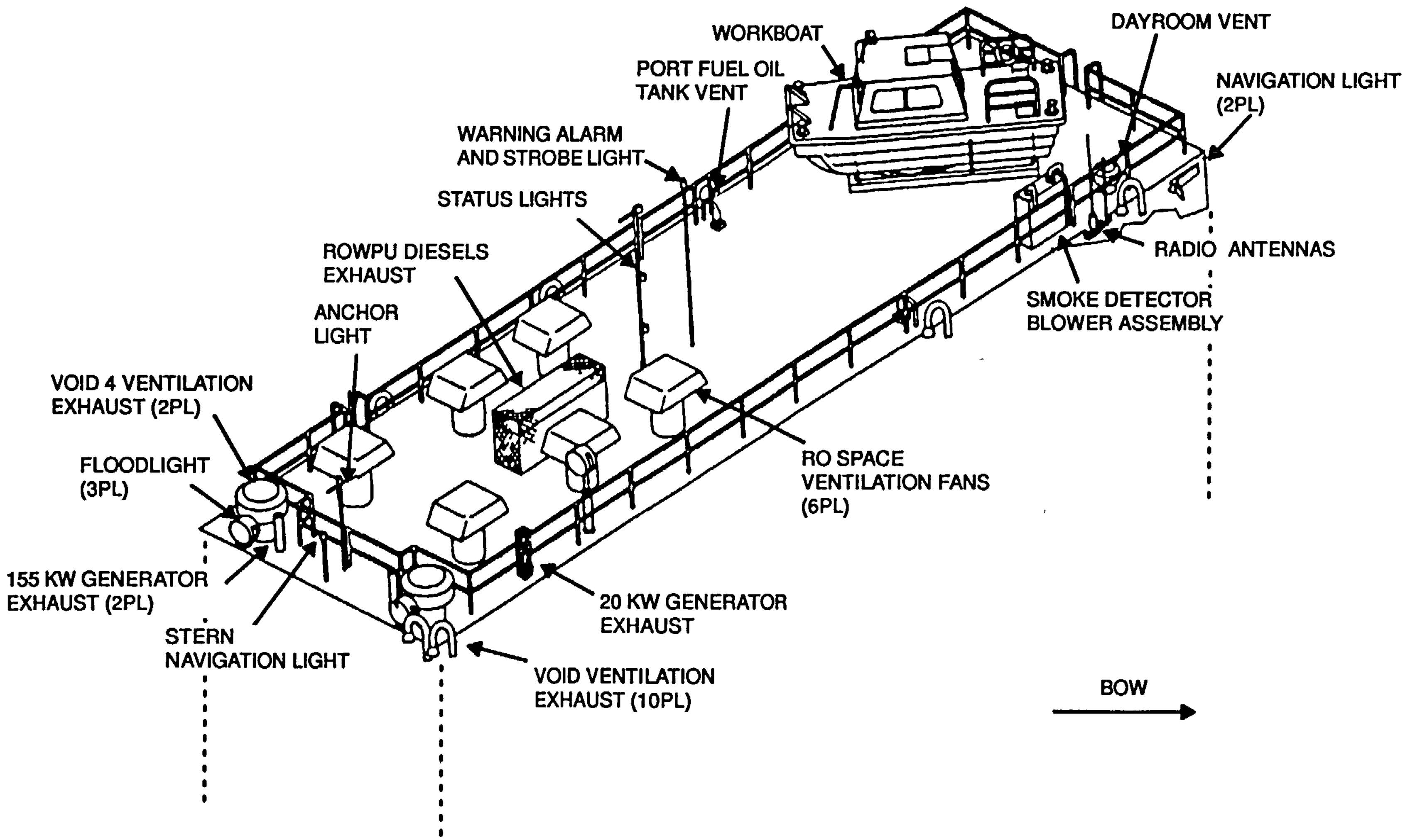


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Deckhouse Roof (Sheet 1 of 3)

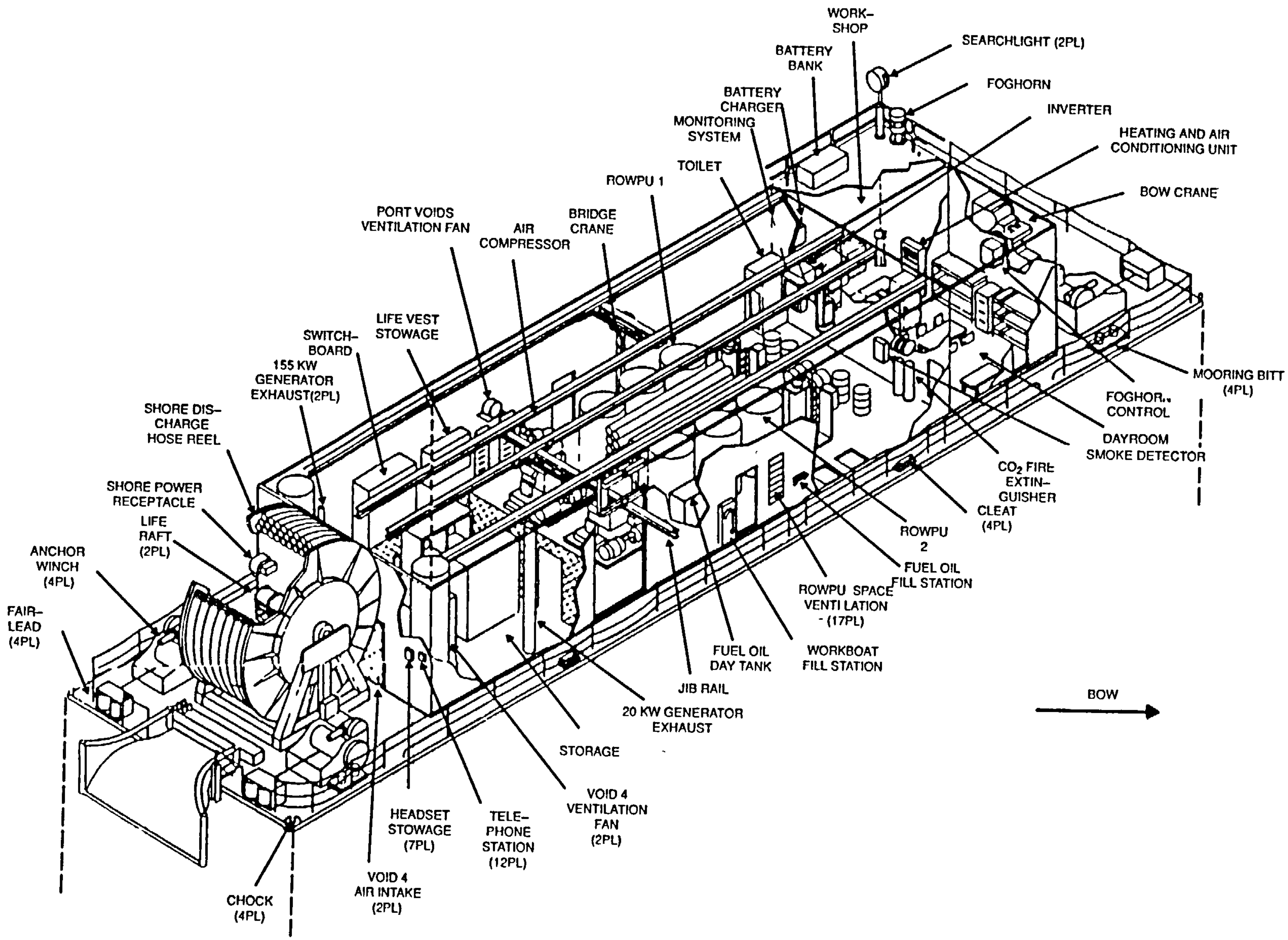


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Deckhouse (Sheet 2 of 3)

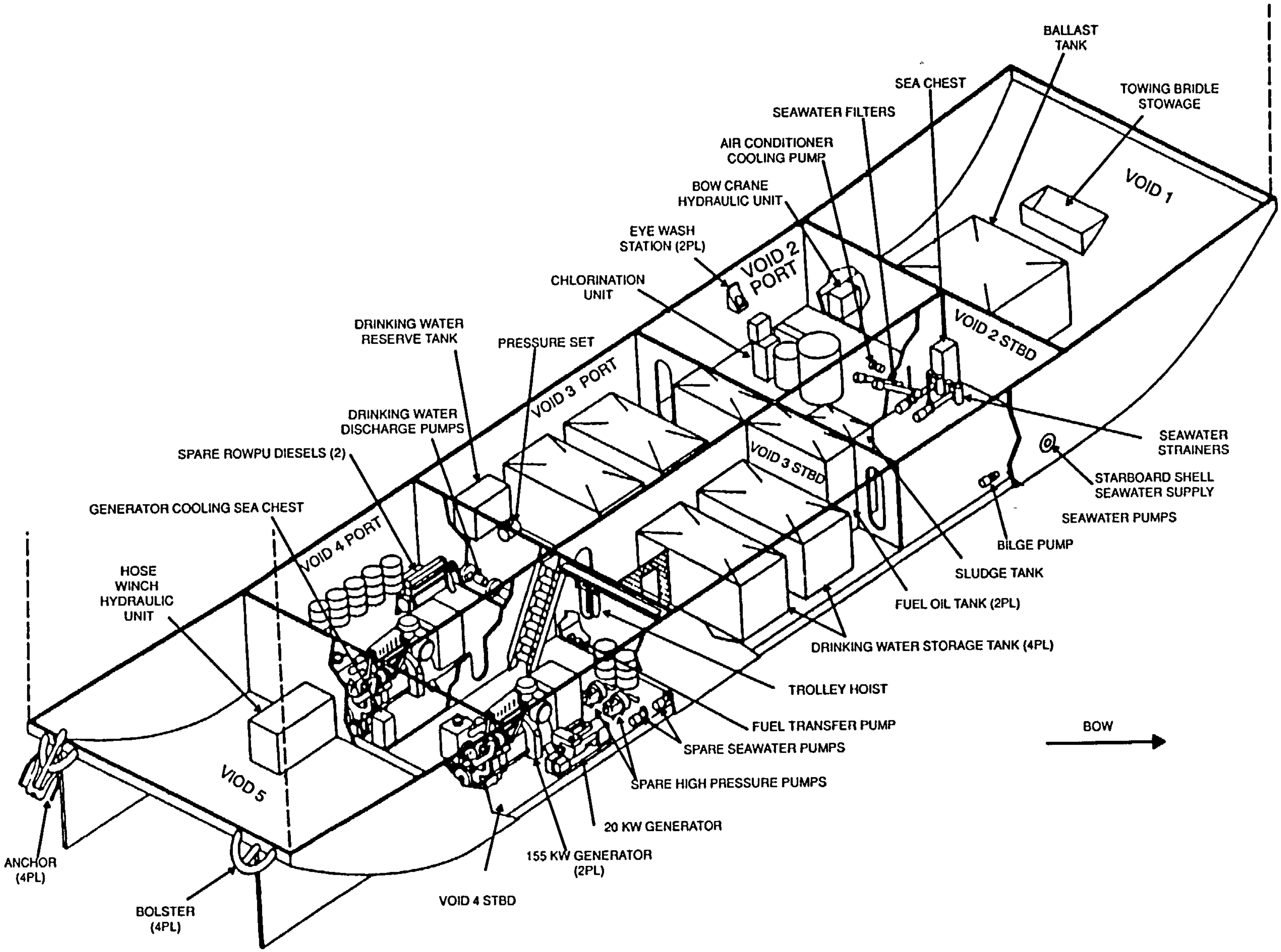


Figure 1-1. Major Components of ROWPU Barge Systems and Equipment - Voids (Sheet 3 of 3)

Section II. Description and Data

1-7 General. The water purification barge was originally a Nonpropelled Deck Cargo Barge Design 231. This barge was modified to shelter and transport a mobile drinking water processing plant. Major modifications include installation of two Reverse Osmosis Water Purification Units (ROWPU's) that filter and desalt seawater. These units were originally developed for use in a dispersed field operation mode and are modified to fit and operate in the space available on the barge. A chlorination plant is installed to produce and inject chlorine into the ROWPU processed water to disinfect it. Four water storage tanks installed in the voids store the disinfected (drinking) water. A flexible hose system, installed, on the stem weatherdeck transfers the stored drinking water to a shore facility or to another vessel.

Two 155 kW ship service generators (SSG's) provide the electric power needed for ROWPU operation and service power for barge support systems. Electric power can also be supplied from shore-based electric power service facilities or from another vessel through an onboard shore power receptacle. A 20 kW ship auxiliary generator (SAG) provides power when only barge support systems such as dayroom or workshop equipment, normal lighting, the emergency power and monitoring system, and battery chargers are being operated. When normal electric power service is interrupted, the emergency battery-powered electric system automatically provides power for emergency lighting, navigation lights, and communications.

The following barge operating and support systems are described in this TM:

a. Major systems and equipment for production and transfer of drinking water

(1) Seawater and ballast system

(2) ROWPU system

(3) Chlorination system

(4) Drinking water system

(5) Drinking water shore discharge system

b. Auxiliary systems and equipment

(1) Compressed air system

(2) Fuel oil system

(3) Electrical power system (normal and emergency)

(4) Interior and exterior lights

(5) Equipment Monitoring System (EMS)

(6) Communications systems

(7) Handling equipment, including bridge and bow cranes

(8) Anchoring, mooring, and towing equipment

(9) Deckhouse, voids, and waste disposal system

(10) Ventilation, heating, and air conditioning systems

(11) Workboat, lifesaving, and firefighting equipment

The auxiliary system equipment operating information and maintenance procedures are listed below with their applicable volumes:

Auxiliary System Equipment	Discussed in TM
a. Fuel oil system	TM 55-1930-209-14 & P-8, Fuel Oil System
b. Handling equipment	TM 55-1930-209-14 & P-13, Handling Equipment
Bow crane	
Bridge crane	
Void 4 hoist	
c. Miscellaneous equipment	TM 55-1930-209-14 & P-15, Miscellaneous Equipment
Dayroom equipment	
Workshop equipment	
Bilge system	
Ship's toilet	
d. Lifesaving equipment	TM 55-1930-209-14 & P-17, Workboat, Lifesaving, and Firefighting Equipment
Life rafts	
Life vests	
Life buoys	
e. Firefighting equipment	TM 55-1930-209-14 & P-17, Workboat, Lifesaving, and Firefighting Equipment
Halon 1301 system	
$C0_2$ hose/reel	
Portable $C0_2$ fire extinguishers	
Portable dry chemical fire extinguishers	
Portable firefighting pump, PE-250	
f. Shore winch system	TM 55-1930-209-14 & P-21, Shore Winch System

1-8 Capabilities. The barge is capable of producing 300,000 gallons of drinking water during a 24 hour period in sea conditions not exceeding Sea State 3. This level of water production is based on optimum environmental and operational conditions. Performance will vary with changing conditions and the age of the reverse osmosis (RO) block membranes in the pressure tubes.

1-8.1 Definitions. System capability definitions used in this TM are as follows: C - Centigrade, F - Fahrenheit, gal - gallons, gpd -gallons per day, gph - gallons per hour, gpm - gallons per minute, Hg - hydrargyrum (level of mercury such as used in a pressure gauge), HP - high pressure, hp - horsepower, Hz - Hertz, kVA - kilovoltampere, kW - kilowatt, mA - milliamperes, NPT- National Pipe Thread, ph - phase, POL - petroleum, oil, lubricants, ppm - parts per million, psi - pounds per square inch, RO - reverse osmosis, rpm - revolutions per minute, V - volts, Vac - volts alternating current, Vdc - volts direct current.

1-9 Special limitations:

a. Barge cannot operate where water depth is less than 15 feet at low tide.

b. Barge cannot be safely anchored In waters deeper than 50 feet.

c. Barge cannot provide drinking water to a shore facility if anchored more than 2000 feet from shoreline.

d. Barge cannot operate in sea conditions exceeding Sea State 3. Barge may weather Sea State 4 if riding on one anchor rigged with bridle to bow winches and shore discharge hose is retrieved.

e. Barge cannot be towed in Sea State 3 at speeds in excess of 8 knots.

f. Barge cannot operate beyond 7 days without refueling Other consumables onboard may last about 90 days.

g. Barge crews must be billeted ashore and transported to barge as crews change.

1-10 Performance characteristics. Under ideal conditions and with each ROWPU operating at least 10 hours out of every 12 (average 2 hours per unit for periodic maintenance and servicing), drinking water production should be:

a. Each ROWPU unit - 150,000 gallons per 24 hours.

b. Total barge capacity - 300,000 gallons per 24 hours.

1-11 Equipment specifications:

a. Length overall	120 feet
b. Beam, molded'	33 feet
c. Depth, molded	10.5 feet
d. Displacement:	
(1) Light	425 tons
(2) Loaded	505 tons
e. Draft'	
(1) Light	5 feet
(2) Loaded	5 feet 8 inches
f. Tank capacities:	
(1) Drinking water storage tanks (4)	15,000 gallons total
(2) -Water reserve tank	250 gallons
(3) Fuel oil storage tanks (2)	7,200 gallons total
(4) Fuel oil day tank	320 gallons
(5) Sludge tank	500 gallons
(6) Ballast tank	10,000 gallons
(7) PE-250 fire & bilge pump gasoline tank	6 gallons

1-12 Items furnished. All components installed as part of the barge are listed on the parts lists in drawings referenced in Appendix A and in the Components of End Item List (CEIL) in Appendix B of TM 55-1930-209-14&P-20.

1-12.1 Common and bulk items onboard are listed in the Expendable Supplies and Materials List (ESML) in Appendix E of TM 55-1930-209-14& P-18.

1-12.2 Repair parts and special tools onboard are listed in the Repair Parts and Special Tools List (RPSTL) in Appendix D of TM 55-1930-209-14& P-18.

1-13 Items required but not furnished.

1-13.1 The barge requires a light Army tug or larger, or commercial tug of equivalent capacity, to move it from one location to another. The tug usually tows the barge for long moves in open water and puts the barge "on its hip" for short moves in congested or confined areas.

1-13.2 The barge requires the assistance of a landing craft mechanized (LCM-8) or similar type utility boat to transport the ROWPU barge shore winch to and from the beach. This utility craft may also be used for placement and retrieval of the barge's four anchors. A rough terrain forklift is also required to retrieve the beach winch from the LCM-8 and position it on shore.

1-13.3 Watercraft must be obtained from the commander of the terminal operating area where the barge is being deployed or from the commander providing support for the barge.

1-13.4 Bargemaster must have an accurate angle measuring and sighting device of at least an M-8 lensatic compass capability or better.

1-14 Tools and test equipment. Use existing tools and equipment onboard. A complete list of tools and test equipment onboard is in the Tools and Test Equipment List (TTEL) in Appendix C of TM 55-1930-209-14 & P-18.

1-15 Maintenance. Any Intermediate Direct Support/Intermediate General Support (IDS/IGS) maintenance requirement beyond the capabilities of crewmembers is provided by a shore-based support maintenance unit. This unit also determines when depot level support maintenance is required.

CHAPTER 2 DESCRIPTION OF OPERATION

2-1 General. ROWPU barges are normally maintained in administrative or long-term storage in a logistics holding area. When needed, ROWPU barges are removed from storage configuration and inspected and tested to ensure operational readiness. Any deficiencies are corrected before the barge is towed by commercial or military tug to an operational site. Once onsite and while anchoring is in progress, the chlorination system is started so chlorine will be available when the ROWPU system is activated. As soon as barge anchoring is complete, the shore winch is moved to the beach and securely anchored. The drinking water shore discharge hose is then deployed from the barge to the drinking water facility on the beach. Next, water processing systems, with their auxiliary systems, are started.

2-1.1 To process seawater into drinking water, water is initially pumped through four filtering systems. The filtered seawater is then pumped under high pressure into the RO pressure tubes. These tubes are the heart of the ROWPU system where the reverse osmosis takes place. During this process, the filtered seawater is forced over a specially fabricated membrane and the water that passes through the membrane is free of salt and other impurities. This product water is further processed into drinking water by adding chlorine. The brine water that does not pass through the membrane is pumped directly overboard.

2-1.2 During initial startup and checkout, drinking water is pumped overboard. When the quality of drinking water is acceptable and sufficient time has elapsed to flush out piping, drinking water is then directed into the barge drinking water storage tanks. Finally, the drinking water shore discharge system is started and drinking water is pumped to the water storage facility ashore. Both ROWPU systems operate continuously and simultaneously. After about 10 hours of operation, however, each system is normally shut down for 2 hours of scheduled maintenance. The amount of time needed for this operational maintenance and the time between its performance will vary with the conditions of the water being processed.

2-2 Reverse osmosis process. The reverse osmosis process separates clean water from salt water. During the natural osmosis process, pure water and salt water can be separated by a semipermeable membrane in a container at atmospheric pressure (Figure 2-1). Because of the difference in salt concentration, pure water will naturally diffuse through the membrane and raise the water level in the salt water side as though pressure were being applied to it. The effective driving force causing the flow is called osmotic pressure. The magnitude of the osmotic pressure depends upon the concentration of dissolved solids in the saltwater and the water temperature. The greater the concentration of salt in the saltwater and the higher the water temperature, the higher the osmotic pressure.

2-2.1 To reverse the natural osmosis process, pressure is applied to the saltwater side (Figure 2-1). When the applied pressure is greater than the osmotic pressure, purified water diffuses through the semipermeable membrane from the saltwater side to the freshwater side, thus the term, reverse osmosis. The salt water side of the membrane becomes more concentrated with salt and is called brine concentrate. The resulting purified water is called product water.

2-2.2 ROWPU is arranged so that water that has been filtered several times (pretreated) is pumped under pressure across the semipermeable membrane, called the RO membrane. This membrane separates the pretreated feedwater stream into product water that has passed through the membrane and a brine concentrate that has not passed through the membrane. The product water flows to the drinking water storage tanks in the voids, and the brine concentrate flows directly overboard.

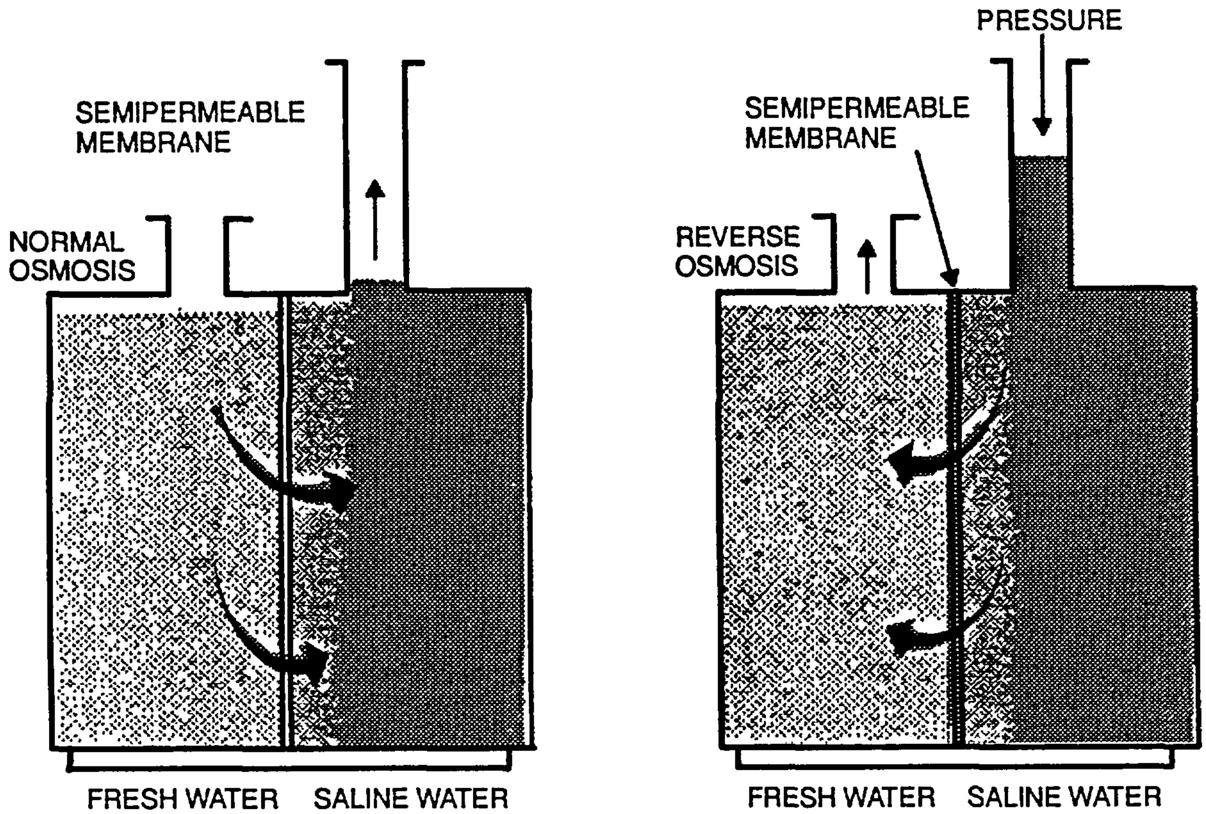


Figure 2-1. Reverse Osmosis Demonstration

2-3 Drinking water production. This section provides a functional description of how each ROWPU produces drinking water from saltwater. While each unit normally operates independently, the two systems contain several crossover points to provide backup during periodic maintenance procedures. These are described in Chapter 13.

2-3.1 An electrically powered seawater pump (Figure 2-2) draws seawater from a seachest mounted in the barge bottom and through a duplex seawater strainer. The strainer (first of four strainer or filtering steps) removes large foreign particles from the seawater. The seawater pump, in void 2 port, discharges the seawater through a seawater filter (commercially referred to as a separator) which removes additional particles from the seawater. The seawater, pressurized up to 150 psi, then flows to the pretreatment skid in the ROWPU space.

2-3.2 As seawater flows into the pretreatment skid (Figure 2-3), its quality and flow rate are shown on a flow rate indicator on top of the pretreatment skid. In addition, the temperature of the incoming seawater is shown on a temperature gauge mounted aft of the flow rate indicator. As seawater enters the pretreatment skid, coagulant (Hydrapol-50) is added by a chemical metering pump. This chemical assists the media filters in removing fine particles and colloids (clouds of fine particles suspended in water). Normal dosage is 4 parts per million (ppm). Dosage can be increased, however, if a seawater sample contains above average impurities.

2-3.3 Seawater containing coagulant then flows through three-way valves to three media filters. In these filters, seawater flows from the top downward through five different layers of filtering media where fine particles and colloids are removed from the seawater so it is suitable for processing by the RO block assembly.

2-3.4 Seawater discharged from media filters is collected into a single stream where scale inhibitor (Hydrapol-1 00) is added. A small chemical metering pump, similar to the one used to add Hydrapol-50, normally adds 4.0 ppm of inhibitor. This inhibitor limits formation of scale on the RO pressure tube membranes.

2-3.5 Seawater, with scale inhibitor (Hydrapol-100), then flows through the pretreatment skid cartridge filter assembly. At this stage the water is still being pumped through the system by the electrically powered seawater pumps in void 2 starboard. The cartridge filter assembly removes any foreign matter such as oil, soap, and detergents that would be harmful to the RO tube membranes and the diesel-driven HP pump.

2-3.6 Seawater next flows to the diesel-driven HP water pump where water pressure is increased to the 835 psi (maximum) required for reverse osmosis processing in the RO block.

2-3.7 The pressurized seawater enters the RO block inlet manifold which divides the flow among the 16 pressure tubes. Each pressure tube separates seawater by reverse osmosis into a high purity product water stream and a brine concentrate stream. Product water from each pressure tube flows to a common manifold. It then flows through a flow meter (Figures 2-4 and 2-5), maximum output 108 gpm, and either into the drinking water storage tanks or overboard.

2-3.8 The chlorination unit in void 2 port produces chlorine and adds it to the drinking water just before it flows into the storage tanks. One chlorination unit serves both ROWPU's.

2-3.9 Brine from each RO pressure tube also flows to a common manifold and then through a throttling valve and pressure gauge. This routing allows pressure and flow rate adjustment. Brine is then discharged directly overboard through the void 5 port shell.

2-3.10 An electrically powered discharge pump takes drinking water from storage tanks and pumps it through a flexible discharge hose to a water distribution point ashore. Drinking water can also be discharged to other vessels through piping on the port side.

2-4 Manual format for operational use. The following chapters are arranged in the sequence in which they would normally be used by the operating crew in performing a predeployment checkout and initial barge deployment. These procedures assume that the barge has been completely removed from its preservation status; covers have been removed from all ventilation shafts, specially stored items have been returned to their normal locations, batteries stored in dry configuration have been installed and activated, handling equipment, firefighting equipment, and lifesaving equipment have been certified operational, barge has been fueled, and all systems are operational.

The sequence assumes the barge is at dockside and the first step is to activate the SAG to provide power for lights and battery chargers so an SSG can be started (Chapter 3). With power being provided, smoke detector system (Chapter 4), communications (Chapter 5), normal lighting (emergency lighting has been used while starting the SAG) (Chapter 6), ventilation and heating/air conditioning (H/AC) (Chapter 7), and the EMS can be activated (Chapter 8). These may be done simultaneously if crew members are available and well trained. Next, activate the chlorination system (Chapter 9). The chlorination system takes about 4 hours to develop to full capability and should be started as soon as possible. After the chlorination unit has been started, the workboat can be removed from its deckhouse storage (Chapter 10). The seawater system can be started (Chapter 11) and, if required, the compressed air system activated (Chapter 12). Next, the ROWPU system (Chapter 13) and drinking water system (Chapter 14) are activated. For a dockside predeployment check, the shore discharge system may be activated to pump product water overboard (Chapter 15). When all systems are operational, the barge can be deployed (Chapter 16).

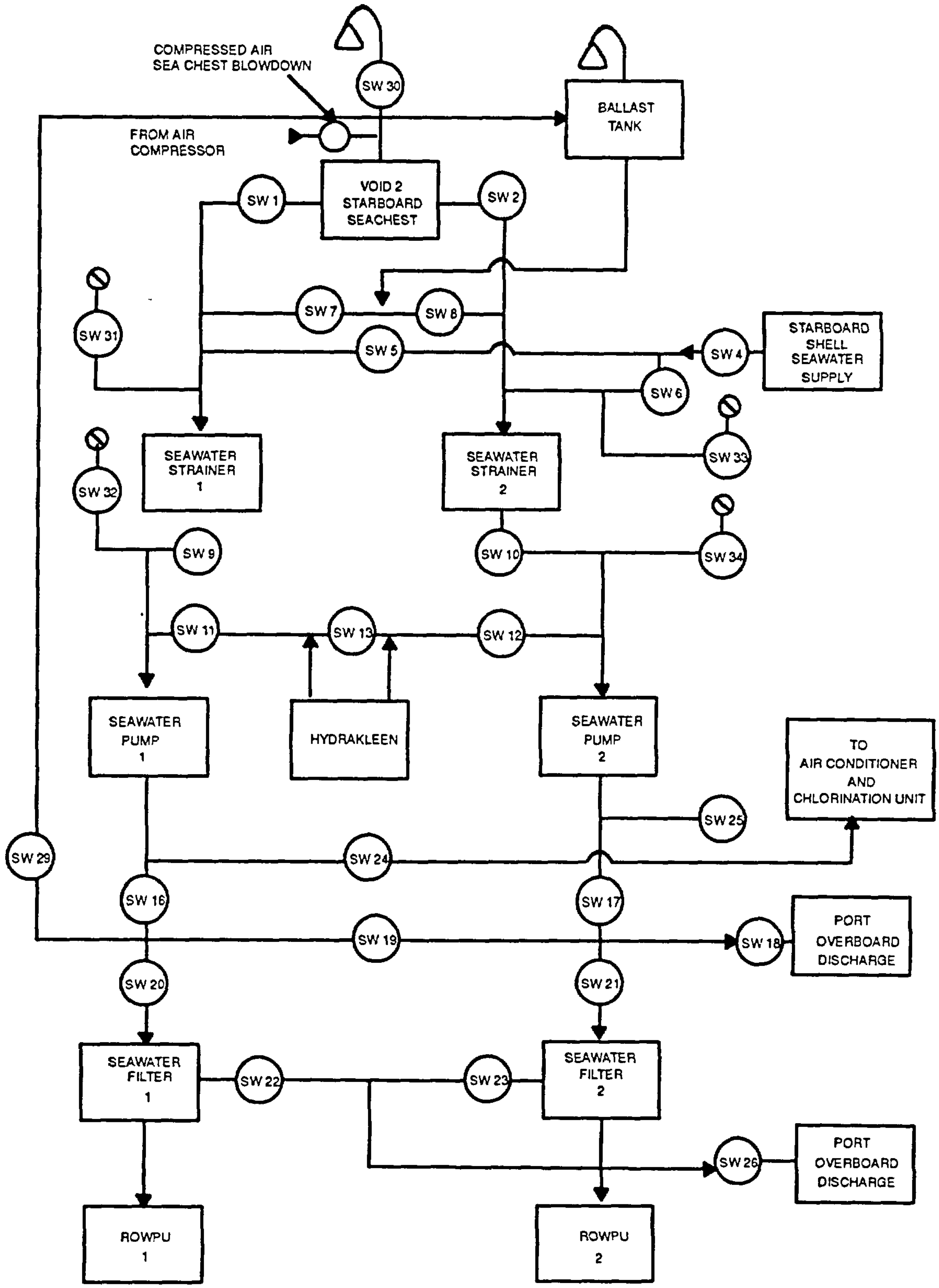


Figure 2-2. ROWPU and Ballast Seawater Supply Block Diagram

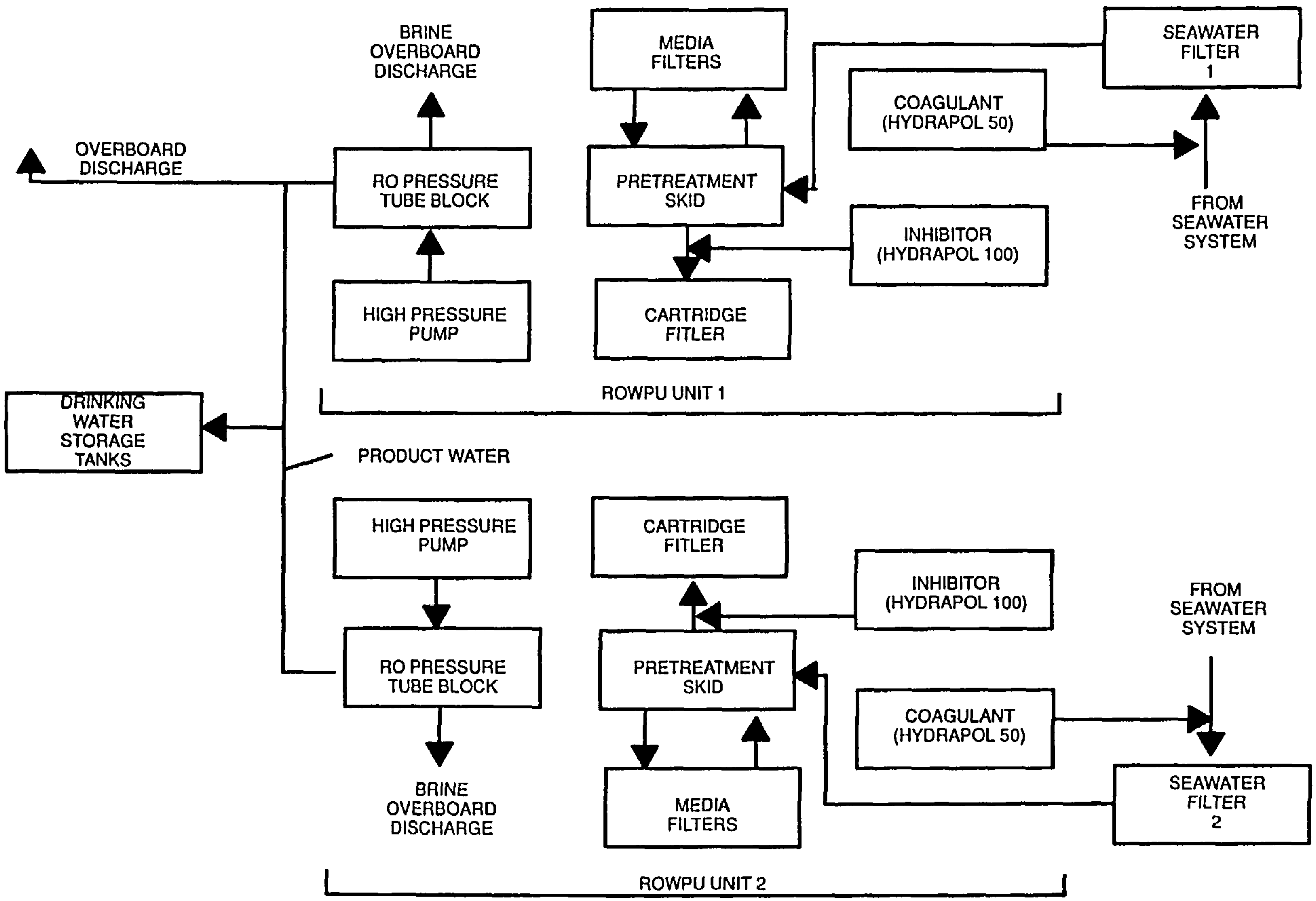


Figure 2-3. ROWPU System Block Diagram

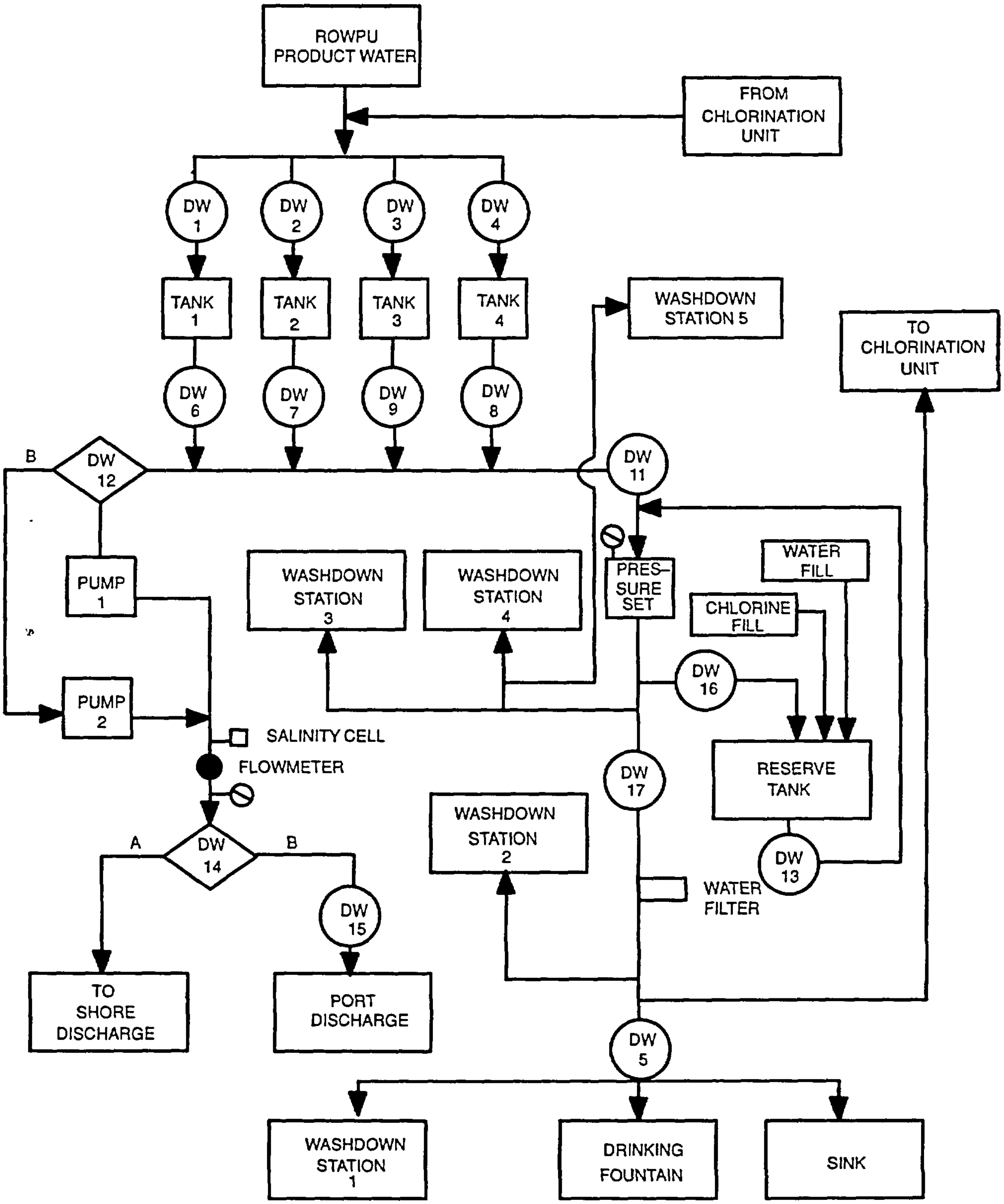


Figure 2-4. Drinking Water System Block Diagram (Barge 1)

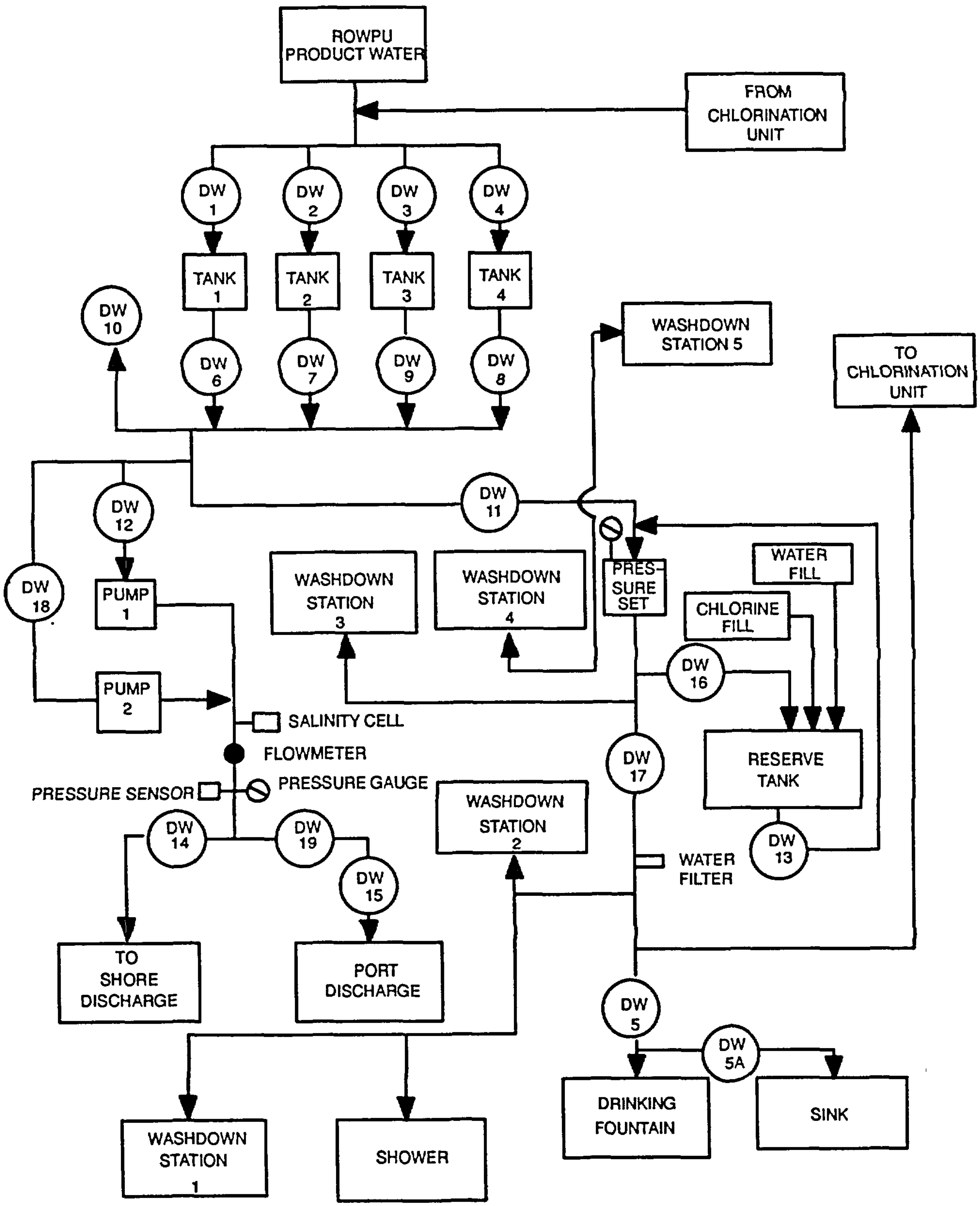


Figure 2-5. Drinking Water System Block Diagram (Barges 2 and 3)

CHAPTER 3 ELECTRICAL POWER SYSTEMS

Section I. General

3-1 General. Two electrical systems, normal and emergency, are installed onboard The normal electrical system generates, controls, and distributes all electrical power used onboard to operate the water purification system and its auxiliary systems. The emergency electrical system supplies 24 Vdc from a battery pack to onboard 24 Vdc equipment and, through an inverter, converts 24 Vdc to 120 Vac to power emergency lighting and equipment Details are in Section II thru Section V.

3-1.1 Normal electrical system

3-1.1.1 Normal electric power service consists of any of the following power sources: Electric power generated by either of the two SSG's, the SAG, or power received from an onshore electric power generating service or from another vessel through the external power receptacle. In addition, electric power generated onboard the barge can be transmitted ashore or to another vessel through an external power receptacle.

3-1.1.2 Power from these various sources is controlled and distributed by a master switchboard in ROWPU space portside aft.

3-1.1.3 Distribution from the switchboard goes either directly to equipment, such as seawater pumps, or to three intermediate distribution power panels.

3-1.2 Emergency electrical system. This system obtains 24 Vdc power from a battery bank on the deckhouse top for distribution through a 24 Vdc power panel to operate navigation lights and other equipment. It also supplies power to an inverter that converts 24 Vdc to 120 Vac for the emergency lighting system.

Section II. Normal electrical system

3-2 Description.

3-2.1 The normal electrical system provides electrical power for the operation of major and auxiliary systems on the barge including the emergency system battery charger discussed in Section III. The normal system has six major elements which are discussed below:

a. Normal electrical power is generated onboard by one of three diesel-powered generator sets. These generators, located in voids 4, are normally operated and controlled from a master switchboard in the ROWPU space. Section V provides detailed information on the two SSG sets, and Section VI provides similar information on the SAG set. When all generator sets are shut down, a shore-based powerplant or another vessel can be used to provide electrical power to operate onboard equipment. This outside source is connected to the barge through electrical cabling to a watertight shore power receptacle on aft weatherdeck portside. These sources provide 440 Vac, 60 Hz, 3 ph electrical power.

b. Power control and distribution is provided by a main switchboard on the port bulkhead aft of diesel HP pumps in the ROWPU space. This unit has six panels, three above the grab rail and three below. The three panels above the grab rail are controls and indicators for the three diesel generators in voids 4. The lower left (as operator faces the switchboard) distribution panel has two rows of circuit breakers that provide initial normal power distribution. Two lower right panels contain controls and indicators for the electrical system. This panel also has indicators for ground detection system. Normal electrical system controls and indicators are discussed in paragraph 3-13.

c. Electrical power is distributed through a switchboard distribution panel (Figure 3-1 for Barge 1 and Figure 3-2 for Barges 2 and 3) and these additional distribution panels:

Power panel 1 (440 Vac) (Figure 3-3)
Power panel 2 (440 Vac) (Figure 3-4)
Power panel 3 (120 Vac) (Figure 3-5)
Power Panel 4 (440 Vac) (Barge 1) (Figure 3-6)
Deck lighting panel (120 Vac) (Figure 3-7)
Void lighting panel (120 Vac) (Figure 3-8)
Receptacle panel (120 Vac) (Figure 3-9)
Emergency lighting panel (120 Vac) (Figure 3-19)**
Direct current panel (24 Vdc) (Figure 3-18)**
** Discussed in Section III, Emergency electrical system.

d. Transformers change electrical power from 440Vacto either 220 Vac or 120 Vac. Three 15 kVA transformers (in parallel) on switchboard circuit breaker P13 provide 120 Vac power for power panel 3 which provides 120 Vac power distribution for the barge. One 2 kVA transformer on power panel 1 circuit breaker 11 P5 provides 220 Vac for the electric motor that powers the drinking water pressure set.

e. Mechanisms such as starters, controllers, and switches provide another level for controlling electrical power. These are discussed in the TM for each individual system.

f. The final elements are the electrical power consuming devices such as motors, lights, and heaters. These are discussed in the volume for the system of which they are a part.

3-2.2 Major components of this system are listed in Table 3-1 and shown in engineering drawings listed in TM 55-1930-209-14 & P-9.

3-3 Capabilities. This system provides electrical power for operating the barge equipment. Either of two 155 kW SSG's provide sufficient electrical power to operate all systems onboard. The SAG provides sufficient power for barge occupancy but not for major ROWPU systems operation. When onboard generator sets are not operating, power can be supplied through the shore power receptacle from onshore or from another vessel. An emergency shutdown system is also provided to stop individual systems or to stop all electrically powered equipment onboard. Paragraph 3-7.9 provides additional information.

3-4 Special limitations. This system must have sufficient fuel for diesel-powered generators and the generators must be operational.

3-5 Performance characteristics

a. Shore power to switchboard	440 Vac, 60 Hz, 3 ph
b. Generators to switchboard	440 Vac, 60 Hz, 3 ph
c. Switchboard	440 Vac, 60 Hz, 3 ph

SHORE DISCHARGE PUMP NO 1	
P9	50 AMPS
POWER PANEL NO 1	
P5	80 AMPS
ROWPU BOOSTER PUMP NO 2	
P7	70 AMPS
ROWPU BOOSTER PUMP NO.1	
P6	70 AMPS
CRANE HYDRAULIC UNIT	
P16	50 AMPS
WELDING MACHINE	
P17	50 AMPS
GENERATOR BATTERY CHARGERS	
P18	10AMPS

POWER PANEL NO 2	
P8	70 AMPS
ANCHOR WINCH NO. 1 AND NO 2	
P1	35 AMPS
HOSE REEL	
P12	50 AMPS
SHORE DISCHARGE PUMP NO 2	
P15	50 AMPS
POWER PANEL NO 350 AMPS	
P13	50 AMPS
ANCHOR WINCH NO 3 AND NO 4	
P11	35 AMPS
SPARE	

THE FOLLOWING PRIMARY CIRCUIT BREAKERS ARE NOT ON DISTRIBUTION PANEL BUT ARE LOCATED ON SWITCHBOARD

P1 SSG1 TO SWITCHBOARD BUS (300 AMPS)

P2 SSG2 TO SWITCHBOARD BUS (300 AMPS)

P3 SAG3 TO SWITCHBOARD BUS (50 AMPS)

P4 SHORE POWER TO SWITCHBOARD BUS (200 AMPS)

P14 NOT ON SWITCHBOARD. DESIGNATION USED FOR 24 VDC POWER PANEL

Figure 3-1. Switchboard Distribution Circuit Breakers (Barge 1)

POWER PANEL NO. 1	
P5	80AMPS
ROWPU BOOSTER PUMP NO 1	
P6	70 AMPS
ROWPU BOOSTER PUMP NO 2	
P7	70 AMPS
POWER PANEL NO. 2	
P8	70 AMPS
SHORE DISCHARGE PUMP NO. 1	
P9	50 AMPS
ANCHOR WINCH NO. 1 AND NO. 2	
P10	35AMPS

ANCHOR WINCH NO. 3 AND NO 4	
P11	35AMPS
HOSE REEL	
P12	50 AMPS
POWER PANEL NO. 3 120 VOLTS	
P13	50 AMPS
SHORE DISCHARGE PUMP NO. 2	
P15	50AMPS
CRANE HYDRAULIC UNIT	
P16	50 AMPS
WELDING MACHINE	
P17	50 AMPS
GENERATOR BATTERY CHARGERS	
P18	10AMPS
(P14 NOT USED)	

THE FOLLOWING PRIMARY CIRCUIT BREAKERS ARE NOT ON DISTRIBUTION PANEL BUT ARE LOCATED ON SWITCHBOARD:

P1 SSG1 TO SWITCHBOARD BUS (300 AMPS)

P2 SSG2 TO SWITCHBOARD BUS (300 AMPS)

P3 SAG3 TO SWITCHBOARD BUS (50 AMPS)

P4 SHORE POWER TO SWITCHBOARD BUS (200 AMPS)

P14 NOT ON SWITCHBOARD. DESIGNATION USED FOR 24 VDC POWER PANEL

Figure 3-2. Switchboard Distribution Circuit Breakers (Barges 2 and 3)

POWER PANEL 1
440 VAC, 60 HZ

1P5 AIR CONDITIONING COOLING PUMP 15A	2P5 FUEL TRANSFER PUMP 15A
3P5 AIR COMPRESSOR 15A	4P5 DRILL PRESS 15A
SP5 AIR CONDITIONER 15A	6P5 BRIDGE CRANE 15A
7P5 SPARE 15A	8P5 GRINDER 15A
9P5 CHLORINATION UNIT 25A	10Ps CHLORINE METERING PUMP 15A
11P5 DRINKING WATER PRESSURE SET 15A	12P5 BILGE PUMP 15A

LOCATED IN ROWPU SPACE ON FORWARD PORT BULKHEAD, FORWARD OF DOOR TO WEATHERDECK. POWER INPUT FROM SWITCHBOARD CIRCUIT BREAKER P5.

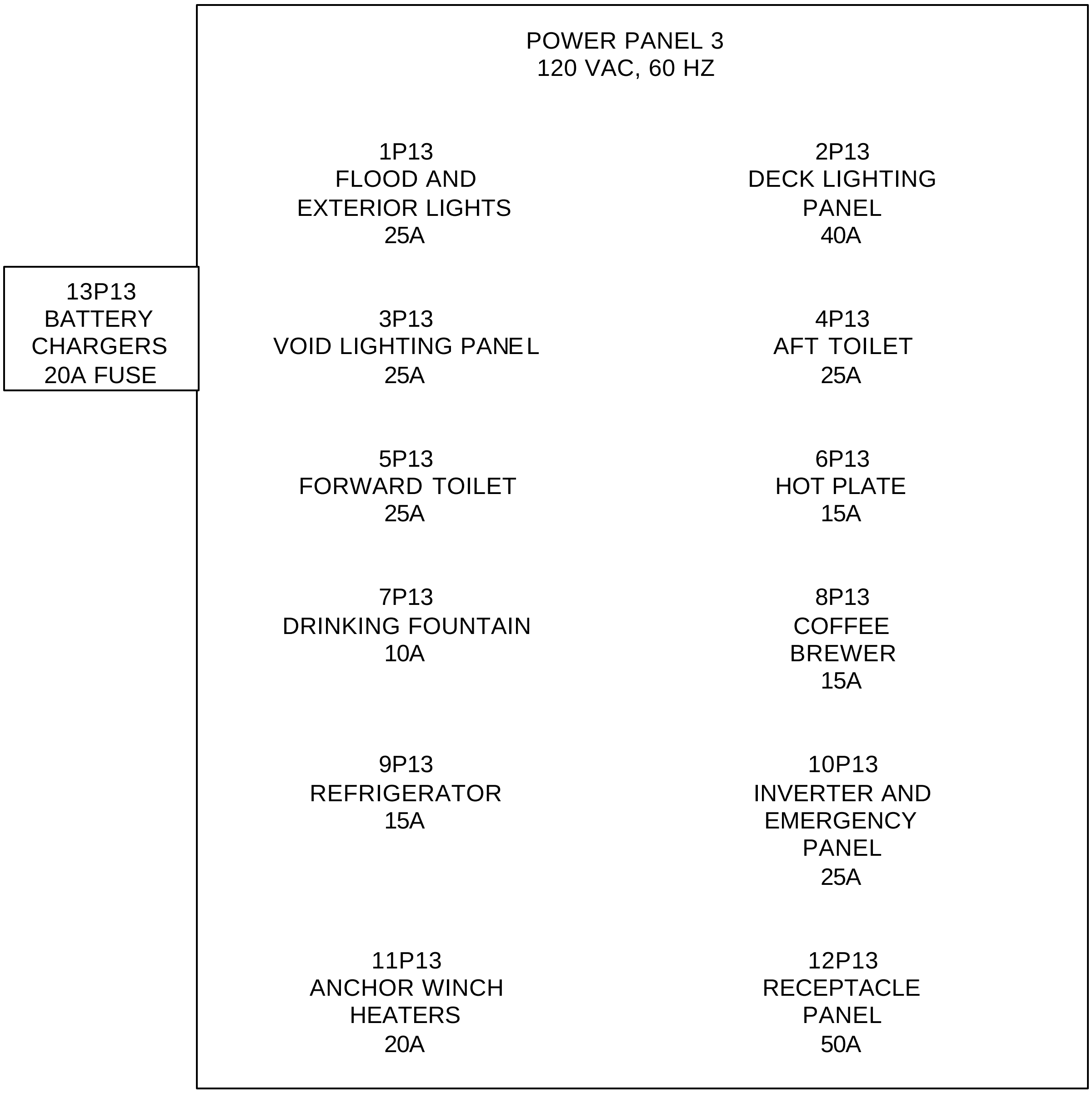
Figure 3-3. Power Panel 1 Circuit Breakers, 440 Vac

POWER PANEL 2
440 VAC, 60 HZ

1P8 ROWPU SPACE VENTILATION VENT FAN 1 15A	2P8 ROWPU SPACE VENTILATION FAN 2 15A
3P8 ROWPU SPACE VENTILATION VENT FAN 3 15A	4P8 ROWPU SPACE VENTILATION FAN 4 15A
5P8 ROWPU SPACE VENTILATION VENT FAN 5 15A	6P8 ROWPU SPACE VENTILATION FAN 6 15A
7P8 STARBOARD VOIDS VENTILATION FAN 7 15A	8P8 PORT VOIDS VENTILATION FAN 8 15A
9P8 VOID 4 STARBOARD VENTILATION FAN 9 15A	10P8 VOID 4 PORT VENTILATION FAN 10 15A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD, FORWARD OF SLIDING DOOR. POWER INPUT FROM SWITCHBOARD CIRCUIT BREAKER P8.

Figure 3-4. Power Distribution Panel 2, 440 Vac



LOCATED IN ROWPU SPACE ON FORWARD BULKHEAD.

Figure 3-5. Power Distribution Panel 3, 120 Vac

POWER PANEL 4
440 VAC, 60 HZ

1P19 HEATER 1-A FND STBD HEATER 1-B FWD PORT ROWPU SPACE	2P19 HEATER 2-A AFT STBD HEATER 2-B AFT PORT ROWPU SPACE
3P19 HEATER 3 VOID 5	4P19 HEATER 4 VOID 1
5P19 HEATER 5 VOID 2 STBD	6P19 HEATER 6 VOID 2 PORT
7P19 HEATER 7 VOID 3 STBD	8P19 HEATER 8 VOID 3 PORT
SP19 HEATER 9 VOID 4 STBD	10P19 HEATER 10 VOID 4 PORT

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD OF DOOR TO WEATHERDECK. POWER INPUT FROM SWITCHBOARD CIRCUIT BREAKER P19.

Figure 3-6. Power Distribution Panel 4, 440 Vac (Barge 1)

DECK LIGHTING PANEL
120 VAC, 60HZ

2P13-2 ROWPU SPACE STARBOARD CENTER LIGHTS 10A	2P13-1 ROWPU SPACE PORT LIGHTS 10A
2P13-4 ROWPU SPACE PORT CENTER LIGHTS 10A	2P13-3 ROWPU SPACE STARBOARD LIGHTS 10A
2P13-6 DAYROOM LIGHTS 10A	2P13-5 WORKSHOP LIGHTS 10A
2P13-8 PORT SEARCHLIGHT 10A	2P13-7 RANGE HOOD 10A
2P13-10 SPARE 10A	2P13-9 STARBOARD SEARCHLIGHT 10A
2P13-12 SPARE 10A	2P13-11 SPARE 10A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD

Figure 3-7. Deck Lighting Panel

VOID LIGHTING PANEL
120 VAC, 60HZ

3P13-2 VOID 2 PORT LIGHTS 10A	3P13-1 VOID 1 LIGHTS 10A
3P13-4 VOID 3 PORT LIGHTS 10A	3P13-3 VOID 2 STARBOARD LIGHTS 10A
3P13-6 VOID 4 PORT LIGHTS 10A	3P13-5 VOID 3 STARBOARD LIGHTS 10A
3P13-8 VOID 5 LIGHTS 10A	3P13-7 VOID 4 STARBOARD LIGHTS 10A
3P13-10 SPARE 10A	3P13-9 SMOKE DETECTOR 20A
3P13-12 SPARE 10A	3P13-11 SPARE 10A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD NEAR DAYROOM DOOR.

Figure 3-8. Void Lighting Panel

RECEPTACLE PANEL
120 VAC, 60HZ

12P13A-1 ROWPU SPACE PORT RECEPTACLES 10A	12P13A-2 WORKSHOP RECEPTACLES 10A
12P13A-3 ROWPU SPACE STARBOARD RECEPTACLES 10A	12P13A-4 DAYROOM RECEPTACLES 10A
12P13A-5 VOID 2 RECEPTACLES 15A	12P13A-6 VOIDS 4 AND 5 RECEPTACLES 15A
12P13A-7 VOID 3 RECEPTACLES 15A	12P13A-8 VOID 1 RECEPTACLES 15A

LOCATED IN WORKSHOP ON AFT BULKHEAD POWER INPUT FROM POWER PANEL 3 CIRCUIT BREAKER 12P13

Figure 3-9. Receptacle Panel

3-6 Description of operation. Normal electrical power is generated onboard by one of three diesel-powered generator sets. Two of these are rated at 155 kW (designated as SSG1 and SSG2 sets), and one is rated at 20 kW (designated as the SAG set). Except for a few minutes when transferring power loads from one generator to another, only one of these three generators is providing power (termed "online") at any moment. These generator sets are normally operated and controlled from the master switchboard in the ROWPU space. For maintenance and servicing, they can be locally operated and controlled at the generator set location.

Either 155 kW SSG set supplies electrical power to the switchboard power distribution center. Power flow is then distributed from the switchboard directly to ROWPU operating equipment and to subordinate distribution panels for the auxiliary systems used in barge support. Electrical power generated by the 20 kW SAG set also flows through the switchboard power distribution center, but power from the SAG is distributed only to crew support auxiliary systems such as communications, dayroom equipment, workshop equipment, and interior lighting. When electrical power is supplied from either a shore-based facility or from another vessel, the power is received through the shore power receptacle located on the weather deck portside, from there it flows to the switchboard distribution center. Table 3-2 lists power distribution from normal electrical power supply sources.

Table 3-1. Electrical Power System Major Components

Component	Quantity/Function	Location
Switchboard	1 - Controls and distributes electrical power	ROWPU space port bulkhead aft
Shore power receptacle	1 - Receives power from outside source	Stem weatherdeck portside
SSG	2 - Provides electrical power	Voids 4 port & starboard
SAG	1 - Provides electrical power	Void 4 starboard
Power panel 1	1 - Distributes 440 Vac power	ROWPU space port bulkhead forward near door to weatherdeck
Power panel 2	1 - Distributes 440 Vac power	ROWPU space starboard bulkhead forward of sliding door
Power panel 3	1 - Distributes 220 Vac power	ROWPU space forward bulkhead
Power panel 4 (Barge 1)	1 - Distributes 440 Vac power	ROWPU space starboard bulkhead
Deck lighting panel	1 - Controls electrical power for deck lights	ROWPU space starboard bulkhead
Void lighting panel	1 - Controls electrical power for void lights	ROWPU space starboard bulkhead near dayroom door
Receptacle panel	1 - Controls electrical power to receptacles	Workshop aft bulkhead
Ground detector panel	1 - Indicates ground in 120 Vac power system	ROWPU space forward bulkhead
Emergency shutdown	1 - Shuts down electric-powered equipment or total electric power	See paragraph 3-7.9

Table 3-2. Barge Normal Electrical Power Distribution

SSG	SAG
Power generated by the 155kW SSG's, shore-based power, or power from another vessel supports the following' All ROWPU operating systems and both barge and crew support systems such as: anchor winches, bridge and bow cranes, trolley hoist, ventilating systems, exterior and interior lighting, communications, navigation lights, dayroom and workshop equipment, bilges and sanitation systems.	Power generated by the 20 kW SAG or equivalent wattage transmitted to the barge supports the following only: Crew support systems including dayroom and workshop equipment, communications, interior lighting, navigation lights, emergency battery charger, heating and air conditioning, chlorination system initial startup, ventilation, bilge pumps, and toilets

3-6.1 Watertight electrical cabling. Approved watertight electrical cabling and associated hardware is required for use in receiving or transferring electrical power between the barge and a shore-based facility or another vessel.

3-7 Operating instructions

3-7.1 Operating controls and Indicators

3-7.1.1 General. Figure 3-10 shows an overall view of switchboard. It is divided into four different types of panels: generator control panels, switchboard distribution panel, paralleling and control panel, and miscellaneous controls and indicators.

3-7.1.2 Generator control panels. Three panels (Figure 3-11) across top of switchboard (SSG 1 on left, SSG 2 in center, and SAG on right, as you face the panel) control generator sets from the switchboard.

a. VOLTMETER (V). This gauge reads voltage output from generator.
b. AMMETER (A). This gauge reads amperage output from generator.
c. FREQUENCY METER (F). This gauge reads generator output frequency.
d. VOLTMETER SWITCH (VS). This switch selects bus V1-2 on left, OFF in center, and GEN V1-2, V2-3 or V3-1 on right.
e. AMMETER SWITCH (AS). This switch selects A-3 on left, OFF in center top, A-2 in center bottom and A-1 on right.
f. GOVERNOR SPEED CONTROL (GS). This toggle switch increases governor speed by moving left for INCREASE and right for DECREASE. This switch is not connected on the SAG panel since the SAG does not have a govemor.
g. VOLTAGE REGULATOR (VR). This two-position switch sets engine to either RUN or IDLE.
h. AUTOMATIC VOLTAGE CONTROL (VAR) RHEOSTAT. This rotating switch lowers generator output voltage by turning toward LOWER (left) and raises output voltage by turning toward RAISE (right). On the SAG panel, this switch is not installed.
i. ENGINE FAILURE LIGHTS. This grouping shows four warning lights, from left to right: REVERSE POWER, OVERSPEED, LOW OIL PRESSURE and HIGH WATER TEMPERATURE. Use press-to-test technique for checking lights.
j. ENGINE CONTROL SWITCH (ECS). This toggle switch has three positions: START, STOP and REMOTE. ECS controls the engine start/stop switch (paragraph 3-19.1.1c). In run mode, engine runs at full speed, voltage regulator operates and generator circuit breaker can be dosed.

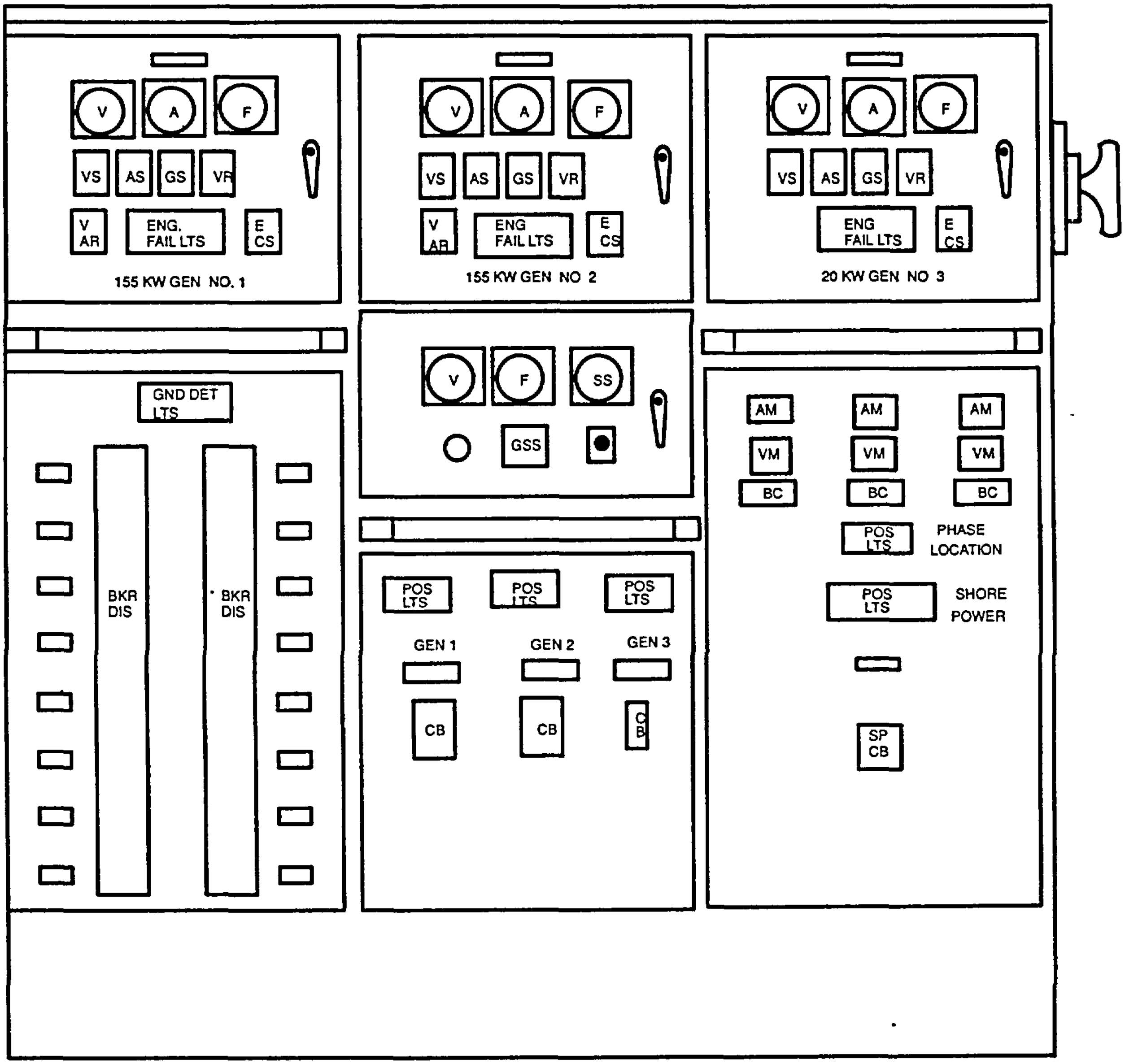


Figure 3-10. Overall View of Switchboard Control Panels

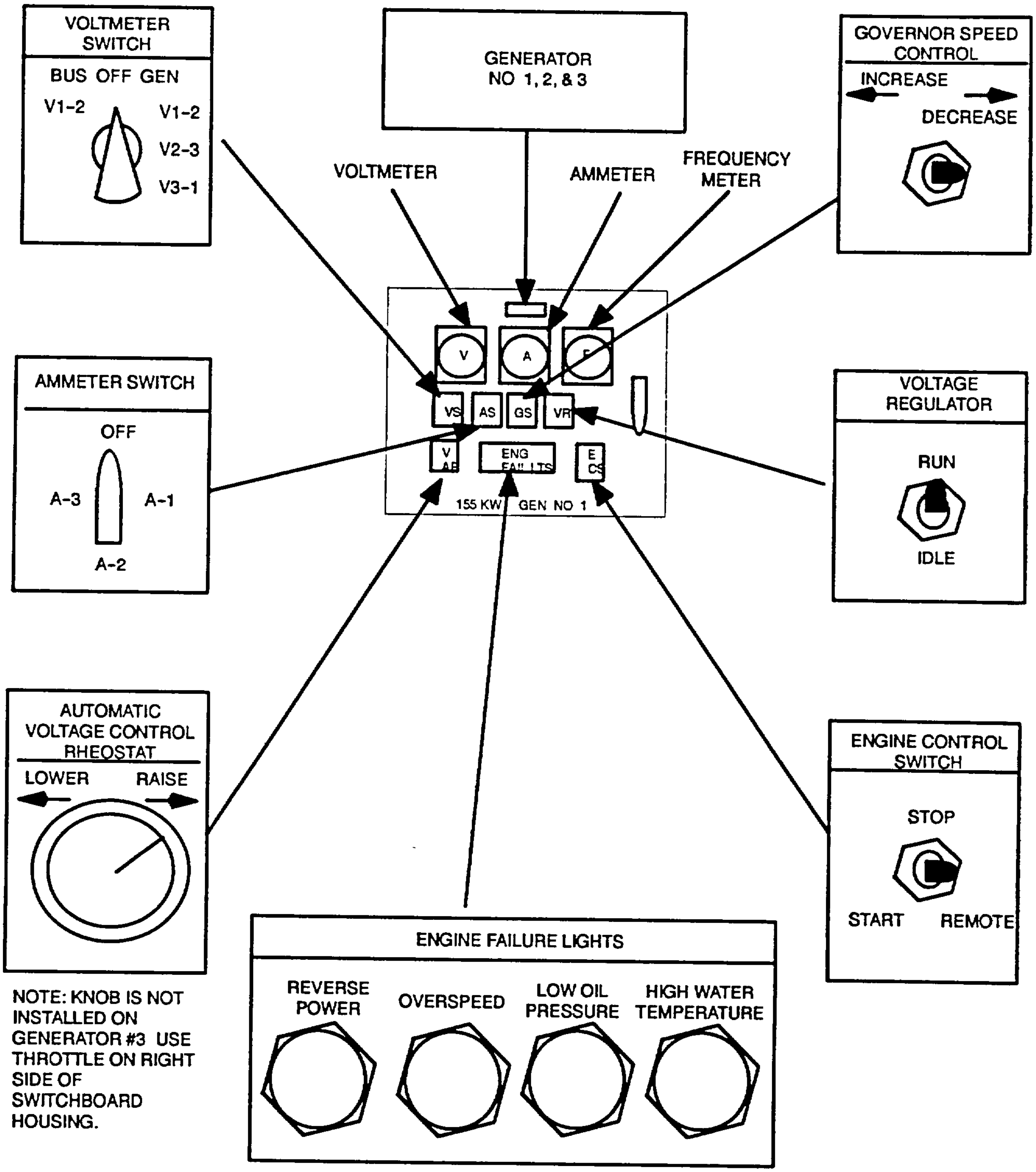


Figure 3-11. Typical Switchboard Generator Control Panel

3-7.1.3 Switchboard distribution panel. This panel (Figure 3-12 and Figure 3-13) controls two functions: fault detection panel and power distribution panel.

a. 440 volt ground fault detection. This panel shows three lights, labeled: PHASE 1, PHASE 2, and PHASE 3. A fourth light is a press-to-test method of checking these three indicator bulbs.

b. Barge 1 power distribution panel has 14 active and one spare circuit breaker, each one labeled with its function. Barges 2 and 3 distribution panels have 13 active and three spare circuit breakers, each one labeled with its function.

3-7.1.4 Paralleling and control panels. These panels (Figure 3-14) are located in center of switchboard below SSG 2 control panel. They include the following controls and indicators:

a. VOLTMETER (V). Reads incoming generator voltage selected with the INCOMING GENERATOR switch. Left gauge in top row of three gauges.

b. FREQUENCY METER. Reads generator output frequency selected with INCOMING GENERATOR switch. Center gauge in row of gauges.

c. SYNCHROSCOPE (SS). Shows synchronization between the incoming generator selected with INCOMING GENERATOR switch and the switchboard bus. Right gauge in row of gauges.

d. INCOMING GENERATOR SWITCH (IGS). Switch has four positions: OFF, GEN 1, GEN 2, and GEN 3. Switch selects which generator is being synchronized with the bus. That generator's voltage and frequency are shown on gauges above the switch. Place switch in OFF position when not being used for synchronization.

e. GENERATOR. status lights. These subpanels, just below grab rail on center portion of switchboard, show status of each generator. RUN light shows generator is running. The next two lights show generator circuit breaker position as OPEN or CLOSED. The subpanels are labeled GENERATOR 1 on the left, GENERATOR 2 in the center, and GENERATOR 3 on the right.

f. Generator circuit breakers. These circuit breakers (P1 for SSG 1, P2 for SSG 2, and P3 for SAG) connect generator output to switchboard bus and are located beneath the corresponding generator status lights. Label plates identify each circuit breaker.

3-7.1.5 Miscellaneous controls and indicators. The lower right switchboard panel (Figure 3-15) monitors the three battery chargers that maintain generator battery banks and shows status of the shore power circuit breaker. Panel indicators and controls include the following:

a. DC AMMETERS (AM) and DC VOLTMETERS (VM). These meters indicate operation of battery chargers for SSG 1, SSG 2, and SAG.
b. BATTERY CHARGER (BC) switches. This is a two-position toggle switch with FLOAT to left and EQUALIZE to right. FLOAT is the normal setting. Each switch controls battery charging for one of the three generator set diesel engines.
c. SHORE POWER status lights. These three status lights show shore power receptacle status. AVAILABLE indicates power is plugged into shore power receptacle on aft weatherdeck portside. The other two lights show if the shore power circuit breaker is OPEN or CLOSED.
d. SHORE POWER circuit breaker. Circuit breaker P4 connects shore power to switchboard bus. When this circuit breaker is dosed (ON), generator circuit breakers will NOT dose.
e. PHASE ROTATION status lights. These two status lights indicate the shore power phase rotation. The shore power breaker will not dose if the phase is not in proper sequence.

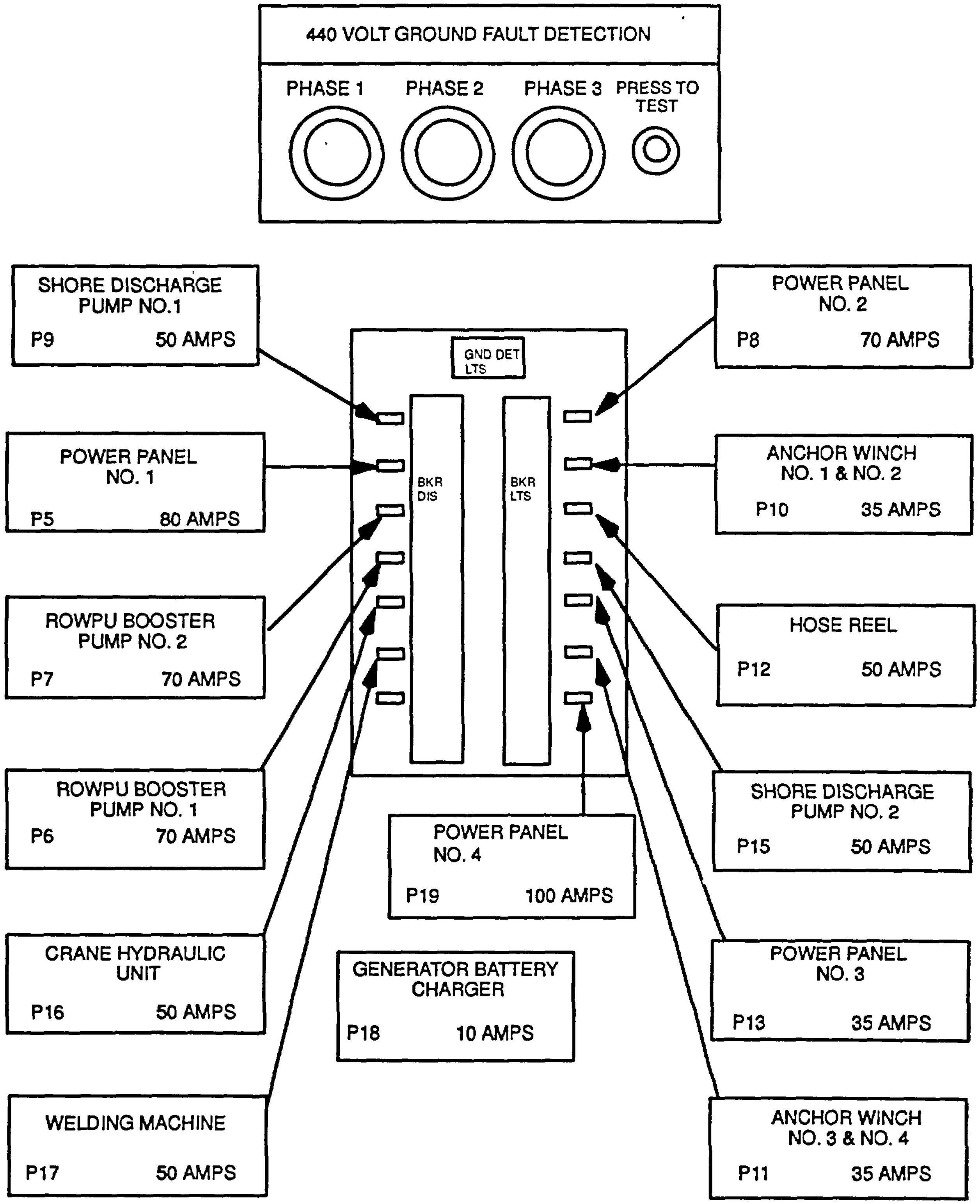


Figure 3-12. Switchboard Distribution Panel (Barge 1)

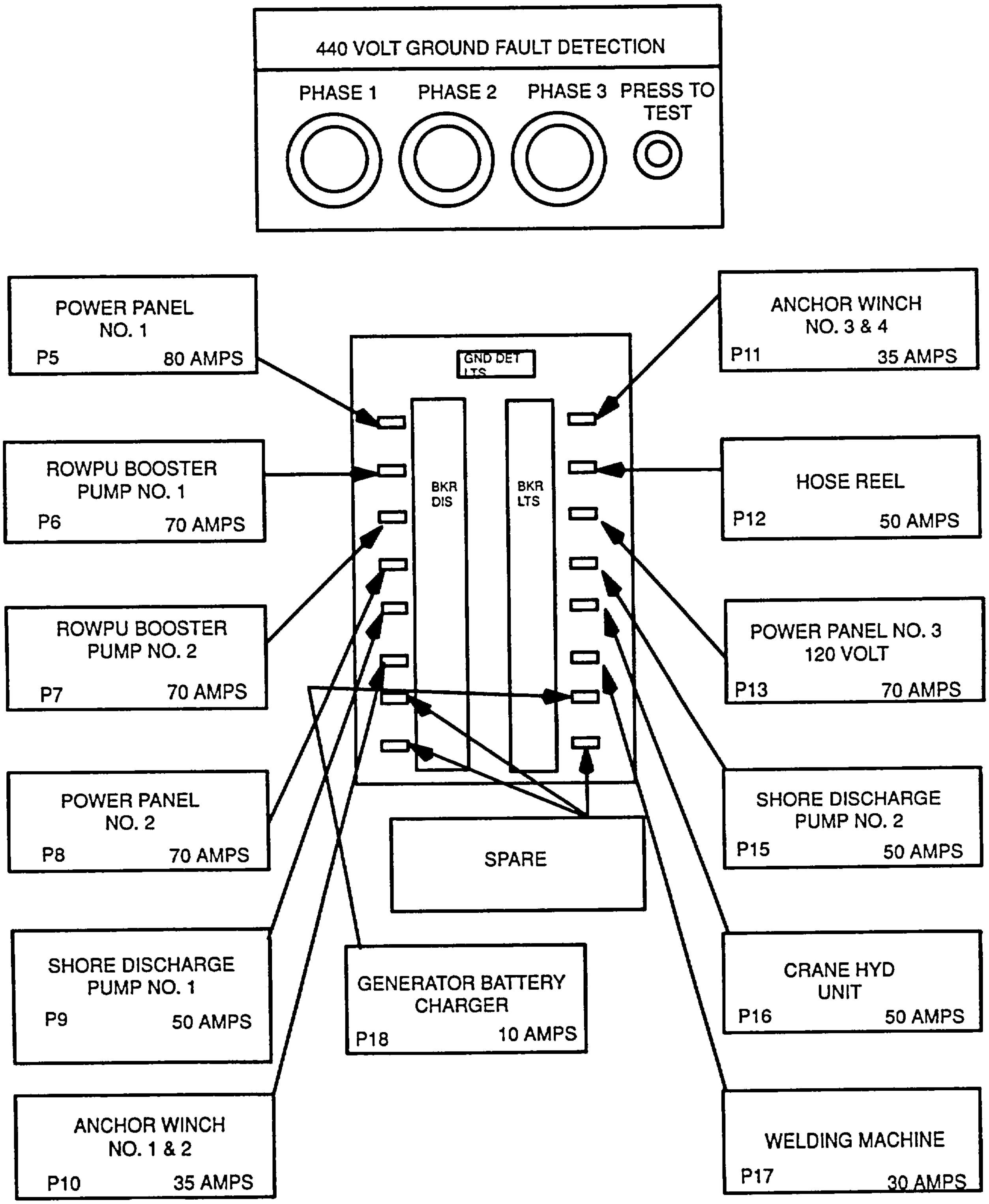


Figure 3-13. Switchboard Distribution Panel (Barges 2 and 3)

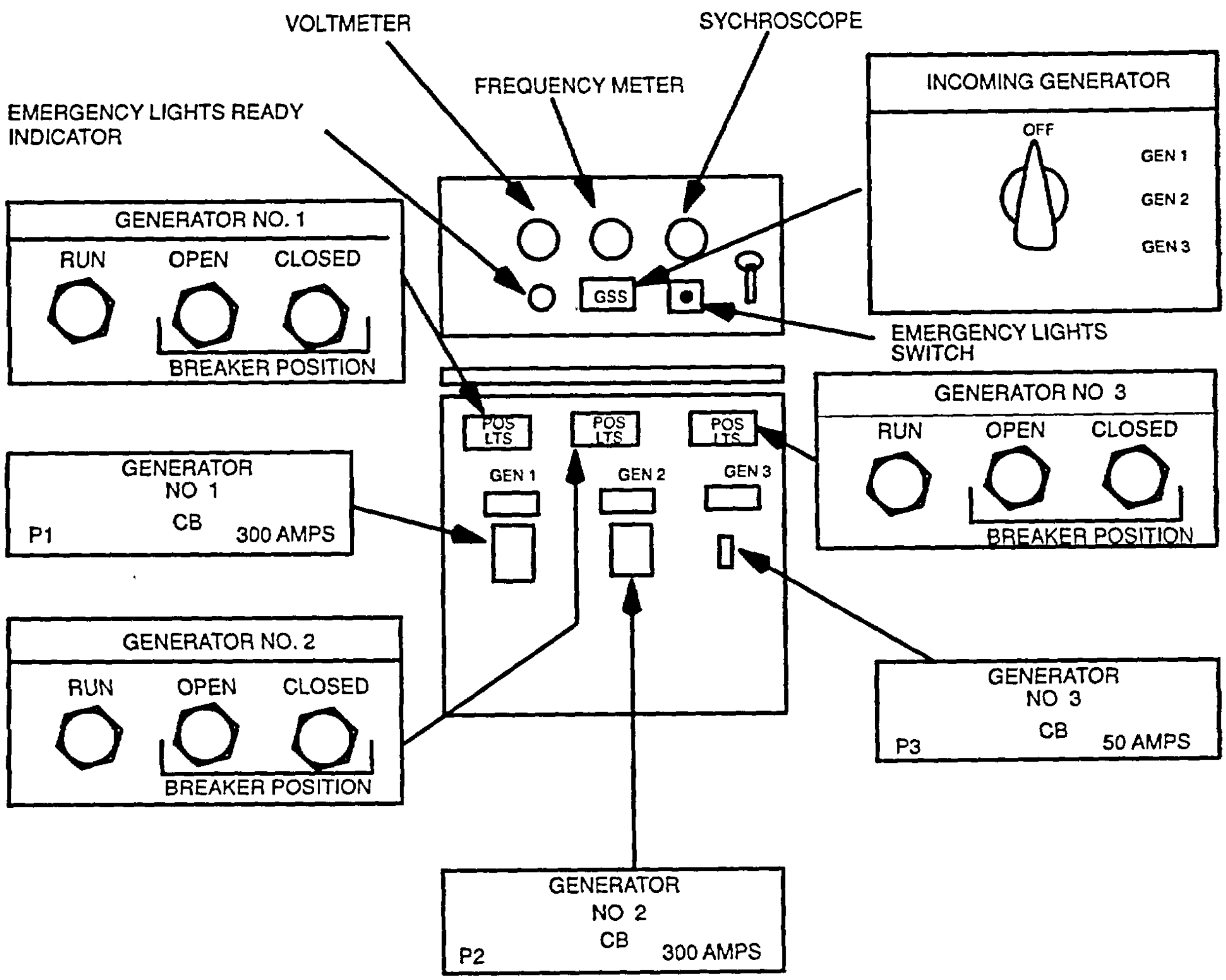


Figure 3-14. Paralleling and Control Panel

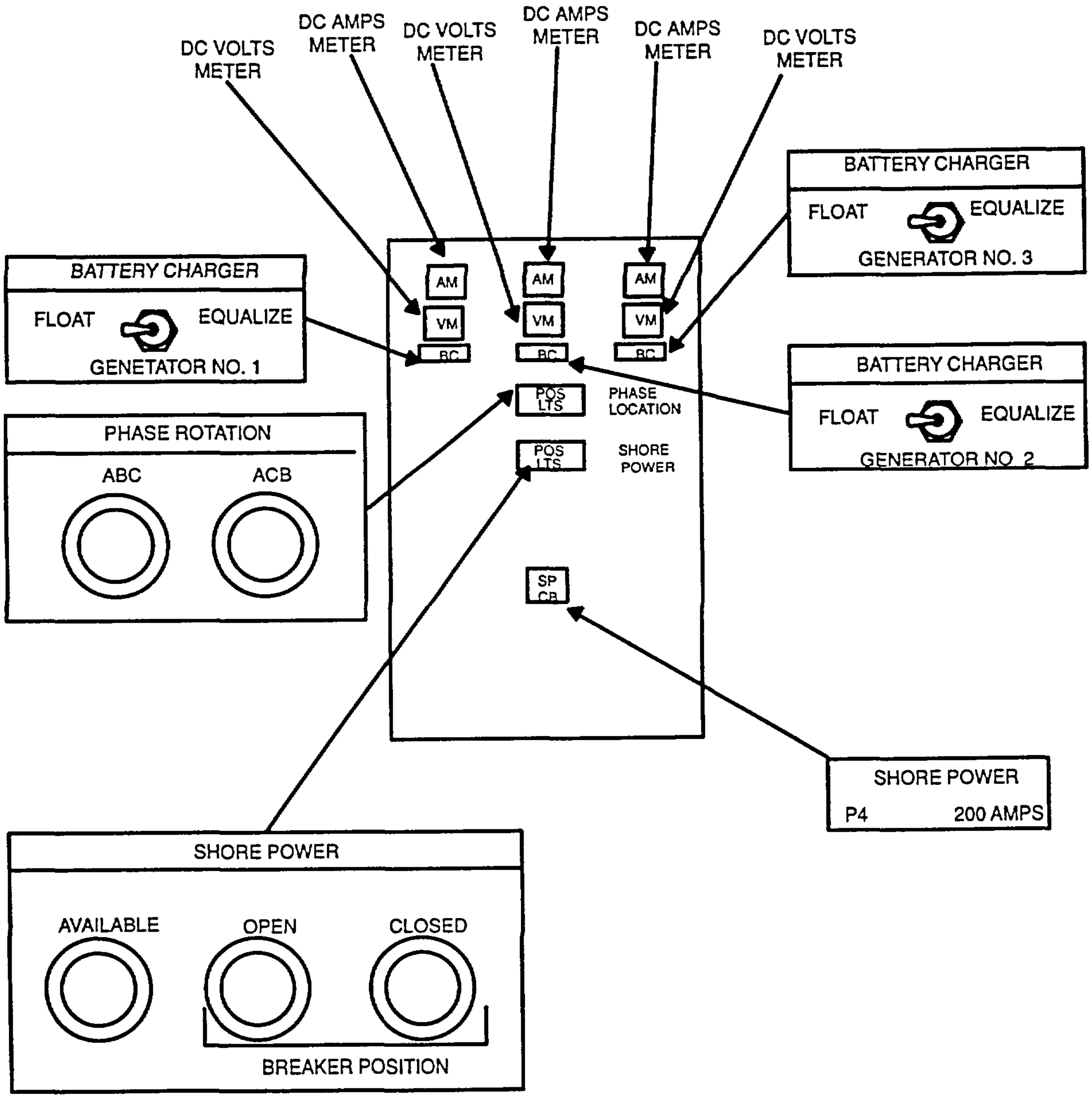


Figure 3-15. Switchboard Miscellaneous Controls and Indicators

3-7.2 Prestart procedures from switchboard

NOTE

This chapter provides procedures when operating generator sets from the switchboard. Section V and Section VI provide procedures for local operation of generator sets at engine locations in void 4.

a. Perform prestart procedures in paragraph 3-19.3 for SSG 1 or SSG 2 or paragraph 3-25.2 for SAG.
b. Check that circuit breaker for starting generator (Figure 3-14) (P1, P2 or P3) is (OFF).
c. Check that shore power circuit breaker P4 (Figure 3-15) is (OFF).
d. Check that INCOMING GENERATOR selector switch (Figure 3-14) is (OFF).
e. Check that generator VOLTAGE REGULATOR switch is on IDLE (Figure 3-11).
f. Check that ENGINE CONTROL SWITCH is STOP (Figure 3-11).
g. Check that battery charger for starting generator is set on FLOAT (Figure 3-15).
h. Make sure EMS is operating by pushing up on monitor controller left of equipment monitoring processor. If video screen does not come on, turn it on with switch beneath the screen. For more details on EMS, see TM 55-1930-209-14 & P-11.
i. Check that 24 Vdc power panel in workshop is active (Figure 3-18) and circuit breaker 8P14 is closed (ON) This procedure provides voltage to hold open solenoids in generator fuel lines. Emergency shutdown switches activate these shutoff solenoids by removing this 24 Vdc power. If 24 Vdc panel is not active and circuit breaker 8P1 4 is not dosed, these holding solenoids are dosed and fuel for these generators is shut off. The generator will start and run for about 2 minutes, and then fuel starvation will shut off engine.

CAUTION

If all power panel users are not turned off when all power sources on the barge are turned off, DC battery pack will be drained of power. Without DC power to hold the fuel cutoff solenoids open, generators will not operate to recharge the 24 Vdc battery pack.

3-7.3 Generator set alarm and shutoff systems. The SSG's and SAG have built-in alarm and shutoff systems. Alarms and emergency shutoff systems, discussed in this section, function whether SSG's are operated at the engine or at the switchboard.

3-7.3.1 Alarm systems. Three alarm switches are set at levels of coolant temperature, oil pressure, and rpm less critical than the emergency shutoff controls described in paragraph 3-7.3.2. When alarm conditions exist, three red lights in a row of four ENGINE FAILURE lights (Figure 3-11) on affected generator set switchboard panel light up. When EMS is on (TM 55-1930-209-14&P-11), these critical conditions are also made known to the crew by a blinking display on the EMS video monitor on the forward ROWPU bulkhead, by a strobe light and horn in the ROWPU space, a horn on the deckhouse top, and a buzzer in the dayroom. Alarms warn operators that an unsafe condition is developing and corrective action must be taken immediately. If action is not taken, an emergency shutoff solenoid will shut down the SSG. Alarms continue until turned off or until the unsafe condition is corrected. When the unsafe condition is corrected, switches automatically reset. The fourth alarm condition, reverse power, is discussed in paragraph 3-7.5

3-7.3.2 Shutoff systems. Four electrically operated shutoff systems function in the following manner during operation of the generators. When a critical condition exists, a switch automatically doses the circuit to the shutoff solenoid. This action stops fuel flow to the cylinders and shuts off the engine. The shutoff control either resets itself or must be reset by a crewmember before the engine restarts. These shutoff systems are discussed in Paragraphs a through c below.

CAUTION

The temperature shutoff sensing element must be submerged in coolant to operate. If coolant Is low, engine can overheat, and automatic shutoff will not function to prevent damage to engine.

a. High water temperature shutoff switch is located in the water temperature regulator housing. When the water temperature is too high, the solenoid fuel cutoff switch doses and the engine shuts off. When the engine stops, switch the ECS or ENGINE START/STOP switch to STOP. This will prevent the temperature shutoff switch from automatically restarting the engine when this switch resets after the coolant cools. Troubleshoot cooling system and repair as necessary. Restart engine by following procedures in paragraphs 3-7.2 and 3-7.4.

b. Low oil pressure shutoff switch is on the side of engine with oil lines connecting to the switch. When the engine oil pressure is too low, the solenoid fuel cutoff switch closes and shuts off the engine. When engine stops, switch the ECS on ENGINE START/STOP switch to STOP. Troubleshoot lubricating system and repair as necessary. Before restarting engine, reset oil pressure shutoff switch by pushing reset button until it latches. After engine starts and develops oil pressure, pressure will push reset button to extended position. If button remains in reset position, engine is not developing normal oil pressure. Troubleshoot and correct as necessary. Restart engine by following procedures in paragraphs 3-7.2 and 3-7.4.

CAUTION

If the oil pressure shutoff switch reset button does not move to extended position after engine is running, the shutoff switch Is not protecting the engine from low oil pressure and may damage the engine.

c. Electronic overspeed shutoff switch protects the engine as follows:

CAUTION

- **Sudden stopping of engine under load may be hazardous to systems in operation being powered by an online generator set**

- **If engine overspeeds, stop It Immediately to prevent a runaway engine from destroying Itself.**

(1) The electronic overspeed shutoff switch uses a magnetic pickup mounted in the flywheel housing to sense engine speed. When the engine overspeeds, the magnetic pickup doses the circuit to the fuel shutoff solenoid and stops the engine. When the engine stops, turn the ECS on ENGINE START/STOP switch to STOP. Troubleshoot and repair as necessary. Reset over speed shutoff switch, either on engine overspeed panel or on switchboard SSG panel. Restart engine by following procedures in paragraphs 3-7.2 and 3-7.4.

(2) The overspeed sensing device has a second sensing circuit that prevents the starter pinion from remaining engaged in the flywheel at excessive rpm. After starter has cranked the engine, pinion gear may remain engaged in flywheel as engine speed increases. At 600 rpm, the magnetic sensing device opens a circuit to the starter and disengages pinion. This circuit remains open until flywheel stops. The open circuit prevents starter from energizing while flywheel is turning. This safety device does not require resetting.

3-7.4 Operating procedures from switchboard. Starting procedures for the engines are in paragraph 3-19.3 for SSG's and 3-25.3 for SAG. Operating procedures using shore power are in paragraph 3-7.6

a. Turn ENGINE CONTROL SWITCH (Figure 3-11) to START. Engine will crank and run.

b. Allow engine to idle for 2 minutes.

c. Monitor the following:

   (1) ENGINE FAILURE LIGHTS do not light (Figure 3-11).

   (2) Battery charger ammeter DC AMPS and DC VOLTS meters (Figure 3-15) indicate ammeter is charging batteries.

   (3) 440 VOLT GROUND DETECTION lights do not light (Figure 3-12 or 3-13).

d. Turn VOLTAGE REGULATOR switch to RUN (Figure 3-11).

e. Wait 1 minute for engine to stabilize.

f. Monitor items listed in step c above.

g. Using AUTOMATIC VOLTAGE CONTROL RHEOSTAT, set generator voltage to 450 V.

h. Set generator frequency to 60 Hz.

   (1) On SSG 1 or SSG2, use GOVERNOR SPEED CONTROL toggle switch (Figure 3-11). Move it left to increase frequency and right to decrease frequency.

   (2) On SAG, GOVERNOR SPEED CONTROL toggle switch is not connected (Figure 3-11). Set SAG generator frequency by adjusting throttle on right side of switchboard. Turn throttle knob clockwise to increase frequency and counterclockwise to decrease frequency.

i. Check ENGINE FAILURE LIGHTS (Figure 3-11) by pressing-to-test. Lights should light when pushed in. If not, make note of bulbs to be changed when that generator is offline.

CAUTION

If this is first generator to be started and placed online, proceed with steps thru m. If another generator Is currently providing power, follow procedures in paragraph 3-7.5

j. When the values in steps g and h are stable, close appropriate switchboard circuit breaker (Figure 3-14) to provide generator output to switchboard bus:

P3 for SAG
P2 for SSG 2
P1 for SSG 1

k. Make sure switchboard GENERATOR status lights (Figure 3-14) for operating generator indicate it is running and its circuit breaker is dosed.

CAUTION

With only SAG online, do NOT close circuit breakers P6, P7, P9, P12, or P15. These circuit breakers engage power requirements beyond SAG's capacity. When these circuits are necessary, start one of the SSG's, transfer load to SSG (paragraph 3-7.5), and shut down SAG.

l. Apply load by dosing (ON), as required, switchboard circuit breakers P5 thru P13 and P15 thru P18 (Figure 3-13) one at a time.

m. Close (ON) circuit breaker P8 (Figure 3-12) to provide power to power panel 2. Start void(s) 4 port and/or starboard exhaust fans to provide ventilation in generator area. Close (ON) circuit breaker 9P8 for void 4 starboard ventilation and circuit breaker 10P8 for void 4 port ventilation (Figure 3-4).

3-7.5 Paralleling generators and transferring load

NOTE

These procedures can be done only while operating generators from switchboard.

a. Start new generator by following procedures in paragraphs 3-7.2 and 3-7.3, steps a thru i.

b. Using AUTOMATIC VOLTAGE CONTROL RHEOSTAT (Figure 3-11), adjust voltage on new generator to a value slightly higher than online generator.

c. Switch INCOMING GENERATOR switch (Figure 3-14) to indicate incoming generator. This action allows SYNCHROSCOPE to indicate frequency of incoming generator.

d. Using GOVERNOR SPEED CONTROL switch (Figure 3-11), adjust frequency of new generator rotation so SYNCHROSCOPE (Figure 3-14) either stops at the 12 o'clock position or turns very slowly in clockwise direction.

e. If synchroscope pointer cannot be stopped at the 12 o'clock position, allow synchroscope to run slowly through several complete rotations before performing step f below.

CAUTION

Before paralleling generators, notify crewmembers NOT to make any electrical power changes such as turning any electrical motors on or off. Sudden power surges while paralleling may cause a reverse power situation on one generator and may damage that generator.

f. Quickly and forcibly engage new generator circuit breaker (P1, P2, P3) (Figure 3-14) as synchroscope pointer is stopped at 12 o'clock position or as it slowly passes through 11 o'clock position on synchroscope dial.

NOTE

If Incoming generator does not electrically match switchboard bus powered by online generator, circuit breaker will forcibly bounce back to open. When this happens, return to procedures in step 3-7.5b and try again.

g. Turn SYNCHROSCOPE off by turning INCOMING GENERATOR switch to OFF (Figure 3-14).

CAUTION

Reverse power can occur when two generators are running in parallel. A generator may not accept a load, usually because Its unloaded running speed is less than the other generator (called speed droop). The other generator will motorize, or reverse power, the drooping generator. This situation creates an undue load on the powering generator and may damage the reverse powered generator.

h. Transfer load from off going generator to oncoming generator by using AUTOMATIC VOLTAGE CONTROL RHEOSTAT controls (Figure 3-11). Simultaneously increase load on oncoming generator by turning control clockwise and decrease load of off going generator by turning control counterclockwise.

i. Once off going generator load has been reduced to a minimum, open that generator's circuit breaker connecting it to switchboard bus.

3-7.5.1 Correcting reverse power situation. If reverse power situation develops, reverse power indicator light for that generator comes on and a safety relay immediately shuts down that generator. a Immediately go through shutdown procedures, paragraph 3-17, for generator set that has been shut down by safety relay.

b. Allow loaded generator about 10 seconds to stabilize.
c. Adjust generator voltage to 450 V, if necessary, by using AUTOMATIC VOLTAGE CONTROL RHEOSTAT control (Figure 3-11).
d. Adjust generator frequency to 60 Hz, if necessary, by using GOVERNOR SPEED CONTROL switch.
e. Start the shutdown generator by following procedures in paragraphs 3-7.2 and 3-7.4.
f. Parallel generators according to paragraph 3-7.5 and try load transfer again.

3-7.6 Operating procedures using shore power. Shore power, if available from an onshore power source or another vessel, is connected to shore power receptacle on aft weatherdeck bulkhead portside.

a. Verify that shore power is 440 Vac, 60 Hz, 3 ph. If power does not match this requirement, switchboard circuit breaker P4 (Figure 3-15), connecting shore power to switchboard bus, will not dose.
b. Verify that all loading circuit breakers (Figure 3-12 or 3-13) on switchboard are open (OFF). Electrically, a dead ship condition must exist prior to engaging shore power circuit breaker.
c. Verify that switchboard circuit breakers for generators (P1 for SSG 1, P2 for SSG 2, and P3 for SAG) (Figure 3-14) are open (OFF).
d. On switchboard panel, dose (ON) circuit breaker P4 (Figure 3-15).
e. Apply load as required by dosing circuit breakers on switchboard panel.

3-7.7 Operating other electrical panels and controls. Electrical panels and controls, other than those on the switchboard, are self-explanatory and labels show their function. Instructions on when to use these controls are included in chapters covering the affected systems.

CAUTION

Circuit breakers on electrical panels should not be used as switches. All electrical devices onboard have switches, control boxes, and/or starters that provide normal control. Circuit breakers should be used only when safety requirements dictate that a circuit be totally Inactive or when that system is being placed in storage.

3-7.8 Normal shutdown procedures from switchboard. Procedures for shutting down these generator sets from the engine locations are in paragraphs 3-19.6.1 for SSG's and 3-25.5.1 for SAG.

a. Offload generator either by paralleling and transferring load to another generator or by opening all switchboard circuit breakers. When this has been completed, check that generator has stabilized.
b. Open (OFF) appropriate switchboard circuit breaker (Figure 3-14) connecting that generator to switchboard bus:

   P1 for SSG 1
   P2 for SSG 2
   P3 for SAG

c. Turn VOLTAGE REGULATOR IDLE/RUN switch (Figure 3-11) to IDLE.

d. Allow engine to idle for 5 minutes to cool.
e. Turn ENGINE CONTROL SWITCH (Figure 3-11) to STOP.

3-7.9 Emergency shutdown

3-7.9.1 General. The barge has two emergency shutdown modes. One mode shuts down individual systems such as the ventilation system or a diesel high pressure pump and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power Is shut off to all operating systems.

Seven emergency system shutdown red buttons are located on the ROWPU space starboard bulkhead just aft of the personnel door. These shutoff buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG 1, SSG 2.

Emergency total shutdown red buttons are:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of row of system emergency shutoff buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

3-7.9.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.
b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.
c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

Section III. Emergency electrical system

3-8 Description

3-8.1 The emergency electrical system provides a limited amount of 120 Vac and 24 Vdc power for selected essential lighting and power requirements.

3-8.2 This system's central unit is a battery bank on the deckhouse top that is maintained at full charge by a battery charger in the workshop. The charger receives Its power from the normal electrical system.

3-8.3 When normal power is disrupted, the battery bank provides 24 Vdc to an Inverter. The inverter converts the 24 Vdc power to 120 Vac, which is supplied to the 120 Vac emergency lighting panel. In addition, this battery bank provides continuous 24 Vdc power directly to a DC power panel.

3-8.4 Components of this system are listed in Table 3-3 A diagram of emergency electrical system operations is shown in figure 3-17. Equipment specifications, maintenance information and manufacturer's service manuals are contained in TM 55-1930-209-14&P-9

Table 3-3. Major Components of Emergency Electrical System

Component	Location	Function
24 Vdc battery charger	Workshop	Keeps battery bank charged
DC-AC standby inverter	Workshop	Converts 24 Vdc from batteries to 120 Vac for emergency lighting panel
Battery bank	Deckhouse top forward	Provides 24 Vdc to DC power panel and to input side of Inverter
24 Vdc power panel	Workshop	Provides 24 Vdc power for Army radio and telephone system, foghorn, bilge alarm module, emergency shutdown system, and navigation and status lights
120 Vac emergency lighting panel	ROWPU space forward bulkhead	Provides power to emergency lights in deckhouse and voids, marine radio and telephone buzzer system

3-9 Capabilities. This system automatically provides 120 Vac power for emergency lighting in the ROWPU space and voids and 24 Vdc power for direct current equipment.

3-10 Special limitations. The battery bank, under optimum conditions, provides only 305 ampere hours of electrical power. This equates to about 5 hours of operating lights and equipment connected to the 120 Vac emergency lighting panel and/or very limited use of equipment powered from the 24 Vdc power panel.

3-11 Performance characteristics. Battery charger:

AC input	120 Vac
DC output	24 Vdc

3-12 Description of operation.

3-12.1 Normal operations. During normal operating conditions, when electrical power is available from either onboard generators or shore power, circuit breaker 13P13 on power panel 3 (120 Vac) (Figure 3-5) provides power to the battery charger. Charger, located in workshop, keeps battery bank on deckhouse top at full charge. Circuit breaker 10P13, using normal power, provides a holding voltage to one side of inverter to keep Inverter inoperative in normal operating mode. This circuit breaker also provides 120 Vac to emergency lighting panel. During normal operating conditions, the battery bank provides 24 Vdc to the other side of inverter. It also provides 24 Vdc to DC power panel for operating army radio, telephone system, bilge alarm module, emergency shutdown system, and navigation and status lights

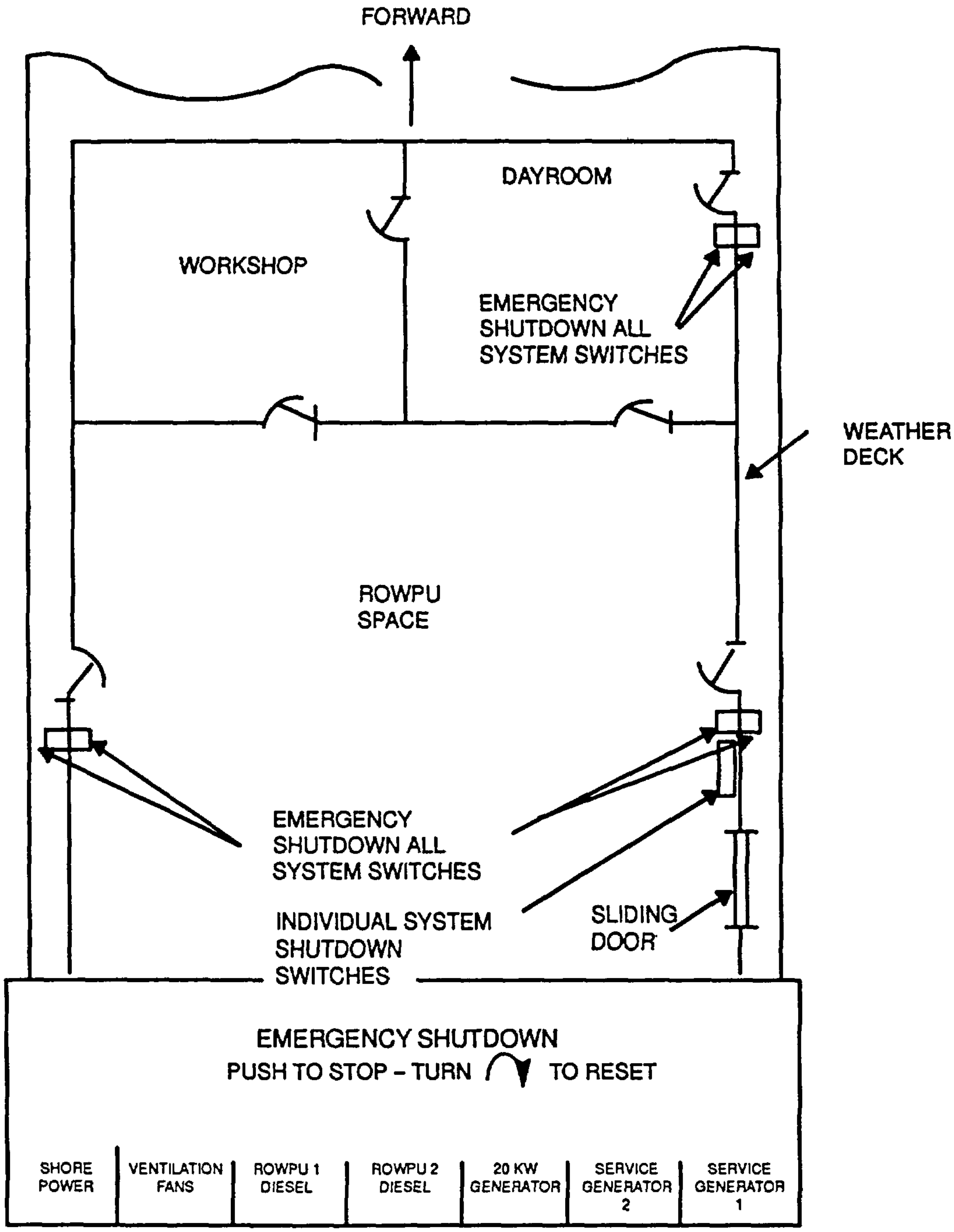


Figure 3-16. Location of Controls for Emergency Shutdown Systems

3-12.2 Emergency operations. When normal electrical sources fail (or when circuit breaker 10P13 is open), holding voltage on output side of inverter drops out. Inverter becomes active with 24 Vdc coming from battery bank and 120 Vac going to emergency lighting panel. This panel provides power to fluorescent lights in deckhouse and voids, marine radio, and telephone station buzzers. Battery bank continues to supply 24 Vdc electricity to DC panel in workshop for operating circuits listed in previous paragraph. If battery bank is at full charge, it provides emergency electricity, depending upon power load, for about 5 hours.

3-12.3 Restoration of normal source of electricity. When normal power is restored, 120 Vac electricity flows to output side of inverter. Inverter ceases to operate, and 120 Vac, from normal power source, provides power directly to emergency lighting panel. The 120 Vac also flows to battery charger, which recharges battery bank Battery bank continues to provide 24 Vdc to DC power panel.

Section IV. Operating instructions

3-13 Operating controls and Indicators.

a. The 24 Vdc power panel in workshop contains eight circuit breakers and one fused circuit (Figure 3-18).
b. Emergency lighting panel, in ROWPU space on forward bulkhead, contains eight circuit breakers (Figure 3-19).
c. Battery charger in workshop (Figure 3-20) has HIGH/FLOAT switch on panel. HIGH setting activates fast charging circuit in charger. FLOAT setting activates slower charging circuit than HIGH setting and maintains charge in battery at all times. FLOAT is normal setting. When activating system after a shutdown of more than 3 days, set on HIGH for not more than 24 hours.
d. Battery charger panel displays a DC ammeter and DC voltmeter(Figure 3-20) that indicate charging rate and battery status.
e. Battery charger panel has ON/OFF switch that turns charger on or off.
f. Battery charger panel has RESET button. When pressed, it resets internal circuit breakers on AC input and DC output circuits. Prior to resetting, troubleshoot emergency system to determine why circuit breakers were tripped.
g. Inverter in workshop has ON/OFF switch that turns inverter on or off.

3-13.1 Prestart checks. Before energizing emergency electrical system, perform the following before operation preventive maintenance services:

WARNING

Fumes from batteries may be flammable and explosive. Do NOT smoke or have open flame when checking or working on battery bank.

a. Check batteries (Figure 3-21) for proper electrolyte level. Add distilled water or dean water to bring level above the plates.

WARNING

Battery electrolyte presents potential health hazards. Contact with eyes and skin should be avoided. Safety glasses, gloves, and rubber aprons must be worn when handling this chemical. Electrolyte contains sulfuric acid, which can cause severe bums, and is highly toxic to skin, eyes, and respiratory system.

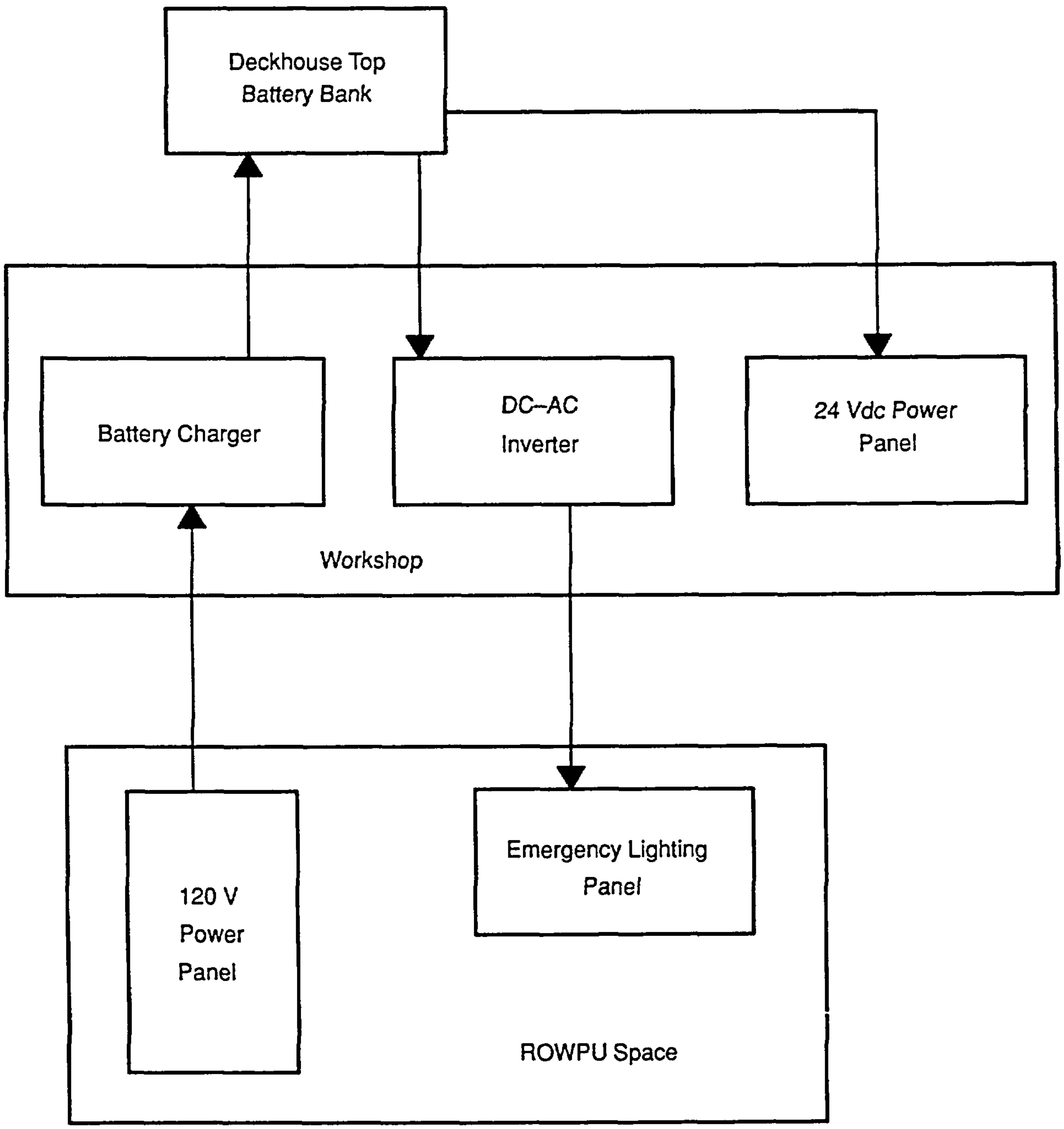
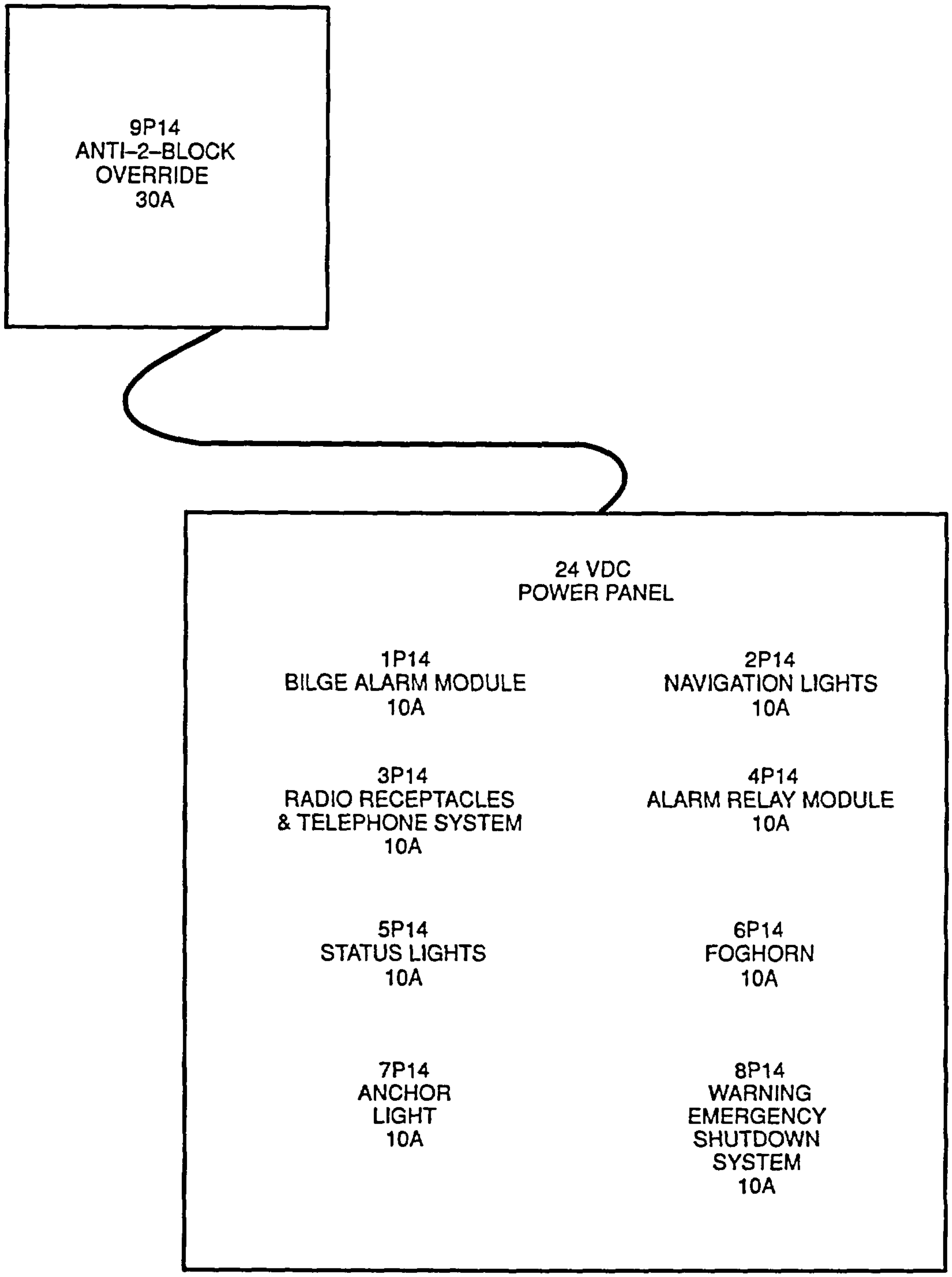


Figure 3-17. Emergency Electrical System Diagram



LOCATION IN WORKSHOP ON AFT BULKHEAD

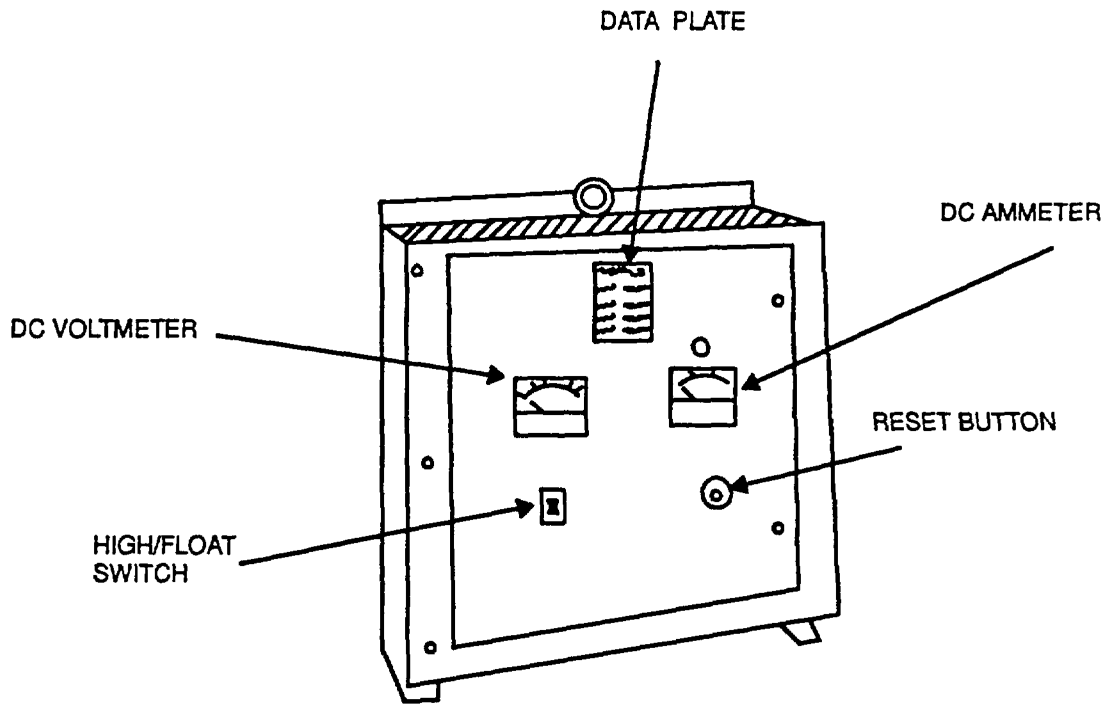
Figure 3-18. 24 Vdc Power Panel

EMERGENCY LIGHTING PANEL
120 VAC, 60HZ

10P13A-2 WORKSHOP, DAYROOM WHITE LIGHTS 10A	10P13A-1 ROWPU SPACE WHITE LIGHTS 10A
10P13A-4 WORKSHOP, DAYROOM RED LIGHTS 10A	10P13A-3 ROWPU SPACE RED LIGHTS 10A
10P13A-6 VOIDS 3, 4 AND 5 WHITE LIGHTS 10A	10P13A-5 VOIDS I AND 2 WHITE LIGHTS 10A
10P13A-8 MARINE RADIO 10A	10P13A-7 STATION BUZZER 10A

LOCATED IN ROWPU SPACE ON FORWARD BULKHEAD NEAR POWER PANEL 3.

Figure 3-19. Emergency Lighting Panel



Receives power from 120 Vac Power Panel In ROWPU space and charges battery in battery box on port forward comer of deckhouse top.

Figure 3-20. Battery Charger

b. Check that battery bank is secure and that electrical cable fittings are tight and coated with anticorrosion grease. Correct as necessary.

c. Check major components (inverter, battery charger, battery bank, 120 Vac emergency panel, and DC panel) for damage and loose fittings or wires. Correct as necessary.

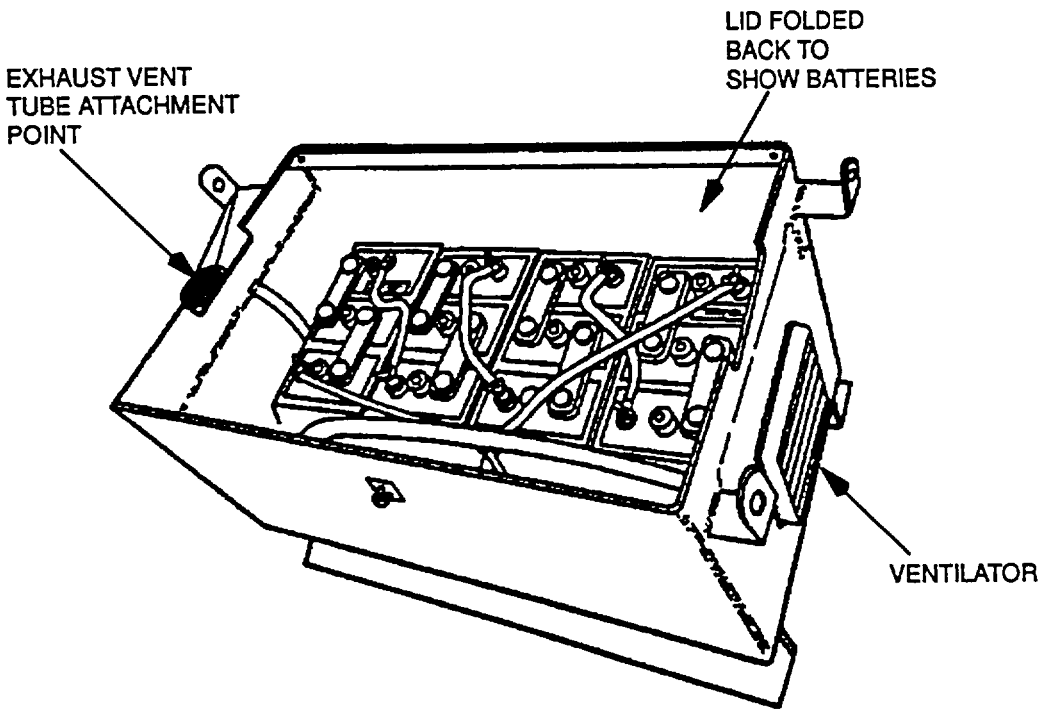
d. Clean major components as necessary.

e. Make sure that inverter switch is OFF.

f. Make sure all circuit breakers on 120 Vac emergency panel and 24 Vdc panel are open.

3-13.2 Normal operating procedures

a. Make sure switchboard circuit breaker P13 is dosed (ON) to provide power to power panel 3 (120 Vac).



Provides 24 Vdc from four 6-volt batteries in steel box on port forward corner of deckhouse top.

Figure 3-21. Battery Bank

b. On power panel 3 (120 Vac), dose (ON) fuse box 13P13 to provide power to battery charger.

c. On battery charger, set HIGH/FLOAT switch in FLOAT position for normal charging or in HIGH position for rapid recharging of battery bank.

CAUTION

Do not allow battery charger to operate on HIGH setting for more than 24 hours.

d. On power panel 3 (120 Vac), dose (ON) circuit breaker 10P13 to provide holding voltage to inverter and 120 Vac power to emergency lighting panel.

e. On inverter, move ON/OFF switch to ON position to place inverter in active standby.

f. On DC power panel in workshop, close appropriate circuit breakers and fused circuits as required for operations:

1P14 Bilge alarm module
2P14 Navigation lights
3P14 Radio receptacles and telephone system
4P14 Alarm relay
5P14 Status lights
6P14 Foghorn
7P14 Anchor light
8P14 Warning emergency shutdown system
9P14 Anti 2-block override

NOTE

DC power panel circuit breaker 8P14 must be closed prior to starting any diesel engines onboard. If not closed, solenoids In emergency shutdown system cut off fuel to diesels. Engine will start and run for a few minutes until lack of fuel shuts It off.

3-13.3 Emergency operating procedures. When normal power fails, 120 Vac power being supplied through circuit breaker 10P1 3 to the inverter is cut off. The inverterdraws power from the battery bank, converts it to 120 Vac, and supplies it to the emergency power panel.

a. Check circuit breakers 10P13A-1 thru 10P13A-6 on 120 V emergency lighting panel on ROWPU space forward bulkhead. Open (OFF) any of them not required for emergency lighting. These circuit breakers normally remain closed so that emergency lights are activated immediately when normal lighting is cut off. Make sure that 10P13A-7 and A-8 for telephone system buzzers and VHF marine radio are closed (ON).

b. While operating on emergency power, turn off any unnecessary power usage.

NOTE

Workshop Items drawing power from 24 Vdc panel are not Immediately affected by changing from normal to emergency power. If not turned off, however, they will deplete the limited supply of electrical power available from the battery bank.

c. While operating on emergency power, check system to make sure it is operating properly. Inverter may become warm to touch with the open hand but should not become hot.

3-13.4 Return to normal power source. When normal power becomes available, holding voltage will be returned to one side of inverter. Inverter reverts to active standby and normal 120 Vac is again supplied to emergency lighting panel. The 24 Vdc being supplied from the battery bank to the DC panel in the workshop continues without change.

a. Check battery charger instruments to verify that battery bank is being recharged.

b. Check that marine radio and telephone station buzzer system are working properly.

3-13.5 Shutdown procedures

3-13.5.1 Normal shutdown procedures. When all electrical power is to be terminated and emergency system is not needed, shutdown as follows:

a. On DC panel, open (ON) circuit breakers 1P14 thru 8P14 and fused circuit 9P14 (Figure 3-18).
b. On emergency lighting panel, verify that circuit breakers 10P13A-1 thru 10P13A-8 (Figure 3-19) are open (OFF).
c. On inverter, turn ON/OFF switch to OFF.
d. On battery charger, turn to OFF (Figure 3-20).
e. On power panel 3 (120 Vac) open (OFF) circuit breaker 10P13 (Figure 3-5).

WARNING

Fumes from battery electrolyte may be flammable and explosive. Do NOT smoke or have open flames when checking electrolyte or working on batteries.

f. Check batteries in battery bank and make sure electrolyte is above plates in each cell of each battery.

g. Clean all major components of system. See TM 55-1930-209-14 & P-9, Electrical Power Systems.

3-13.5.2 Emergency shutdown procedures. Operating either system shutdown or total shutdown buttons does not affect the emergency power system.

Section V. 155 kW ship service generators,

3-14 Description. Two diesel powered generator sets, each rated at 155 kW, serve as primary electrical power sources for the barge. When shore power is not used, one SSG must be online when any of the ROWPU major systems are being operated. These SSG's, number 1 in void 4 port and number 2 in void 4 starboard, are Caterpillar diesel engine driven generator sets. Each SSG consists of a Caterpillar 3306TA diesel engine and a Caterpillar Model SR4 generator mounted, with isolation isolators, on a common base. The set weighs 3960 pounds dry and 4180 pounds wet and is 118 inches long, 39 inches wide, and 59 inches high. The third generator set, rated at 20 kW, supplies power for the barge when ROWPU major systems are not operating and there is a lower demand for electrical power. Information on the SAG is in Section VI. Generator set installation and electrical hookups are shown on drawings listed in TM 55-1930-209-14 & P-9.

3-14.1 3306TA diesel engine. This engine is a 6-cylinder inline, 638-cubic inch displacement, four-stroke cycle diesel. Turbo charged and after cooled, it provides its maximum output at 1800 rpm. It has a 24 Vdc electric starter and battery bank. A battery charger mounted in the switchboard keeps the SSG batteries charged. A heat exchanger provides seawater cooling for both engine coolant and engine lubricating oil. Instrumentation includes an engine service meter calibrated in hours and protective cutoffs that activate in the event engine coolant temperature or oil pressure exceed maximum allowable limits.

3-14.2 SR4 generator. This generator has a revolving field and is statistically regulated with a rotating brushless exciter. It has no brushes or commutator and uses a solid-state automatic voltage regulator. For a more detailed technical description, refer to manufacturers' manuals listed in Section VI of TM 55-1930-209-14&P-9.

3-15 Capabilities. Either SSG is capable of providing all electrical power for barge operations. For load transfer purposes only, SSG's can be operated in parallel with each other or either one can be operated in parallel with the auxiliary generator. When properly operated and maintained, these SSG's are rated for "prime power-continuous operation." With full barge fuel tanks, the SSG's can operate nonstop for 7 days. The supply of other consumables used by the electrical power system, such as lubricating oil, will last 30 days.

3-16 Special limitations.

3-16.1 The SSG's consume fuel at about 12.7 gph at 100 percent of power at 1800 rpm and as low as 4.2 gph at 25 percent of power at the same rpm.

3-16.2 SSG's will not operate in parallel with an external power source.

3-16.3 SSG's are designed to operate at ambient temperatures of -22 to 122°F.

3-17 Performance characteristics. The voltage level can be adjusted within ±5 percent of rated voltage Voltage droop is adjustable for proper division of reactive kVA when operating in parallel with other generators Voltage gain is adjustable to compensate for engine speed variation when operating with a speed droop governor. Full load rpm is 1800, low idle is 1200 rpm. Electrical output characteristics at an 0.8 power factor are listed.

kW	155
kVA	193 75
Voltage	440 Vac
Current	255 amps
Phase	3
Hertz	60

3-18 Description of operation. Normal electrical power for barge operations is supplied by one of the two SSG's. By transferring loads between generator sets, barge operations can continue without interruption. While any two of the three generators onboard can be operated In parallel, this procedure is for load transfer only and not for continuous operation. To transfer the electrical load from one generator to another, start the unused generator. After warmup, parallel its load with the current loaded generator and transfer the load (paragraph 2-14, Vol. 9) Run down, cool off, and shut down the now unused generator. This paralleling and transferring of electrical load can be done between the 20 kW auxiliary generator and either of the two SSG's or between SSG's.

3-18.1 Remote control and startup requirements. While the three generator sets are located in voids 4, they are normally operated from the switchboard in the ROWPU space. Normally, one of the first actions upon entering the barge is to start the auxiliary (20 kW) generator to provide power for barge housekeeping activities This generator does not provide sufficient power to support operation of major ROWPU components, however, so prior to starting a major ROWPU component, one of the SSG's must be brought online. Start an SSG, parallel it with the SAG, and transfer the load to the SSG. Then shut down the SAG

3-19 Operating controls and indicators.

3-19.1 3306TA diesel engine

3-19.1.1 Controls for operating engine at the SSG

a. ENGINE CONTROL switch. This switch on SSG switchboard panel has START, REMOTE, and OFF/RESET positions. To start engine from switchboard, move ECS to START and engine will automatically crank and run. To start engine at the engine, move ECS on switchboard to REMOTE and use engine START/STOP switch on the engine. To stop engine from switchboard, move ECS to OFF/RESET.

b. VOLTAGE REGULATOR switch. Located on switchboard. IDLE position allows engine to run at low speed for warmup and maintenance checks. RUN position allows engine to run at full speed of 1800 rpm While set on IDLE, generator's circuit breaker connecting its power to the switchboard bus will not close.

c. ENGINE START/STOP switch. Located on engine. ENGINE CONTROL SWITCH on switchboard must be in REMOTE for this switch to start the engine Push switch up to start engine. Push switch down to stop engine. When stopping engine, ENGINE CONTROL SWITCH may be in any position.

d. EMERGENCY STOP button. Located on engine. Push to stop engine. Resetting this button will start engine cranking and running unless ENGINE CONTROL SWITCH is set to OFF.

e. Seawater valves control flow of cooling seawater to SSG 1 and SSG 2 to cool engine coolant and lubricating oil. These valves must be open for engines to operate.
   (1) Seawater valve SW37. Located in void 4 port next to seawater strainer. When open, provides water from seawater strainer to manifold piping, which provides cooling seawater to all generators In voids 4.
   (2) Seawater valve SW49. Located in void 4 starboard on starboard bulkhead. When open, provides outlet for used cooling water to flow overboard.
   (3) SSG 1. Open SW valves SW38 and SW39 on side of engine.*
   (4) SSG 2. Open SW valves SW40 and SW41 on side of engine.*

   * These SW valves have temperature gauges with each valve to indicate incoming and outgoing water temperatures.

3-19.1.2 Engine indicators. Engine indicators are on switchboard SSG engine panel, with exception of the following which are on the engine: fuel pressure gauge indicator, oil dipstick, engine alternator ammeter, oil pressure gauge, service meter. coolant level indicator, and coolant temperature gauge.

a. Oil pressure gauge. Left-hand gauge on engine instrument panel indicates oil pressure in pounds per square inch on the bottom scale. Scale reads 0-10-30-50-70. When engine Is new, Its normal oil pressure indication is obtained by operating engine at normal temperature and maximum rpm. Mark this oil pressure reading on gauge rim to indicate normal operating range.

b. Oil dipstick. Shows amount of oil In engine crankcase. Oil level must be between ADD and FULL marks on dipstick.

c. Fuel pressure gauge. Gauge is marked with red zone on the left, an overlapping red and green section in the middle, and a green zone on the right. When fuel filter becomes clogged, needle will move to red zone. When needle indicates in the center section of red and green, primary fuel filter must be washed and secondary fuel filter element replaced.

d. Hour service meter. Located on end of governor, this device indicates number of hours engine has operated.

e. Water temperature gauge. Right-hand gauge on instrument panel indicates temperature of coolant circulating in engine block. Bottom scale reads in degrees Fahrenheit from left to right (100-140-180-200), and gauge Is marked in red from 200 to right end of scale. A thermostat In closed-circuit portion of system keeps coolant within designed limits.

f. Coolant filler cap. On top of coolant tank. When removed, shows level of coolant in closed coolant portion of engine cooling system.

3-19.2 SR4 generator controls. SR4 generator controls are on the main switchboard and are discussed in Chapter 2, Volume 9.

3-19.3 Prestart procedures

a. In ROWPU space, make sure EMS is operating by pushing up on monitor controller left of monitoring processor. If monitor does not come on, turn it on with switch beneath the screen. For more details on EMS, see TM 55-1930-209-14 & P-11.

b. Check maintenance records to make sure all required maintenance checks and services have been completed.

c. In void 4, conduct walk-around inspection of generator set to detect visible deficiencies that, if not corrected, could become hazardous to people or equipment.

<u>WARNING</u>

At operating temperatures, engine coolant is hot and under pressure. It also contains alkaline materials harmful to eyes and skin. To avoid personal Injury, check coolant level only when engine Is stopped and filler cap is cool enough to be touched with a bare hand. Should engine coolant come in contact with eyes or skin, Immediately flush affected area with clean water and seek medical assistance if necessary.

CAUTION

Sensing element must be submerged In coolant to operate. If coolant Is low, engine can overheat and automatic shutoff will not function to prevent damage to engine.

d. When engine is cool, slowly open coolant tank filler cap. Check that engine coolant is not more than 1/2 inch below top of filler pipe. If it is, fill to required level with clean fresh water (low in scale-forming minerals but not softened water) and cooling system conditioner. Always add conditioner to water. Never use plain water. Conditioner should be 3 percent by volume of total coolant capacity - about 1/2 pint of conditioner per 2 gallons of water. If cap gasket is tom or damaged, repair or replace gasket.

e. Check that crankcase oil shows between ADD and FULL marks on dipstick. If oil shows below ADD mark, add oil at oil fill, located above oil dipstick on accessory end of engine. Oil must meet engine service classification CD (MIL-L-2104) or CD/TO-2. Diesel engines onboard use 15W40 as standard crankcase lubricant for normal temperatures. If temperatures in voids consistently exceed 1200F, use SAE 40.

f. Check that batteries are dean of corrosion, all cable connections tight and covered with anti-corrosion grease, and electrolyte covers plates.

g. Check that fuel pressure gauge indicates NORMAL. If gauge indicates CAUTION or OUT, wash primary fuel filter and replace secondary fuel filter element. (See TM 55-1930-209-14 & P-9, for details.)

h. Drain water and sediment from fuel/water separator (if SSG is so equipped).

i. Check that engine has fuel oil (for further information on fuel oil system, see TM 55-1930-209-14&P-8) by setting fuel oil valves as follows:

   (1) For SSG 1: Close fuel oil valves FO13-FO15, FO17, FO18, FO20, FO21, FO24-FO27, and open fuel valves FO16, FO19, and FO23.

   (2) For SSG 2: Close fuel oil valves FO13-FO16, FO18, FO20, FO21, FO23, FO25-FO27 and open FO17, FO19, and FO24.

j. Check that 24 Vdc power panel in workshop is active (Figure 3-18) and circuit breaker 8P14 is dosed (ON). This action provides voltage to hold open solenoids in generator fuel lines. Emergency shutdown switches activate these shutoff solenoids by removing this 24 Vdc power. If 24 Vdc panel is not active and circuit breaker 8P14 is open (OFF), these holding solenoids are dosed and fuel for these generators is shut off. The generator will start and run for about 2 minutes until lack of fuel shuts it off.

CAUTION

Turn off all emergency panel power users and all emergency lights when all power sources are turned off on barge. If not, DC battery bank will be drained of power. Without DC power to hold these fuel cutoff solenoids open, generators will not operate to recharge the 24 Vdc battery bank.

k Check that seawater is available for heat exchanger.

(1) Make sure both stem seawater strainer baskets are dean and operable. For details on servicing these strainers, see TM 55-1930-209-14&P-2, Seawater System.

(2) Open seawater valves SW45 and SW46 in void 4 port to monitor pressure drop across strainers (Barges 2 and 3 only). If pressure difference during operation becomes greater than 8 in Hg, turn handle to direct water through other basket. Clean dirty basket (TM 55-1930-209-14&P-2, Seawater System).

(3) Open seawater valve SW37 in void 4 port and SW49 in void 4 starboard.

(4) For SSG 1: Open seawater valves SW38 and SW39 in void 4 port.

(5) For SSG 2: Open seawater valves SW40 and SW41 in void 4 starboard.

l. On SR4 generator, if SSG has not run under load within last 3 months or SSG has been in storage, follow procedures provided on page 20, Caterpillar Operation and Maintenance Manual for SR4 and SRCR Generators, SEBU5717-02.

3-19.4 Starting procedures at the engine

NOTE

Normally, SSG's are started at switchboard In ROWPU space. Starting these engines at the engines In voids 4 can be done when necessary, such as initial starting after storage or after maintenance or repair. Following procedures are for starting SSG's, with no load, from engine location In voids 4. For starting from switchboard In ROWPU space, see Chapter 2, TM 55-1930-209-14 & P-9.

a. On switchboard control panel for starting SSG, set ENGINE CONTROL SWITCH to REMOTE.
b. On switchboard control panel for starting SSG, set VOLTAGE REGULATOR switch to IDLE.
c. On switchboard, check that GENERATOR circuit breaker (P1 or P2) for starting generator is OPEN.
d. On switchboard, set AMMETER SWITCH to ON.

WARNING

Ear protection must be worn in voids 4 when generators are operating.

e. On starting SSG, push ENGINE START/STOP SWITCH up and hold until engine starts. Release switch when engine starts. Engine should start and operate at idling speed.

NOTE

If engine does not start within 30 seconds, release ENGINE START/STOP SWITCH. Wait 2 minutes for starter motor to cool. Then, try again. Release SWITCH when engine starts. If engine does not start after three attempts, troubleshoot by following procedures on page 53, Caterpillar Systems Operation Testing and Adjusting for 3304B & 3306B Generator Set Engines, Form No. SENR2797 in Appendix B of TM 55-1930-209-14&P-9.

f. With engine idling, check that oil pressure gauge shows positive pressure. If not, stop engine. Troubleshoot according to procedures in TM 55-1930-209-14&P-9, and correct problem.
g. With engine idling, check that fuel pressure gauge on engine is in normal (green) range.
h. With engine idling, check that coolant temperature gauge is registering. As engine warms up, gauge starts to move toward higher reading. Engine can be switched from IDLE to RUN and a load applied
i. On switchboard, set battery charger FLOAT/EQUALIZE switch to FLOAT.
j. On switchboard control panel for starting SSG, check that:
    (1) VOLTMETER reads 440 Vac
    (2) FREQUENCY METER reads 60 Hz
    (3) AMMETER reads 0

3-19.5 Operating procedures. While engine is idling for 5 minutes, check operations as given in paragraph 3-7.4

NOTE

See paragraph 3-7.3 for operation of generator set alarms and shutoffs.

3-19.6 Shutdown procedures

3-19.6.1 Shutdown procedures from engine location. While SSG's are normally operated and shutdown from the switchboard, these procedures provide for shutting down SSG's at the engine from an idling no-load status.

a. Make sure all electrical loads have been transferred to other generator sets and applicable SSG circuit breaker (P1 for SSG 1 or P2 for SSG 2) is open (OFF).
b. Operate engine at idle speed for 5 minutes.
c. At engine, push ENGINE START/STOP switch to STOP.

3-19.6.2 Emergency shutdown. For operating total barge shutdown and system shutdown systems, see paragraph 3-7.9 For emergency shutdown of the SSG at the engine:

a. Push red EMERGENCY STOP button on side of generator housing.
b. Turn ENGINE START/STOP switch to STOP.
c. Reset EMERGENCY STOP button by turning clockwise and pulling out.
d. Troubleshoot and correct problem requiring emergency shutdown.

Section VI. 20 kW ship auxiliary generator (SAG) set

3-20 Description. The 20 kW SAG set supplies limited amounts of electrical power for the barge when ROWPU systems are not in operation. It provides sufficient power for operating normal lighting, dayroom equipment, workshop equipment, and battery chargers. It must never be used to provide power for any major system onboard (TM 55-1930-209-14 & P-9).

3-20.1 This generator set consists of a Perkins Model 4.236M engine and a Newage Stamford SC144E generator mounted, with vibration isolators, on a common base. It has free standing switching gear and is capable of parallel operations. The set weighs 1300 pounds dry and 1451 pounds wet and is 74 inches long, 26 inches wide, and 40 inches high. Installation is shown in engineering drawings listed in Appendix A.

3-20.2 The Perkins 4.236M engine is a 236-cubic inch inline, four cylinder, four-stroke diesel specifically built for use in a maritime environment. It has direct injection, with a 16:1 compression ratio and is rated at 72 hp at about 2500 rpm. The engine has a heat exchanger using seawater to cool both engine coolant and engine oil and a 24 V electric starter. The battery pack on the engine is charged by a battery charger built into the switchboard in the ROWPU space.

3-20.3 The Newage Stamford SC144E generator is a brushless, revolving field machine. It is based on a fabricated frame and cast iron end brackets with a large sheet metal terminal box mounted on the nondrive end. The stator/rotor is made from low loss electrical grade sheet steel laminations with special building techniques to provide an extremely rigid core to withstand vibration and load impulses. A high-grade, precision-machined shaft carries the rotor assembly. For a more detailed technical description, refer to manufacturers' manuals listed in TM 55-1930-209-14 & P-9.

3-21 Capabilities. This auxiliary generator set provides electrical power necessary for normal occupancy of the barge when major ROWPU systems are NOT operating. It will provide continuous power under these conditions. For load transfer purposes only, it may be operated, for a very short time, in parallel with either of the two SSG's.

3-22 Special limitations. This generator set cannot be operated in parallel with power from the shore power receptacle. It cannot be used to provide power for any major systems onboard. It must be used only to provide power for normal non-operating occupancy and housekeeping equipment.

3-23 Performance characteristics. The auxiliary generator's voltage regulation is maintained within the limits of ±2 percent from no load to a full load. This includes cold to hot variations at any power factor between 0.8 lagging and unity and inclusive of a speed variation of 4.5 percent. Total distortion of the voltage waveform, with open circuit between phases or between phases and neutral, is on the order of 2 percent. On a 3-phase, balanced, harmonic-free load, total distortion is on the order of 3.5 percent. Electrical output characteristics at an 0.8 power factor are listed below:

kW	20
kVA	25
Voltage	440 Vac
Current	32
Phase	3
Hertz	60

3-24 Description of operation. Normally, this generator set is started as soon as the barge is activated. When major ROWPU systems are not operating, SAG provides power for normal housekeeping functions such as lighting, heating, air conditioning, ventilation, operation of dayroom and workshop equipment, and initial startup of chlorination system. This auxiliary generator set cannot provide sufficient power to operate any of the major ROWPU systems. One of the two SSG's must be online to provide sufficient power for operating any major ROWPU system. When one of the SSG's is online, the 20 kW set is normally shut down.

3-24.1 This generator, like the two SSG's, is normally started and operated from a control panel on the switchboard in the ROWPU space.

3-24.2 Like the two SSG's, this generator can operate in parallel with either of the two SSG's for load transfer.

3-25 Operating instructions.

3-25.1 Operating controls and indicators

3-25.1.1 4.236M diesel engine

3-25.1.1.1 Engine instruments. These are on a small instrument panel on top of the engine block

a. Engine oil pressure gauge. Located on upper left portion of this small panel, this gauge indicates oil pressure on its upper scale. Normal oil pressure is 30/60 psi when engine is new at normal operating temperature and engine is at maximum speed. During the life of the engine, as bearing surfaces wear, pressure will gradually decrease. When oil is hot or wrong grade of oil is used for certain climatic conditions, oil pressure may decrease slightly.

b. Engine coolant temperature gauge. Located on upper right portion of panel, this gauge indicates temperature of engine block coolant in degrees Fahrenheit on upper scale. A thermostat in the dosed circuit portion of the cooling system keeps this temperature between 168 and 197°F.

c. Coolant pressure gauge. Located on lower left side of panel, this gauge reads from 0 to 15 psi. Low pressure is an indication of possibly blocked water passage.

d. Hour meter. Located on lower right portion of panel, this meter indicates number of hours generator set has operated and provides the basis for scheduling maintenance and services

3-25.1.1.2 Engine indicators

a Fuel pressure gauge. On top of fuel oil filtering system, this gauge indicates fuel pressure in psi and indicates when fuel oil filters should be changed.

b. Oil dipstick. Located on left side of engine block (looking at engine from generator). The dipstick shows amount of oil in crankcase. Oil level must be between minimum and maximum marks on dipstick. Never fill above maximum level.

c. Coolant filler cap. Located at top front (accessory end) of engine on top of coolant tank. When removed, cap shows level of coolant in dosed coolant portion of engine cooling system.

3-25.1.1.3 Engine controls

a. ENGINE CONTROL SWITCH. This switch, on SAG switchboard control panel, has START, REMOTE, and OFF/RESET positions. To start engine from switchboard, place switch in START. To stop engine from switchboard, place switch in OFF/RESET. To operate engine from engine, place switch in REMOTE and use ENGINE START/STOP switch on engine.

b. VOLTAGE REGULATOR switch. The SAG controls on the switchboard control panel do not include this switch to control engine speed. It is found on the SSG control panels only.

c. THROTTLE. Black knob on right side (as you face switchboard) of switchboard housing. Large changes in speed are obtained by pushing in on center button and then pulling out on throttle knob to increase speed and pushing in to decrease speed. For fine throttle adjustments, turn knob counterclockwise to increase speed and clockwise to decrease speed. Most throttle adjustment will be done by turning throttle knob rather than by pushing or pulling

d. ENGINE START/STOP switch. Located on engine. Push down on this switch to stop engine regardless of ENGINE CONTROL SWITCH setting. When ENGINE CONTROL SWITCH switch is in REMOTE, push up on this switch to start engine.

e. Red EMERGENCY STOP button on engine control panel. Push to stop engine. When emergency situation has been corrected, reset by turning clockwise and button will pop out to normal position. Start engine by following normal starting procedures.

f. Seawater valves control flow of seawater to SAG 1 for cooling engine coolant and lubricating oil. These valves must be open for engine to operate.
   (1) Seawater valve SW37. Located in void 4 port next to seawater strainer. When open, provides water from seawater strainer to manifold piping, which provides cooling seawater to all generators in void 4.
   (2) Seawater valve SW49. Located in void 4 starboard on starboard bulkhead. When open, provides outlet for used cooling water to flow overboard.
   (3) Seawater valve SW42. Controls flow of cooling seawater from aft seawater seachest strainer to inlet into engine cooling exchanger. Valve piping also includes a temperature gauge indicating inlet water temperature. Valve must be open for engine to operate.
   (4) Seawater valve SW43. Controls flow of cooling seawater from engine cooling exchanger to overboard outlet. Valve piping also includes a temperature gauge indicating temperature of water leaving the engine heat exchanger (Barges 2 and 3 only). Valve must be open for engine to operate.

3-25.1.2 SC144E generator. Controls and indicators are on switchboard in ROWPU space. These are discussed in Section II, paragraph 3-7.1.2, as part of the primary electrical system.

3-25.2 Prestart procedures

a. In ROWPU space, make sure EMS (TM 55-1930-209-14&P-11) is operating by pushing up on monitor controller left of monitoring processor. If video monitor screen does not come on, turn it on with switch beneath the screen. For more details on EMS, see TM 55-1930-209-14&P-11.
b. Check maintenance records to make sure all required maintenance checks and services have been completed and no deficiencies exist that would prevent safe and proper equipment operation.
c. In void 4 starboard, inspect generator set for visible deficiencies that, if not corrected, could become hazardous to people or equipment.

CAUTION

Never overfill crankcase. Fill only to maximum level as indicated on dipstick.

d. Check crankcase engine oil level on dipstick on left side of engine. If not up to full mark, add lubricating oil through filler on top of engine. Use SAE 15W40 that meets Military Specification MIL-L-2104 (API "CD"). If temperature in the voids consistently exceeds 120°F, use SAE 40.
e. Check coolant level in heat exchanger (header) tank. Level should be less than 1 inch below bottom of neck opening. If necessary, add clean fresh water to bring to required level. Cooling system has an anticorrosion zinc anode in coolant heat exchanger. Water conditioner, therefore, is not required or desirable.
f. Check that seawater is available for heat exchanger.
   (1) Make sure both stem seawater strainer baskets are dean and operable. For details on servicing these strainers, see TM 55-1930-209-14&P-2, Seawater System.
   (2) Open seawater valves SW45 and SW46 (on Barges 2 and 3 only) to monitor pressure drop across strainers. If pressure difference during operation becomes greater than 8 in. Hg, turn handle to direct water through other basket. Clean dirty basket (TM 55-1930-209-14&P-2), Seawater System.
   (3) Open seawater valve SW37 in void 4 port and SW42, SW43, and SW49 in void 4 starboard.
g. Check that fuel oil is available by setting fuel oil valves as follows:

   Open: FO18, FO19, and FO25

   Close: FO13 thru FO17, FO20 thru FO24, FO26, and FO27. *

- Fuel oil valve settings above are for operating auxiliary generator only. As other diesel engines are needed, some of those valves listed as closed may be opened to supply fuel oil to other diesels. This will not have any impact on fuel oil supply for this diesel.

h. Check that 24 Vdc power panel in workshop is active and circuit breaker 8P14 is dosed (ON) (Figure 3-18) to provide holding voltage to solenoids in fuel lines to generators. Emergency shutdown switches activate these shutoff solenoids by removing this 24 Vdc power. If 24 Vdc panel is not active, these holding solenoids are closed. The generator will start and run for a few minutes until lack of fuel stops the engine.

CAUTION

Turn off all emergency panel power users and all emergency lights when all power sources are turned off. If not, battery bank will be drained of power. Without power from this battery bank to hold fuel shutoff solenoids open, generators will not operate to recharge the 24 Vdc batteries.

i. Check that generator set batteries are clean of corrosion, cable connections are tight and covered with anticorrosion grease, and electrolyte covers the plates.

3-25.3 Starting procedures

NOTE

Following procedures are for starting SAG engine from its location in void 4 starboard. For remote starting from switchboard in ROWPU space, see Section II.

a. On switchboard auxiliary generator control panel, make sure ENGINE CONTROL SWITCH is set to REMOTE.
b. Make sure switchboard circuit breaker P3 is open (OFF)
c. On switchboard, make sure throttle knob is pushed all the way in and turned clockwise as far as it will go. This sets throttle for starting and idling at about 900 rpm. Throttle cannot be set until engine has started. After engine starts, throttle arm can be moved manually to momentarily increase engine speed. When released, it will return to idle set with throttle knob on switchboard.
d. On switchboard, set AMMETER SWITCH to ON

WARNING

Ear protection must be worn in voids 4 when any generator is operating.

e. On SAG, push ENGINE START/STOP switch up and hold until engine starts.

NOTE

If engine does not start within 20 seconds, release ENGINE START/STOP SWITCH and wait 2 minutes for starter motor to cool. Then, try again. Release switch when engine starts. If engine does not start after three attempts, troubleshoot by following troubleshooting procedures on page 67, Perkins Engines Operators Manual for Marine Diesel Engines, 4.236M, found in Appendix B of TM 55-1930-209-14&P-9. Correct as Indicated by chart.

f. With engine idling, check that lubricating oil pressure gauge shows positive pressure. If not, stop engine. Troubleshoot according to TM 55-1930-209-14&P-9 and Troubleshooting Chart on page 67, Perkins Engines Operations Manual for Marine Diesel Engines (in Appendix B, TM-55-1930-209-14&P-9). Correct trouble before proceeding

g. With engine idling, check that fuel oil pressure gauge shows normal fuel pressure. If not, change fuel oil filters as provided in TM 55-1930-209-14&P-9.
h. On switchboard, set battery charger FLOAT/EQUALIZER switch to FLOAT.
i. With engine idling, check that coolant temperature gauge is registering. When gauge starts to move toward higher reading, engine speed may be increased, using throttle on side of the switchboard.
j. On SAG switchboard control panel, check that:
   (1) VOLTMETER reads 440 Vac
   (2) FREQUENCY METER reads 60 Hz
   (3) AMMETER reads 0.

3-25.4 Operating procedures. After starting, the SAG is difficult to operate from the engine location, due to limited throttle control. It is normally operated from the switchboard. For operating procedures from the switchboard, see paragraph 3-7.4

NOTE

See paragraph 3-7.3 for operations of generator set alarms and shutoffs.

a. During operation, perform during operation checks according to paragraph 3-7.4
b. During operation, make sure that lubricating oil pressure, fuel oil pressure, and coolant temperature gauges indicate normal range of operation.

3-25.5 Shutdown procedures

3-25.5.1 Shutdown procedures at engine. While this auxiliary generator set is normally operated from switchboard, it can be shut down at the engine location by following these procedures:
a. Make sure all electrical loads have been transferred to other generator sets and SAG circuit breaker P3 is open (OFF).
b. At switchboard, decrease throttle setting to idle (900 rpm) by pushing in on central button and then pushing throttle knob all the way in and turning clockwise as far as it will go.
c. Operate engine at idle speed for 5 minutes.
d. At engine, push ENGINE START/STOP switch to STOP.

3-25.5.2 Emergency shutdown. For activating total barge shutdown and individual system shutdowns, see paragraph 3-7.9. For emergency SAG shutdown at the engine:
a. Push red EMERGENCY STOP button on side of generator housing.
b. Turn ENGINE START/STOP switch to STOP.
c. Troubleshoot according to procedures on page 67 of Troubleshooting Chart in Perkins Engines Operators Manual for Marine Diesel Engines 4.236M, in Appendix B of TM 55-1930-209-14&P-9.
d. When corrections have been completed, reset EMERGENCY STOP button by turning clockwise. Button will pop out and be in ready position.

CHAPTER 4 SMOKE DETECTOR SYSTEM

Section I. General

4-1 General. The smoke detector system provides a means of detecting smoke in any or all of the barge's eight voids. When smoke is detected, an alarm sounds to alert crewmembers. Flashing light(s) on the detector panel identifies in which void or voids the smoke is being generated. Barge firefighting equipment consists of a Halon 1301 system, 2 CO_2 hose reel units, 17 portable CO_2 and 5 dry-chemical fire extinguishers, 5 self-contained breathing devices, and a portable, engine-driven firefighting water pump. Details about barge firefighting equipment are in TM 55-1930-204-14&P-17.

4-2 Description. The smoke detector system has a cabinet with display panel (Figure 4-1) on the ROWPU space forward bulkhead. A suction blower cabinet is located on the deckhouse top and alarm bells are mounted in the detector cabinet and in the dayroom. Air sampling accumulators are located in each void and are connected to the smoke detector cabinet by associated pipes and tubing.

4-3 Capabilities. This system has the capability of simultaneously detecting smoke in one or more voids.

4-4 Special limitations. The smoke detector system samples the air in the voids for smoke only. The system cannot detect flame or heat. It does not sample air in the ROWPU space, workshop, or dayroom. This system operates on 115 Vac from the void lighting panel. It does NOT activate any firefighting equipment.

Section II. Description of operation

4-5 General. In operation, the smoke detector system's suction blower assembly on the deckhouse top pulls air through air accumulators in the voids to the smoke detector cabinet. As air passes through the cabinet, it passes through a lightbeam. If smoke is in the air, it scatters this lightbeam, triggering a photo-electric cell which activates the system. Alarms sound in the ROWPU space and dayroom. Lights on front of the smoke detector cabinet indicate the space(s) in which smoke is being produced. In addition, an olfactory (sniffer) valve near the smoke detector cabinet provides a crewmember with a sample of the smoke. Smelling the smoke may permit crewmembers to determine type of fire or cause for the smoke.

Section III. Operating instructions

4-6 Controls and Indicators. Operator controls and indicators are at the smoke detector cabinet in the ROWPU space (Figure 4-1). An olfactory (sniffer) valve is near the smoke detector cabinet. The sniffer valve allows a crewmember to determine the type of fire by smelling the smoke.

4-7 Prestart procedures.

a. Make sure smoke detector cabinets in ROWPU space and blower assembly cabinet on deckhouse top are not damaged and air hose and electrical connections are tight and secure.
b. Close (ON) power panel 3 circuit breaker 3P13 to supply power to void lighting panel.
c. Close (ON) void lighting panel 3 circuit breaker 3P13-9 to supply power to smoke detector system.

NOTE

Operate blower no. 1 on odd-numbered days and blower no. 2 on even days.

d. Supply power to smoke detector system (Figure 4-1) by setting BLOWER SELECT toggle switch to M1 or M2. Make sure green POWER ON indicator light on cabinet panel comes on.
e. Set DAY/NITE toggle switch to DAY. If dark in ROWPU space, switch to NITE.

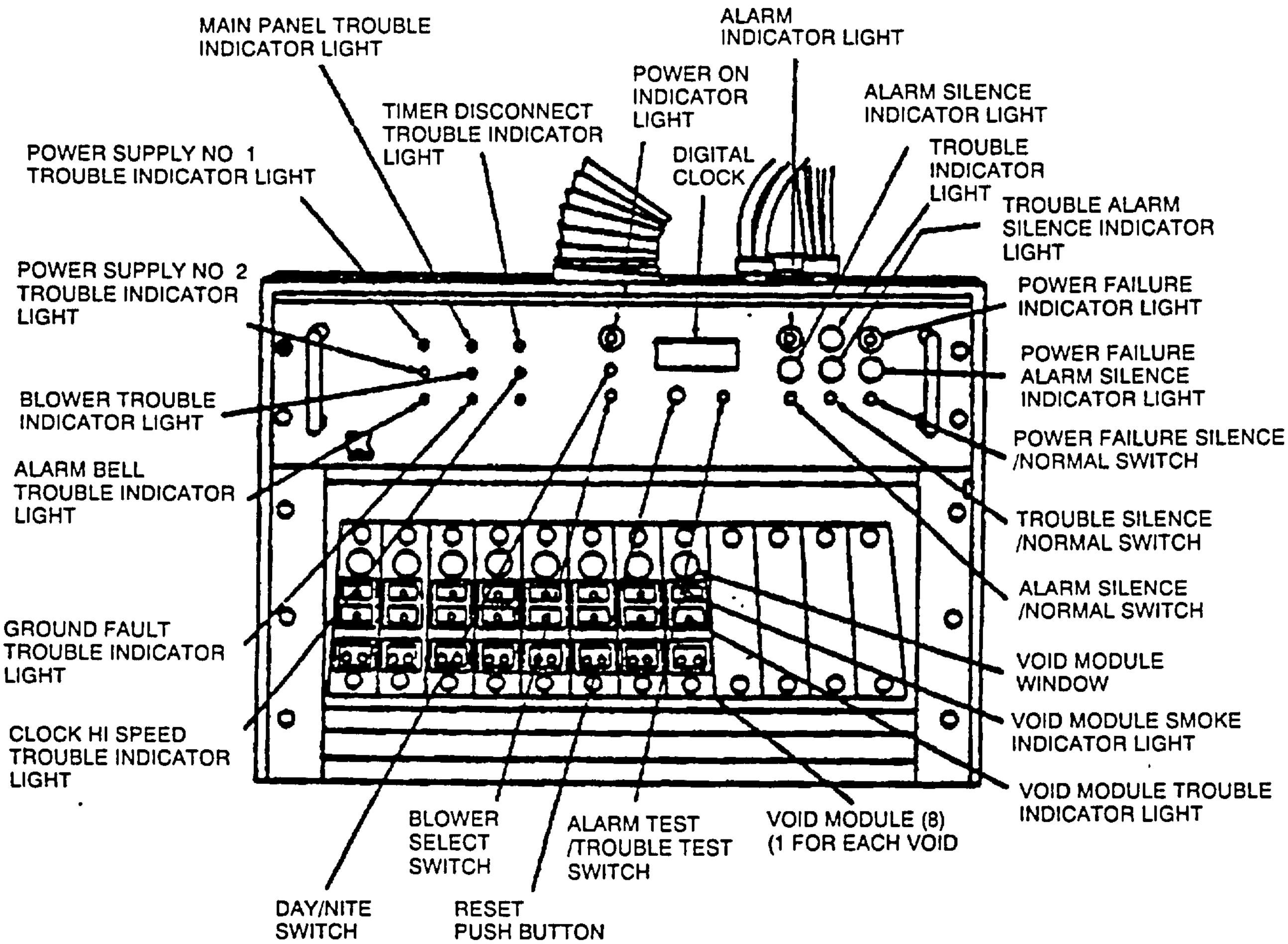


Figure 4-1. Front Panel of Marine Smoke Detector Cabinet

f. Set following toggle switches to NORMAL:
   (1) ALARM SILENCE/NORMAL
   (2) TROUBLE SILENCE/NORMAL
   (3) POWER FAILURE SILENCE/NORMAL.

g. Check all indicators and alarms by operating ALARM TEST/TROUBLE TEST switch as follows:
   (1) Hold switch in ALARM TEST position to simulate presence of smoke in each of eight voids (voids 1 through 5). Make sure red VOID MODULE SMOKE INDICATOR light comes on, and that alarms sound in the ROWPU space and dayroom.
   (2) Release switch and push blue RESET button to silence alarms and return system to normal operation. If trouble is indicated, troubleshoot according to TM 55-1930-209-14&P-17.
   (3) Hold switch in TROUBLE TEST position to simulate trouble condition. Make sure trouble buzzer on detector cabinet sounds, amber VOID MODULE TROUBLE INDICATOR light on each of eight modules comes on, and that the following amber indicator lights in ZONE TROUBLE come on:
      (a) Power supply no. 1
      (b) Power supply no. 2
      (c) Alarm bell

(d) Main panel
(e) Blower
(f) Ground fault
(g) Timer disconnect
(h) Clock hi speed

(4) Release switch to return system to normal operation. If trouble is indicated, troubleshoot according to TM 55-1930-209-14 & P-17.

h. Smoke detector system is now operational

4-8 Normal operations.

a. Make sure flag in each of eight detection modules shows NORMAL.
b. Make sure digital clock is operating as indicated by a flashing decimal point on numerical display.
c. While smoke detector system is operating, periodically check indicator lights on smoke detector cabinet and listen for buzzer and alarms.

4-9 Emergency procedures for smoke. When alarms sound, indicating smoke in one or more of the voids:

a. Check if alarms are sounding due to a problem with the alarms by observing if amber ALARM BELL TROUBLE indicator light in ZONE TROUBLE or any of the eight void module TROUBLE indicator lights are on. If these lights are on, follow procedures in paragraph 4-11. If not on, continue to next step.
b. Determine location generating smoke by checking void module windows and red SMOKE INDICATOR light of eight void modules.
c. Open olfactory valve and sniff air being discharged by blower to determine possible source of smoke.
d. Activate emergency procedures as necessary. If fire is producing the smoke, use dry chemical portable fire extinguishers in the voids or activate the Halon 1301 system for fires in void 4. See TM 55-1930-209-14 & P-17 to operate the Halon 1301 system and the dry-chemical fire extinguisher.
e. Silence alarms by setting ALARM SILENCE/NORMAL switch to SILENCE. Both red ALARM and void module smoke indicator lights go out and amber ALARM SILENCE indicator light comes on.
f. Observe void module window in detection module. When air is free of smoke, push blue RESET button to reset smoke detector cabinet panel.

NOTE

When panel resets, trouble buzzer on detector cabinet will sound until ALARM SILENCE/NORMAL switch is returned to NORMAL.

g. Set ALARM SILENCE/NORMAL switch to NORMAL. Amber SILENCE indicator light goes out.
h. Smoke detector system is now operating normally.

4-10 Emergency procedures for malfunctions. If smoke detector cabinet trouble buzzer sounds, do the following:

a. Make sure blue POWER FAILURE indicator light comes on.

NOTE

When a power failure occurs, blue POWER FAILURE indicator lamp on smoke detector cabinet comes on and trouble buzzer Indicates that one of the following has occurred: loss of main power, fuse opening, or simultaneous failure of both power supply no. 1 and power supply no. 2.

b. Silence buzzer by setting POWER FAILURE SILENCE/NORMAL switch to SILENCE.

c. Make sure blue POWER FAILURE indicator light goes out and amber POWER FAILURE ALARM SILENCE indicator light comes on.
d. Troubleshoot according to TM 55-1930-209-14 & P-17 to determine cause of failure.

NOTE

As soon as power is restored, trouble buzzer will sound.

e. Silence buzzer by setting POWER FAILURE SILENCE/NORMAL switch to NORMAL. Make sure amber POWER FAILURE ALARM SILENCE indicator light goes out.
f. If power failure was only problem, smoke detector system is now operational.

NOTE

When any supervised item in ZONE TROUBLE falls, amber TROUBLE Indicator lights on smoke detector cabinet come on and trouble buzzer sounds. Individual amber lights In ZONE TROUBLE also come on to Indicate specific trouble.

g. As soon as buzzer sounds, make sure amber TROUBLE indicator light comes on.
h. Check following amber indicator lights in TROUBLE ZONE to determine item causing trouble. Also check amber TROUBLE indicator light of each individual void module to determine malfunctioning module:
Power supply no. 1
Power supply no. 2
Alarm bell
Main panel
Blower
Ground fault
Timer disconnect
Clock hi speed
Individual void modules
i. Silence buzzer by setting TROUBLE SILENCE/NORMAL switch to SILENCE.
j. Make sure amber TROUBLE indicator light goes out and amber TROUBLE ALARM SILENCE indicator light comes on.

NOTE

If power supply no. 1 or power supply no. 2 is source of trouble, panel automatically switches to other power supply.

k After determining item causing trouble, troubleshoot according to paragraph 4-19 in TM 55-1930-209-14 & P-17.

NOTE

As soon as trouble is eliminated, amber Indicator light In TROUBLE ZONE and TROUBLE indicator light(s) go out and trouble buzzer sounds.

l. Make sure amber indicator lights go out. Silence buzzer by setting TROUBLE SILENCE/NORMAL switch to NORMAL. Make sure amber TROUBLE indicator light goes out and amber TROUBLE ALARM SILENCE indicator comes on.
m. Smoke detector system is now operational.

4-11 Shutdown procedures.

a. Set BLOWER SELECT switch to middle position.
b. Open (OFF) void lighting panel 3 circuit breaker 3P13-9 to stop power to smoke detector system.

CHAPTER 5 COMMUNICATIONS SYSTEMS

Section I. General

5-1 General. The communications system consists of three separate communication methods. These include radio communications equipment, foghorn, and intercom telephones, which are briefly described as follows. Details are in Section II thru Section IV.

5-1.1 Radio communications equipment. Barge radio communications equipment is located in the dayroom and consists of a type AN/VRC- 46 High Frequency (HF) Frequency Modulation (FM) Army issue radio (hereafter the HF/FM Army radio), a Very High Frequency/Frequency Modulation (VHF/FM) commercial marine radio, and Ultra High Frequency (UHF) FM handheld walkie-talkie transceivers.

5-1.1.1 Army radio. The HF/FM Army radio provides communications with other stations equipped with radio frequencies reserved for military (primarily US Army) use. This radio enables the barge to communicate with its towing vessel, other military support vessels, military shore-based radio stations, and aircraft. Transmission distance is normally 25 miles or less.

5-1.1.2 Commercial marine radios. These provide VHF/FM radio communications between workboat and barge and between workboat or barge and other vessels equipped with radios working these same channel frequencies. Transmission distance is normally 25 miles or less.

5-1.1.3 Walkie-talkies. These preset, crystal-controlled, handheld, nickel cadmium (ni-cad), battery-powered, portable radios can be set to the same frequencies available on the commercial marine radio channels and provide VHF/FM communications between crew personnel onboard, between shore and crew personnel, and between crew personnel on workboat and barge. Transmission distance is normally 5 miles or less.

NOTES

Under US Federal Communications Commission (FCC) regulations, commercial marine ship radio and walkie-talkie stations, operating In US and adjacent waters, are primarily reserved for safety of life and property. Therefore, distress and safety communications have absolute priority. Those frequencies not reserved for calling, distress, or other safety purposes, however, may be used for radio telephone calls to coast stations or between ships.

Operation of radios using military frequencies Is controlled by Army Standard Signal Instructions (SSI) and Signal Operating Instructions (SOI). Extracts of necessary portions of these documents are obtained from the Army unit to which the barge Is attached or assigned.

5-1.2 Foghorn equipment. This equipment sounds the foghorn to warn oncoming vessels of barge location during poor visibility.

5-1.3 Telephone system. This system provides intercommunications between dayroom system operator and crewmembers at any telephone station on the barge. Telephone stations provide jack receptacles for connecting a headset. By using dayroom telephone equipment, operator can page and communicate with personnel at any telephone station. When on line with operator, crewmembers at telephone stations can communicate with operator or crewmembers plugged into other stations.

Section II. Radio communications system

5-2 Description. The radio communications system for Water Purification Barges 300-WPB-XXX includes a US Army tactical radio AN/VRC-46, two commercial marine radios, and three walkie-talkies. Each is designed to provide radio communications with stations equipped with similar type radios operating on matching frequencies. This system, shown in Figure 5-1, consists of the major components listed in Table 5-1. Individual radio equipment is shown in Figures 5-2 thru 5-5. Equipment specifications, maintenance information, and manufacturers' service manuals are contained in TM 55-1930-209-14&P-12.

5-3 Capabilities.

5-3.1 Army radio. The Army radio provides HF/FM communications with other military radio stations operating on frequencies within the band assigned for military use. These may include other military ships such as Army or Navy tugboats, military commanders and their headquarters and staffs, and military bases ashore. Transmission distance normally is 25 miles or less.

5-3.2 Commercial marine radios. Commercial marine radios provide VHF/FM radio communications with commercial (nonmilitary) radio stations equipped to operate in the FCC-assigned marine radio band (156.250-162.550 MHz). These may include commercial tugboats, other commercial vessels, commercial shore stations allied with ships and seagoing activities and United States Coast Guard (USCG) ships and stations. Transmission distance is normally 25 miles or less.

Table 5-1. Radio Communications System Major Components

Component/Quantity	Location	Function
Army AN/VRC-46 transceiver/1	Mounted on shelf on aft bulkhead in dayroom	For radio communications with military stations
Army M-80/GR microphone/1	Connected to AN/VRC-46 transceiver on aft bulkhead in dayroom	For transmitting voice messages
Army PP-6224 A/U (Barge 1) Army PP-2953/U (Barges 2 and 3) power supply/1 ea	Mounted on shelf on aft bulkhead in dayroom	Provides a regulated +25.2 VDC for AN/VRC-46 transceiver operation
Army HF antenna AS-1729/ VRC/1	Mounted on deckhouse top, starboard	For receiving or transmitting radio waves
Marine C866S VHF/FM transceiver/2	Mounted under shelf on aft bulkhead in dayroom and in workboat cabin	For radio communications within FCC-assigned commercial marine band
Marine regulated DC power supply/1	Mounted on shelf on aft bulkhead in dayroom	Supplies a regulated +13.8 Vdc power supply for 866S VHF/FM marine transceiver operation
Marine VHF antenna/2	Mounted on deckhouse top, starboard and on workboat cabin	For receiving or transmitting radio wave
HX500S VHF/FM marine handheld transceivers (walkie-talkies)/3	Positioned in battery charger on portside of operator's desk or workshop rack	For radio communications within the FCC-assigned commercial marine band
Handheld transceiver CSB50AM battery charger/1	Mounted in workshop on supply rack ni-cad battery packs	Supplies a 7.5 Vdc output for charging ni-cad battery packs

The barge has two marine band radios, one in the barge dayroom and the other in the workboat cabin. These are identical pieces of equipment, operate in the same manner, on the same channels/frequencies, and are interchangeable. The barge mounted radio has a separate power supply to provide proper voltage for radio operation. The workboat mounted radio uses power from the workboat electrical system.

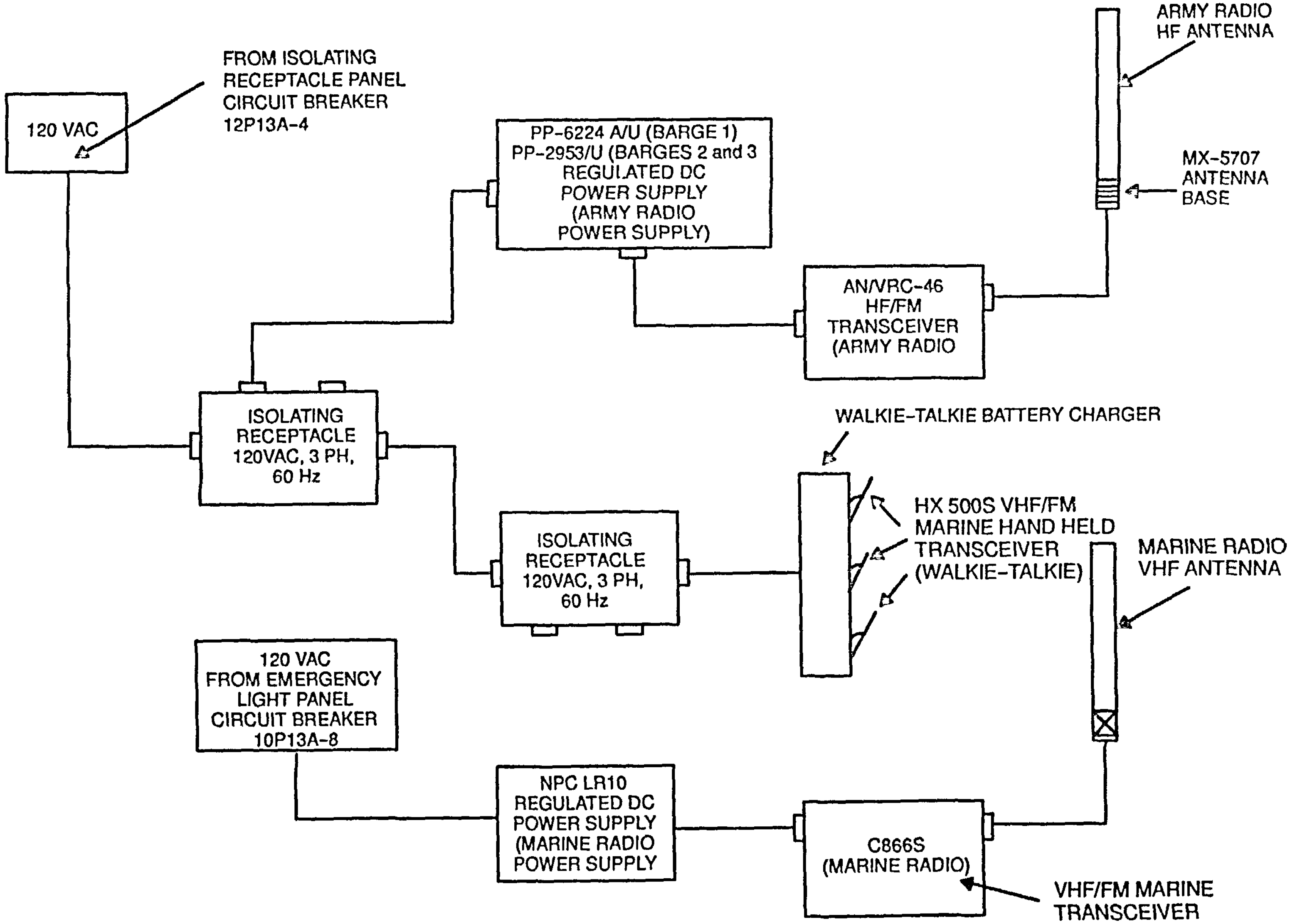


Figure 5-1. Radio Communications System Major Components

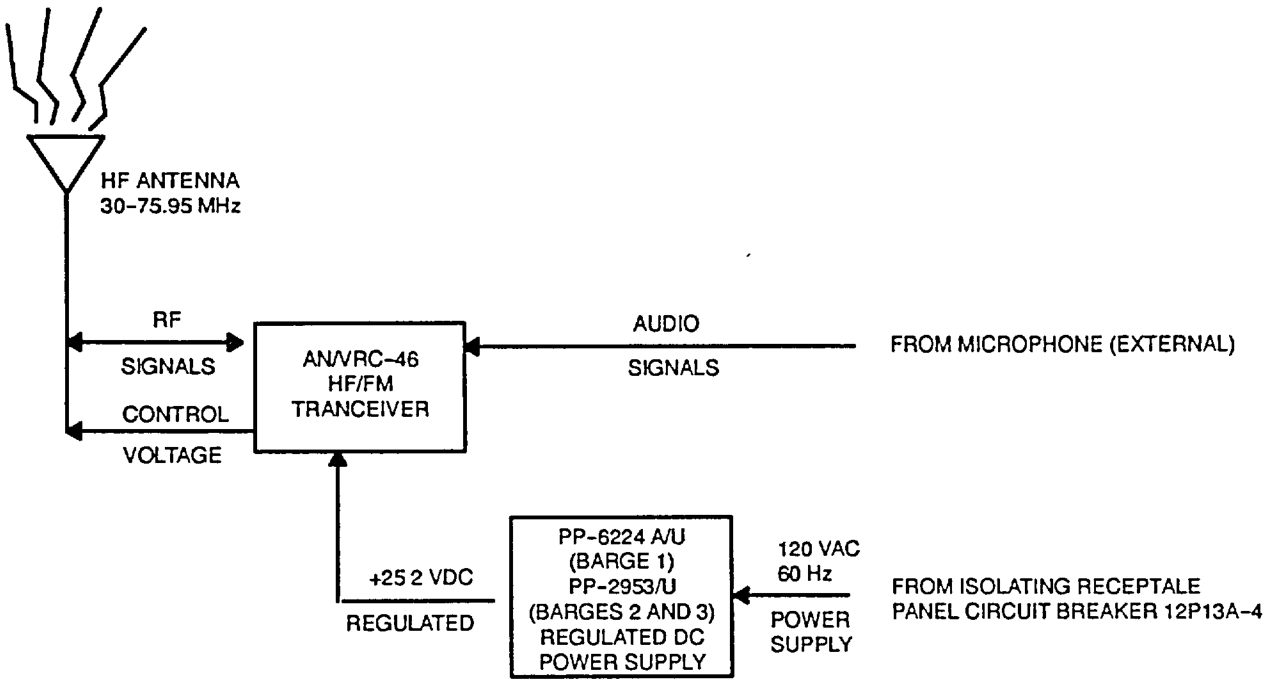


Figure 5-2. Army Radio Equipment Interface

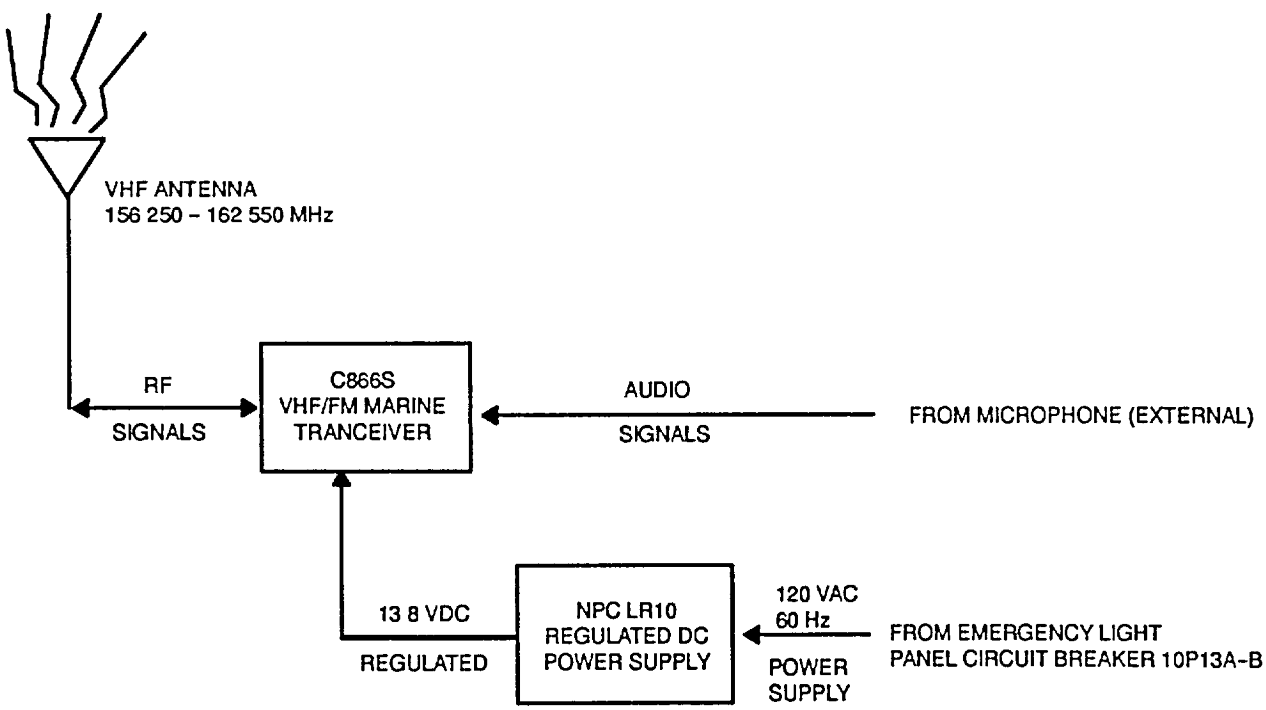


Figure 5-3. Marine Radio Equipment Interface

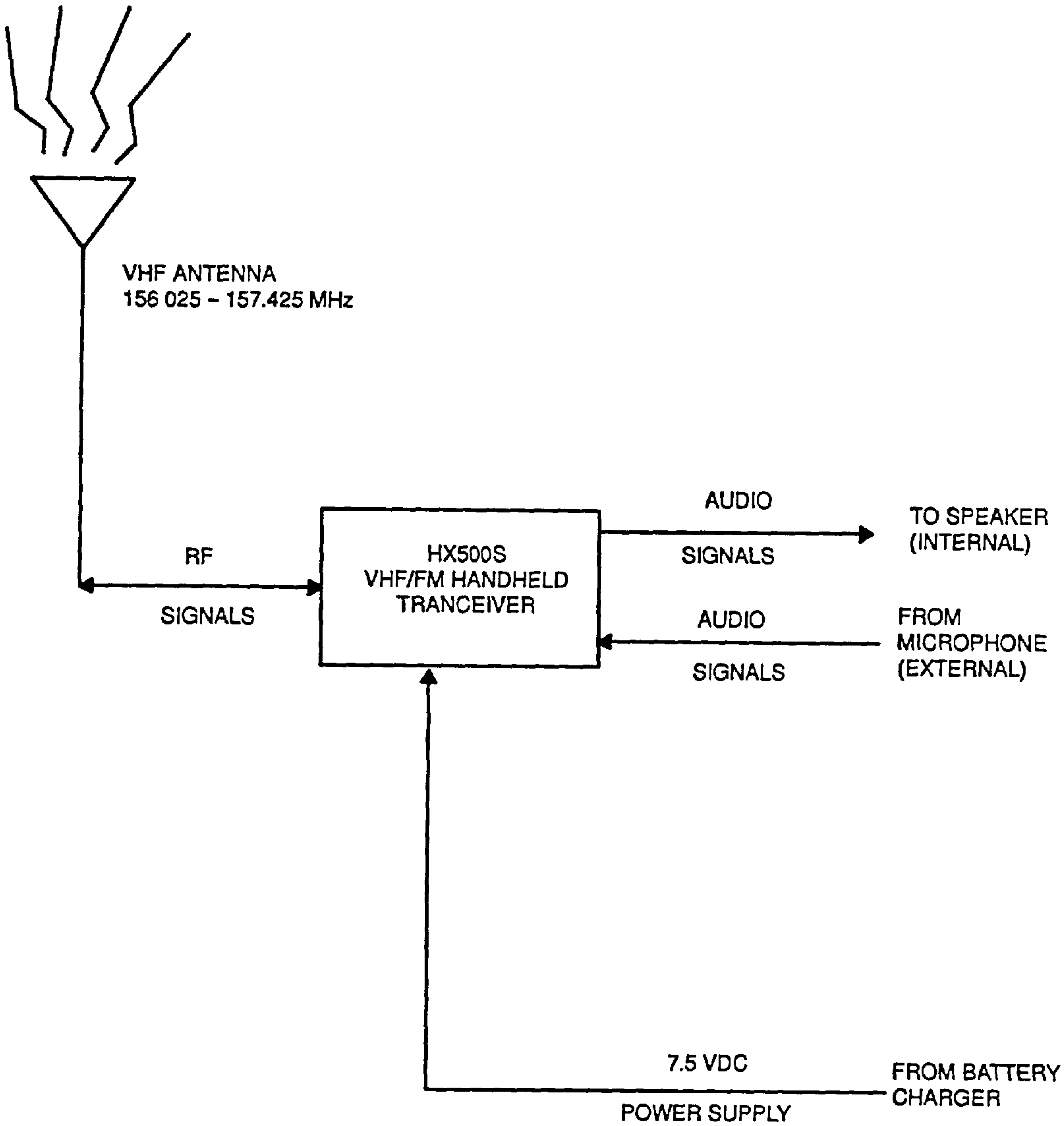


Figure 5-4. Walkie-Talkie Equipment Interface

5-3.3 Walkie-talkies. Three walkie-talkies provide short-distance communications (normally less than five miles) on three preset frequencies in the FCC-assigned marine radio band. They provide communications between crewmembers carrying these transceivers, with the commercial marine sets In the barge dayroom and workboat cabin, and other radio equipment operating on the same frequencies within the marine VHF/FM radio band. Transmission distance is normally 5 miles or less.

5-4 Special limitations. Operation of commercial marine radios must be in accordance with FCC regulations. Operation of Army radios must follow Army SSI/SOI. For specifics, refer to applicable service manual/instructions. According to FCC regulations, marine radios are licensed primarily for safety of life and property. Therefore, distress and safety communications have absolute priority. However, frequencies that are not reserved may be used for ship-to-ship and ship-to-shore official communications.

5-5 Performance characteristics

a. Army radio (AN/VRC-46 HF/FM transceiver)

Frequency range	30 to 75.95 MHz
Channels	920
RF output power	Low-0.5 to 10 W High-35 to 65 W
Transmission distance	About 5 miles on low power; about 25 miles on high power

(1) Army radio power supply PP-6224 A/U (Barge 1) or PP-2953/U (Barges 2 and 3) regulated power supply

Power input	115/230 Vac, 60 Hz
Regulated power output	25 2 Vdc at 10 Amp

(2) Army radio HF antenna (AS-1729/VRC HF antenna)

Frequency range	30 to 76 MHz
Power handling capability	70 W, maximum

b. Marine radio (C866S VHF/FM marine transceiver)

Input voltage	13.8 Vdc (±20 percent)
Frequency range	156.250-162.550 MHz
Channels - Receive -	50
Transmit -	46
RF power output	Low - 1 W High - 25 W

(1) Marine radio antenna (VHF antenna)

Frequency range	156.025 to 157.8 MHz

(2) Marine radio power supply (NPC LR 10 regulated dc power supply)

Input power requirement	115/230 Vac, 60 Hz
Regulated power output	13 8 Vdc

c. Walkie-talkie (HX-500S VHF/FM marine handheld transceiver)

Input voltage	7.5 Vdc (+/-15 percent)
Frequency range	Transmit - 156.025 to 157.425 MHz Receive - 156.050 to 157.425 MHz
Channels	6
RF power output	Low - 1 W High - 5 W

(1) Walkie-talkie battery charger (Model CSB50AM battery charger)

Input power requirement	Any 120/220/240 Vac, 50/60 Hz source
Power handling capability	6.5 W
Regulated power output	8.7 Vdc at 90 mA

5-6 Description of operation

5-6.1 General. Each radio has four main components: antenna, transceiver (radio) and speaker, regulated DC power supply, and microphone. When power is turned on, the radio can be used for receiving or transmitting radio messages. Receiving and transmitting radio messages are described in paragraphs 5-6.2 and 5-6.3.

5-6.2 Receiving radio messages. After radio is turned on, the antenna picks up incoming radio waves. These input radio waves are then converted into sound (audio) output signals to produce words and sounds through the radio speaker.

5-6.3 Transmitting radio messages. After the radio is turned on and the microphone push-to-talk button is pressed, words spoken into the microphone are converted into radio waves in the transceiver. The radio waves are then broadcast from the antenna for reception by other radio stations.

5-7 Operating Instructions

5-7.1 Operating controls and indicators. Controls and indicators for radio communications system major components are shown in Figures 5-6 thru 5-11.

5-7.2 Prestart procedures. The following prestart procedures should be performed by system operator before activating radio communications system.

a. Perform before operation checks below as appropriate:

(1) Make sure Army radio and marine radio installations are complete, connected to a power source and electronically connected.

(2) Make sure walkie-talkie battery pack is fully charged.

CAUTION

Use only clean water and a cloth to clean plastic surfaces. Do not paint plastic surfaces. Damage to plastic will result if cleaned with solvent or painted.

(3) Check for corrosion or rust. Clean and touch up paint as necessary, in accordance with TB 43-0144, to match surroundings.
 (a) When cleaning, avoid damaging insulation, mounting system, and hardware, or impairing electrical/electronic properties of item being cleaned.
 (b) Vacuum internal portions of electronic components.
 (c) Wipe dirt from external sources, except plastics, with dry cheesecloth or, if necessary, with a soapy cloth. Cloth should be damp but not dripping wet.
 (d) Avoid using solvents for cleaning internal portions of electrical/electronic equipment. Solvents leave a greasy film on components and may reduce electrical conductivity.
(4) Check controls of components to make sure knobs are not missing, broken, or loose and that controls turn properly.
(5) Check for loose plugs and jacks. Tighten if necessary.
(6) Check for loose mountings, hardware, brackets, etc. Tighten as necessary.
(7) Make sure Army radio and marine radio antennas are properly installed.

b. Make sure power switches are set to OFF position for all radio system operating equipment.

c. Make sure correct power fuses are installed in the radio equipment as specified in the following table.

CAUTION

Be sure proper fuse ampere rating and type are Installed as listed in the following table. If a larger ampere-rated fuse is installed, damage to equipment circuitry can occur.

Operating equipment	Fuse rating	Location
Army radio power supply	3A ac	Front panel of power supply
Marine radio	10A	ac power cord to radio
Walkie-talkie	3/4A	In series with power input circuit from CNB4 ni-cad battery pack

d. Make sure circuit breakers are dosed (ON) for the radio equipment specified in the following table.

Radio Equipment	Circuit breaker no.	Panel	Location
Army radio	3P14	24 Vdc power panel	Workshop on aft bulkhead
Army radio power supply	12P13A-4	Isolating receptacle panel	Workshop on aft bulkhead
Marine radio and radio power supply	10P13A-8	Emergency light panel	ROWPU space on forward starboard bulkhead
Walkie-talkie battery charger	N/A	N/A	N/A

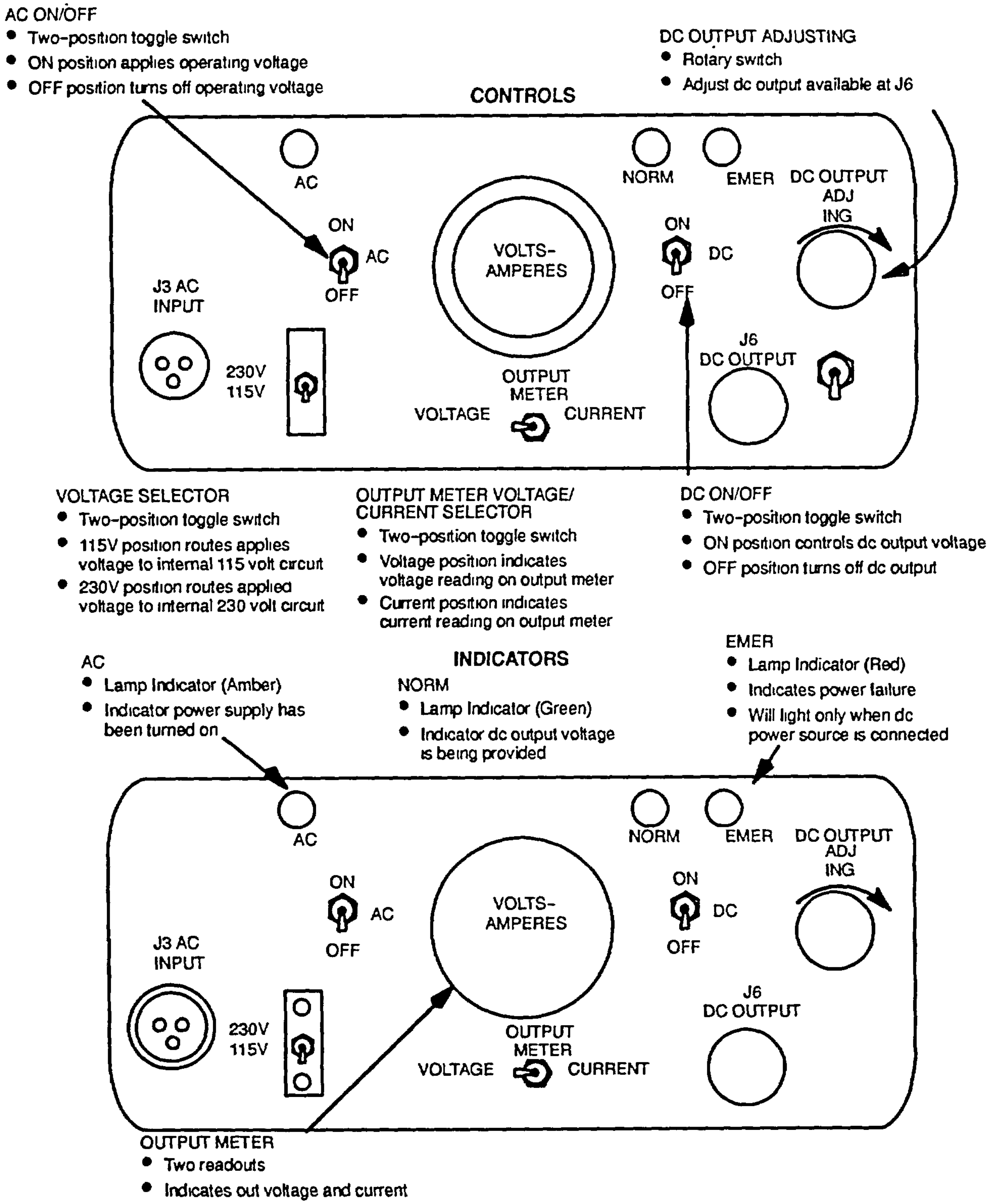


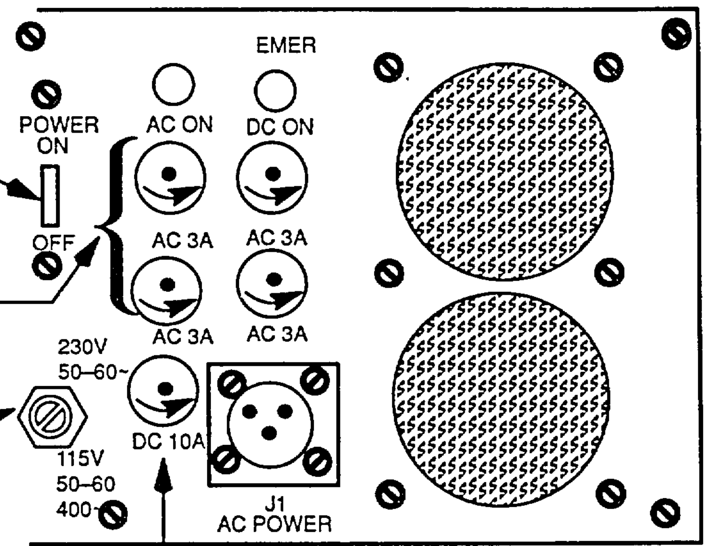
Figure 5-5. Army Radio Power Supply PP-6224 A/U Controls and Indicators (Barge 1)

CONTROLS

POWER ON/OFF
- Two–position toggle switch
- ON position applies operating voltage and controls dc output
- OFF position turns off operating voltage and output voltages

AC3A
- Four, 3 ampere powering fuses
- During operation protects the Power Supply from line surges, application of incorrect voltages, and part malfunctions

VOLTAGE SELECTOR
- Two–position rotary switch
- Routes applied voltage to internal circuits
  230V 50–60–230 volts ac input
  115 50–60 400–115 volts ac input



DC 10A
- 10 ampere output fuse
- During operation protects the Power Supply from excessive load current draw.

INDICATORS

EMER DC ON–EMER DC
- Lamp Indicator (Red)
- Indicates ac power failure
  Will light ONLY when emergency dc power source is connected

AC ON
- Lamp Indicator (Green)
- Indicator Power Supply has been turned on and dc output voltage is available

NOTE

Model PP–2953/U has no dc output indicator lamp AC indicator lamp will not light if no dc is available, but the blower will still operate

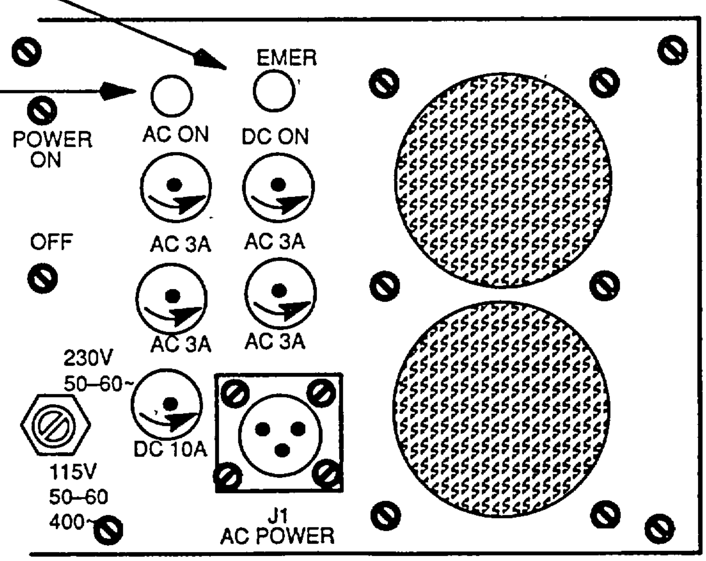
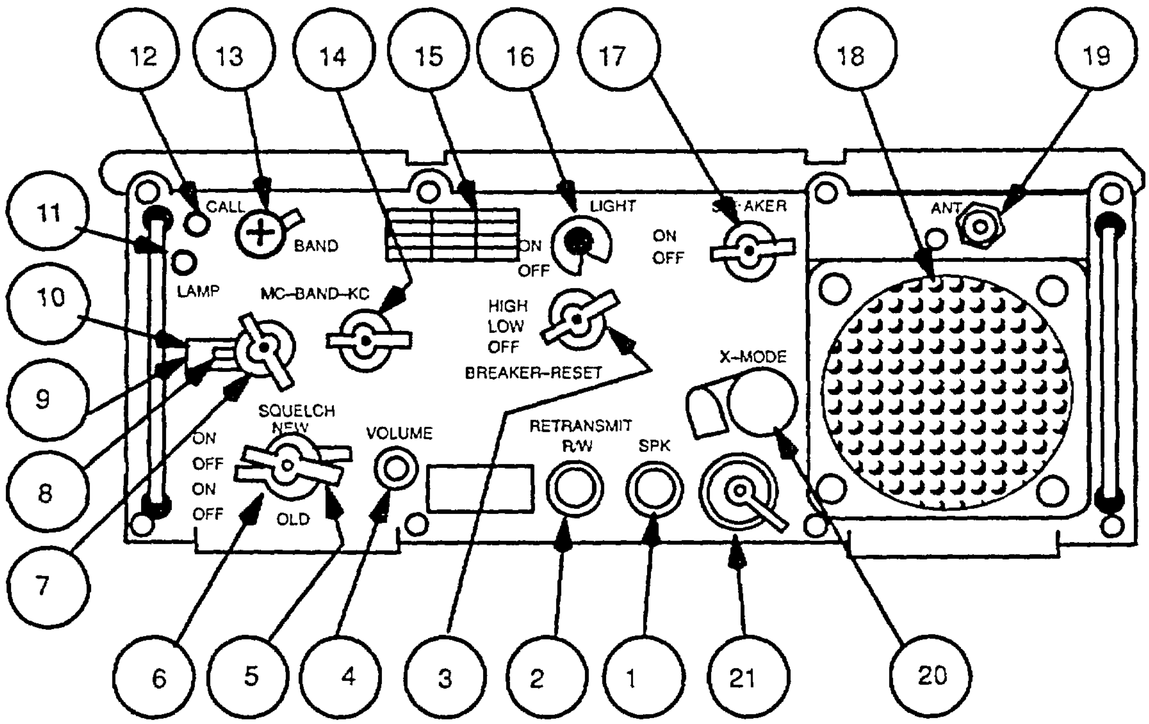
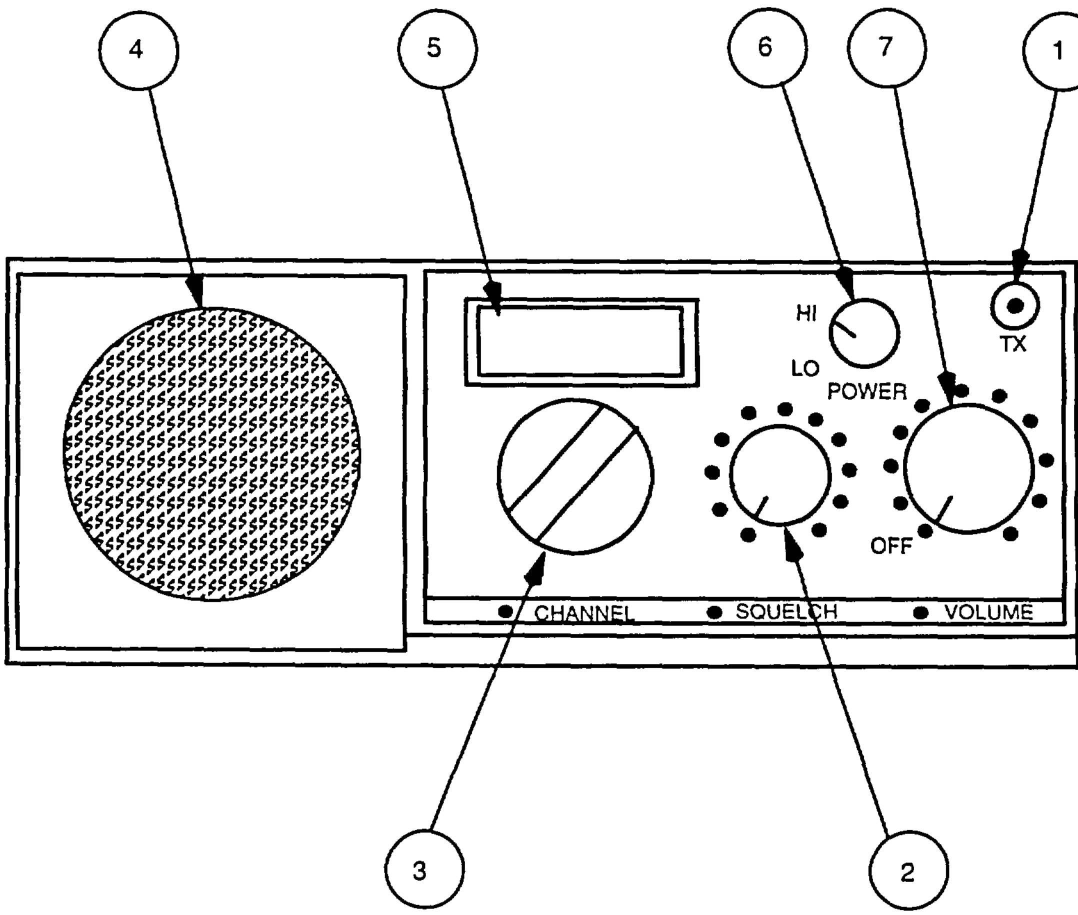


Figure 5-6. Army Radio Power Supply PP-2953/U Controls and Indicators (Barges 2 and 3)



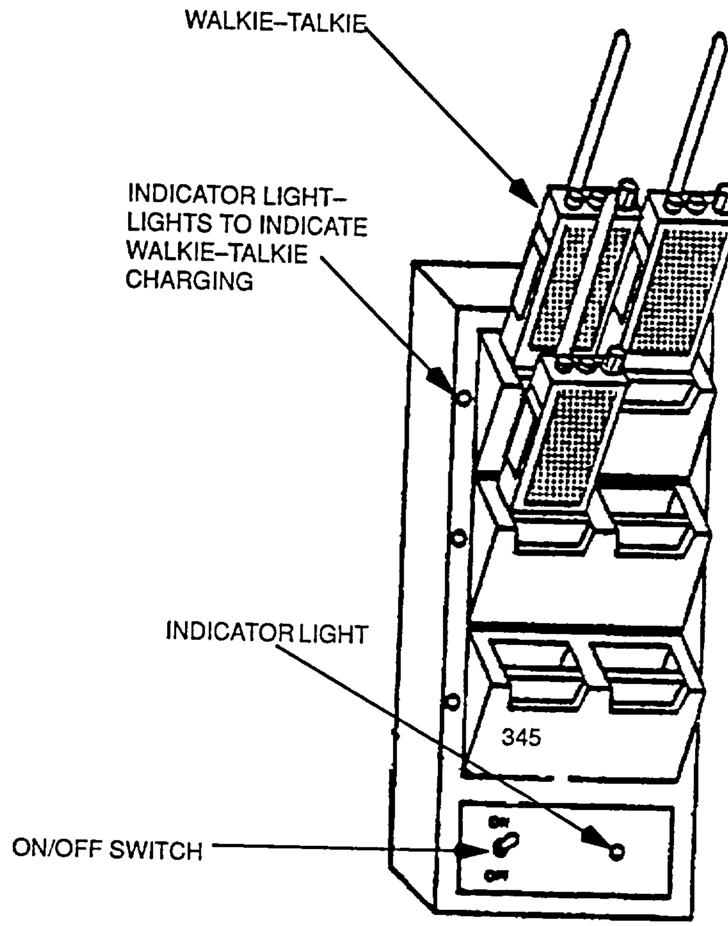
1. SPKR Receptacle
2. RETRANSMIT R/W Receptacle
3. BREAKER-RESET Power Switch
4. VOLUME Control
5. Latch (Mechanical-Lock Device)
6. SQUELCH Control
7. MC TUNE Control
8. Band Shutter Dial Window
9. KC Frequency Display
10. MC Frequency Display
11. LAMP Control Indicator
12. CALL Control Indicator
13. BAND Selector Switch
14. KC TUNE Control -
15. Frequency Write-in Plate
16. LIGHT Selector Switch
17. SPEAKER Selector Switch
18. Speaker
19. ANT Receptacle
20. X-MODE Receptacle (cover contains wiring)
21. ANT CONT Receptacle

Figure 5-7. Army Radio Controls and Indicators



1. TX Control Indicator
2. SQUELCH Control
3. CHANNEL Selector Switch
4. Speaker
5. Channel Indicator Display
6. HI-LO POWER Selector Switch
7. VOLUME Control

Figure 5-8. Marine Radio Controls and Indicators

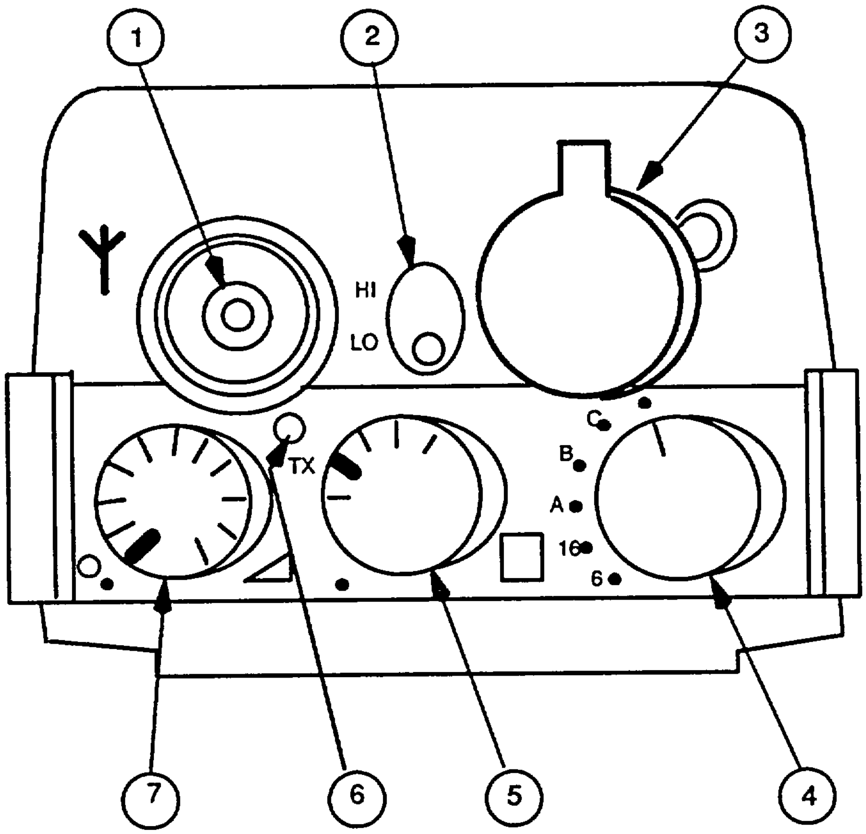


NOTE:

Input cord/plug from 120/220/240 Vac, 50/60 Hz power source not shown.

Figure 5-9. Walkie-Talkie Battery Charger Controls and Indicators

TOP VIEW



1. Antenna Receptacle
2. HI-LO Power Switch
3. External Speaker/ Microphone Receptacle
4. Channel Selector Switch
5. Squelch Control
6. TX Control Indicator
7. Volume-ON/OFF Control

Figure 5-10. Walkie-Talkie Controls and Indicators

5-7.3 Operating procedures. Radio operators must comply with FCC and Army radio communications procedures when operating any radio. These procedures are available in FCC regulations, Army radio training materials and SSI/SOI. They are not part of these instructions. The following paragraphs describe normal technical operations:

5-7.3.1 Army radio

a. Perform following to turn on Army radio:
   (1) Turn power supply (Figures 5-6 and 5-7) ac voltage selector switch to 115V, 50-60 Hz, 400-cycle position.
   (2) Turn power supply POWER ON/OFF switch to ON. Green ac ON indicator lamp should light.
   (3) Turn radio (Figure 5-8) BREAKER-RESET power switch to LOW.
   (4) Set radio LIGHT selector switch to ON so that LAMP and CALL control indicators light.

CAUTION

Do not use following frequencies because they will cause improper operation of Army radio: 33.90 Hz, 45.20 Hz, 56.50 Hz, and 67.80 Hz. Do not use frequencies that are separated exactly by 5.75 Hz or 23.00 Hz.

b. On Army radio (Figure 5-8), perform following to receive transmissions from another Army radio station:

NOTE

Radio operator must obtain assigned frequencies (primary and alternate), network, and call signs for barge radio and other stations to be contacted. Frequencies, call signs, and network organizations are obtained from SSI/SOI. Unit headquarters provide extracts of SSI and SOI.

   (1) Turn BAND selector switch to either A or B position for desired frequency band.

NOTE

When using SQUELCH control, radio background noise is silenced when transmitter is not keyed. Newer model FM radio sets use a squelch control which automatically disables radio squelch circuitry. For reliable communications, make sure that both distant radio stations and barge and workboat radio squelch controls are in same position, i.e., NEW ON or OLD ON. If unsure of distant station squelch control setting, initially tune with squelch in either OFF position.

   (2) For SQUELCH operation, turn SQUELCH control to either NEW ON or OLD ON, as appropriate.
   (3) Turn MC TUNE control to desired MHz frequency. MC TUNE control provides manual tuning of radio in 1 MHz steps as indicated by outer section of dial window.
   (4) Turn KC TUNE control to desired kHz frequency. KC TUNE control provides manual tuning of radio in 0.05 Hz steps as indicated by inner section of dial window.
   (5) Turn SPEAKER selector switch to ON position and adjust to a comfortable listening level.

c. On Army radio (Figure 5-8), perform following to transmit to a radio station on your frequency in your radio net:

NOTE

If there are problems with Interference, have IDS/IGS maintenance check interfering frequency charts to make sure interference-free frequency is being used.

WARNING

Do not touch Army radio antenna while radio is transmitting. Antenna contains high voltage which can cause serious injury.

(1) Perform step b, (1) thru (5) in paragraph 5-7.3.1
(2) Remove microphone from mounting. Key Army radio set by pressing and holding the PUSH-TO-TALK button.
(3) Speak into microphone using proper radio call signs and procedures.

NOTE

A sidetone should now be heard in the loudspeaker. Request distant station transmit to you and then release PUSH-TO-TALK button. Sidetone should stop. Blower will continue to run If equipment is warm; otherwise, it will stop.

(4) Listen to loudspeaker for signal from distant station and readjust SPEAKER control to obtain a comfortable listening level.

NOTE

If desired radio station cannot be reached on LOW power setting, repeat step c, (1) thru (4) In paragraph 5-7.3.1, using HIGH power setting.

5-7.3.2 Commercial marine radios. These radios operate in the 156.250-162.550 MHz frequency range, develop up to 25 watts of radio frequency (RF) power, receive 50 channels for operational and environmental announcements, and transmit on 46 channels. When barge is deployed in US coastal waters and marine radio is not being used for two-way communications, monitor channel 16. Both USCG and commercial vessels initiate contact on this channel.

a. When using the radios for two-way communications, observe secure transmission procedures as specified in unit Communication Electronics Operation Instructions.

b. Perform following to turn on the marine radio:
   (1) On marine radio power supply, set power switch to ON.
   (2) On marine radio (Figure 5-9), turn VOLUME control clockwise to mid-position on dial.

c. Perform the following to receive from a remote radio station:
   (1) On marine radio, turn CHANNEL selector switch to the desired channel in accordance with Table 5-2. In most instances channel 16 is used to establish initial contact and for DISTRESS and SAFETY communications. Once contact is made on channel 16, the appropriate working channel is selected and set.

NOTE

Selection of channel 15 or channel 17 automatically reduces radio output power to 1 watt, in compliance with US FCC regulations.

   (2) Select/set the desired HI/LO power setting.
   (3) Turn SQUELCH control clockwise until background noise just disappears. Do not adjust control beyond this point or the marine radio receiver sensitivity will be reduced.
   (4) When message is received, adjust VOLUME control to obtain desired listening level.

d. Perform the following to transmit to a remote radio station.

NOTE

Do not transmit on frequencies assigned to other radio sets. Refer to Table 5-2 for a general listing of channel assignments and the purpose for which these channels are to be used.

(1) Turn HI-LO POWER selector switch to desired setting.

NOTE

HI-LO POWER selector switch should initially be set in LO position (1 watt RF output power) for near stations (1-2 miles). Use HI position (25 watt RF output power) when contact cannot be made using low power (LO position) or for distant stations (over 2 miles).

(2) Turn CHANNEL selector switch to obtain desired channel, normally channel 16, to establish initial contact. (Channels 16 and 22 are always monitored by the USCG.)

NOTE

Refer to Table 5-2 to select the proper channel to be used as a working channel after initial contact. Before transmitting on the working channel, make sure channel selected is not in use.

(3) Hold microphone about 1 inch from the mouth, press and hold PUSH-TO-TALK button on microphone, and speak into it slowly and distinctly.
(4) When message is complete, release PUSH-TO-TALK button so acknowledgment and incoming messages can be received. Marine radios cannot receive incoming messages while transmitting. Wait until incoming message is completed before pressing PUSH-TO-TALK button again to transmit.

5-7.3.3 Walkie-talkies. The three walkie-talkies are solid state VHF/FM transceivers that operate in the 156.025 to 157.425 MHz frequency range. These frequencies and channels are within the marine radio band as indicated in Table 5-2. Each walkie-talkie operates on six channels: two channels are preprogrammed (i.e., channel 6 for intership safety and channel 16 for distress, safety and calling), and A, B, C, and D which may be programmed by the operator. Each walkie-talkie develops 1 or 5 watts of RF output power.

NOTE

Walkie-talkie battery charger should be connected to a 115 Vac power source.

a. Perform the following to receive incoming messages:
(1) Remove walkie-talkie from battery charger (Figure 5-10).
(2) Attach external VHF antenna to receptacle (Figure 5-11) if not in place.
(3) Turn VOLUME ON/OFF control clockwise to mid-position on dial.
(4) Turn squelch control fully counterclockwise.
(5) Set channel selector switch to desired position.
(6) Turn SQUELCH control clockwise until background noise disappears.
(7) When message is received, adjust VOLUME/ON/OFF control to desired listening level.

Table 5-2. Frequency/Channel Chart for Commercial Marine Radios in USA

Channel	TX frequency	Rx frequency	Channel assignment
01	-- -- --	162.550	Weather
02	-- -- --	162.400	Weather
03	-- -- --	162.475	Weather
05	156.250	156.250	Port operations-intership-ship/coast
06	156.300	156.300	Intership safety
07	156.350	156.350	Commercial intership-ship/coast
08	156.400	156.400	Commercial intership
09	156.450	156.450	Noncommercial intership-ship/coast
10	156.500	156.500	Commercial Intership-ship/coast
11	156.550	156.550	Commercial intership-ship/coast
12	156.600	156.600	Port operations-intership-ship/coast
13	156.650	156.650	Navigational intership-ship/coast
14	156.700	156.700	Port operations-intership-ship/coast
15	-- -- --	156.750	Environmental-ship/coast
16	156.800	156.800	DISTRESS, SAFETY, and calling
17	156.850	156.850	State control-ship/coast
18	156.900	156.900	Commercial intership, ship/coast
19	156.950	156.950	Commercial intership, ship/coast
20	157.000	161.600	Port operations-intership-ship/coast
21	157.050	161.650	Port operations
22	157.100	157.100	USCG liaison-EMERGENCY
23	157.150	157.150	US government
24	157.200	161.800	Public - ship/coast
25	157.250	161.850	Public - ship/coast
26	157.300	161.900	Public - ship/coast
27	157.350	161.950	Public - ship/coast
28	157.400	162.000	Public - ship/coast

Table 5-2. Frequency/Channel Chart for Commercial Marine Radios in USA

Channel	TX frequency	Rx frequency	Channel assignment
65	156.275	156.275	Port operations-intership-ship/coast
66	156.325	156.325	Port operations-intership-ship/coast
67	156.375	156.375	Commercial intership
68	156.425	156.425	Noncommercial intership-ship/coast
69	156.475	156.475	Noncommercial intership-ship/coast
70	156.525	156.525	Noncommercial intership
71	156.575	156.575	Noncommercial intership-ship/coast
72	156.625	156.625	Noncommercial intership
73	156.675	156.675	Port operations-intership-ship/coast
74	156.725	156.725	Port operations-intership-ship/coast
77	156.875	156.875	Commercial intership
78	156.925	156.925	Noncommercial intership-ship/coast
79	156.975	156.975	Commercial intership-ship/coast
80	157.025	157.025	Commercial intership-ship/coast
81	157.075	157.075	US government only
82	157.125	157.125	US government only
83	157.175	157.175	US government only
84	157.225	157.825	Public-ship/coast
85	157.275	161.875	Public-ship/coast
86	157.325	161.925	Public-ship/coast
87	157.375	161.975	Public-ship/coast
88	157.425	157.425	Commercial intership

NOTE

Following procedures are performed using the controls and receptacles on top of the walkie-talkie. Each walkie-talkie must have a VHF antenna. If one is not available, obtain part number from Appendix G in TM 55-1930-209-14&P-12 and requisition a replacement.

b. Perform the following to transmit messages to another station on the same frequency:

NOTE

Before transmitting, listen to channel to be used to make sure it is not presently being used. Make sure external VHF antenna is connected to receptacle on top of unit.

(1) Set HI-LO power switch to desired setting.

NOTE

Use low power setting when communicating with stations within 100 yards of location.

(2) Speak slowly and distinctly into built-in microphone located in lower left comer of speaker grille, while pressing PUSH-TO-TALK button on side of walkie-talkie.
(3) If using an external microphone, associated PUSH-TO-TALK button will activate walkie-talkie.

5-7.4 Shutdown procedures

5-7.4.1 Army radio

a. On Army radio (Figure 5-8), set LIGHT selector switch to OFF. The LAMP and CALL control indicators will go out. Then turn BREAKER-RESET power switch to OFF.
b. On Army radio power supply (Figure 5-6 and Figure 5-7), turn POWER ON/OFF switch to OFF. The AC ON green light will go out.
c. Perform before operation checks in paragraph a as appropriate.

5-7.4.2 Marine radio

a. On marine radio (Figure 5-9), turn VOLUME control fully counterclockwise.
b. On marine radio power supply, set power switch to OFF.

5-7.4.3 Walkie-talkies

a. On walkie-talkie, turn VOLUME-ON/OFF control fully counterclockwise.
b. Replace walkie-talkie in battery charger receptacle and make sure red light next to it goes on to indicate continued charging of walkie-talkie. If red light does not come on, make sure battery charger ON/OFF switch is in ON position.

Section III. Foghorn equipment

5-8 Description. The foghorn produces an omnidirectional sound to warn approaching vessels of barge location during periods of poor visibility. The foghorn shown in Figure 5-12 consists of the major components listed in Table 5-3. Equipment specifications, maintenance information, and manufacturers' service manuals are contained in TM 55-1930-209-14&P-12, Communications System.

5-9 Capabilities. The foghorn meets USCG requirement 33 Code of Federal Regulations (CFR) 67 for a 1/2-mile sound signal. It sounds automatically for approximately 2 seconds, is silent for 18 seconds, and repeats the cycle until turned off. The foghorn sound can be heard in all directions.

5-10 Special limitations. The foghorn does not provide any warning to barge crewmembers of approaching vessels.

5-11 Performance characteristics

Power input	12 Vdc, 2A
Frequency	390 ±.3 Hz
Distance of sound	1/2 mile in all directions
Frequency of sound	2 seconds with 18 seconds silence
Sound level	122.7 dB @ 12V

5-12 Description of operation. When foghorn ON/OFF switch on foghorn remote control is set to ON and foghorn button is pushed, foghorn will automatically sound periodically. Foghorn sounds until switch is set to OFF.

5-13 Operating Instructions

5-13.1 Operating controls and Indicators. Foghorn controls are shown in Figure 5-12.

5-13.2 Prestart procedures. Following procedures are performed by operator before activating foghorn.

a. Perform before operation checks below:

   (1) Make sure foghorn installation is complete.
   (2) Check for corrosion or rust. Clean and touch up paint as necessary. See paragraph 5-7.2a.
   (3) Check controls to make sure that switches or pushbuttons are not missing, broken, or loose and that controls operate properly.
   (4) Check for loose plugs and jacks. Tighten if necessary.
   (5) Check for loose mountings, hardware, brackets, etc. Tighten as necessary.

b. Make sure foghorn ON/OFF switch is OFF.
c. Make sure circuit breaker 6P14 on 24 Vdc power panel is dosed (ON).

5-13.3 Operating procedures

a. Turn foghorn ON/OFF switch on remote control box (Figure 5-12) to ON.
b. Push in foghorn button to start foghorn sound.

NOTE

Foghorn sounds for 2 seconds, is silent for 18 seconds, and repeats cycle until stopped.

5-13.4 Shutdown procedure. When foghorn is to be stopped, set foghorn ON/OFF switch to OFF. Perform before operation checks in paragraph 5-13.2a as appropriate.

Table 5-3. Foghorn Major Components

Component	Location	Function
Foghorn remote control	Dayroom on forward bulkhead	For manual or automatic activation of foghorn
Regulator	Dayroom on forward bulkhead	Converts 24 Vdc input to 12 Vdc output required by foghorn
Foghorn	Deckhouse top on portside forward	Produces an omnidirectional signal that can be heard 1/2 mile away

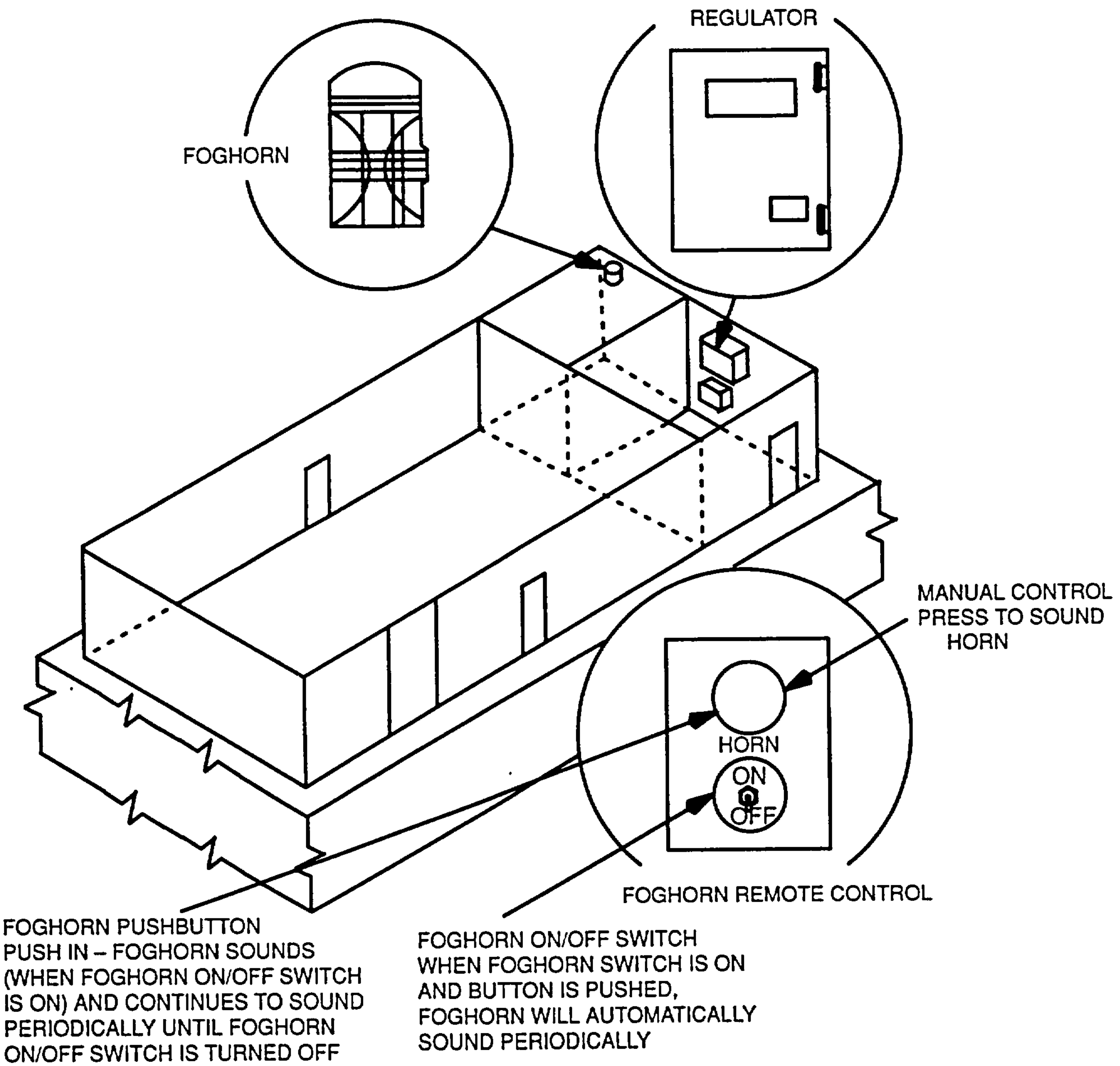


Figure 5-11. Foghorn Major Component Location

Section IV. Telephone system

5-14 Description. The telephone system is an intercom/paging system used for communicating between a system operator in the dayroom and 12 crew telephone stations. The system can also be used for communicating between crew telephone stations. Twelve telephone stations are connected to 21 headset stations that are serviced by 14 buzzers, 3 strobe lights and 10 telephone set stowage boxes. Their locations, station numbers, and equipment are listed in Table 5-4.

The telephone system shown in Figure 5-13 consists of the components listed in Table 5-5. Equipment specifications, maintenance information, and manufacturers' service manuals are contained in TM 55-1930209-14&P-12.

5-15 Capabilities. Telephone system provides two-way conversation capability between a dayroom system operator and crewmembers at 21 telephone headset stations or between crewmembers at these stations.

5-16 Special limitations. Paging can be done only from the dayroom telephone station selector. However, after a telephone headset has been plugged into a headset station jack receptacle, a crewmember can talk through the speaker to page dayroom system operator, talk to dayroom system operator or talk to another headset station.

5-17 Performance characteristics

a. Telephone power amplifier

Input impedance	80,000 ohms minimum
Output	2 watts 24 Vdc and 16 ohms
Gain	32 dB

b. Telephone speaker

Input impedance	8 ohms

c. Telephone power control module

Power input	24 Vdc nominal
Output current	0.5 A

d. Telephone headset

Microphone	M-1/dc Amplified Dynamic, nominal 100 ohms
Earphone	Dynamic, nominal 300 ohms
Noise capacity	125 dB

e. Strobe light

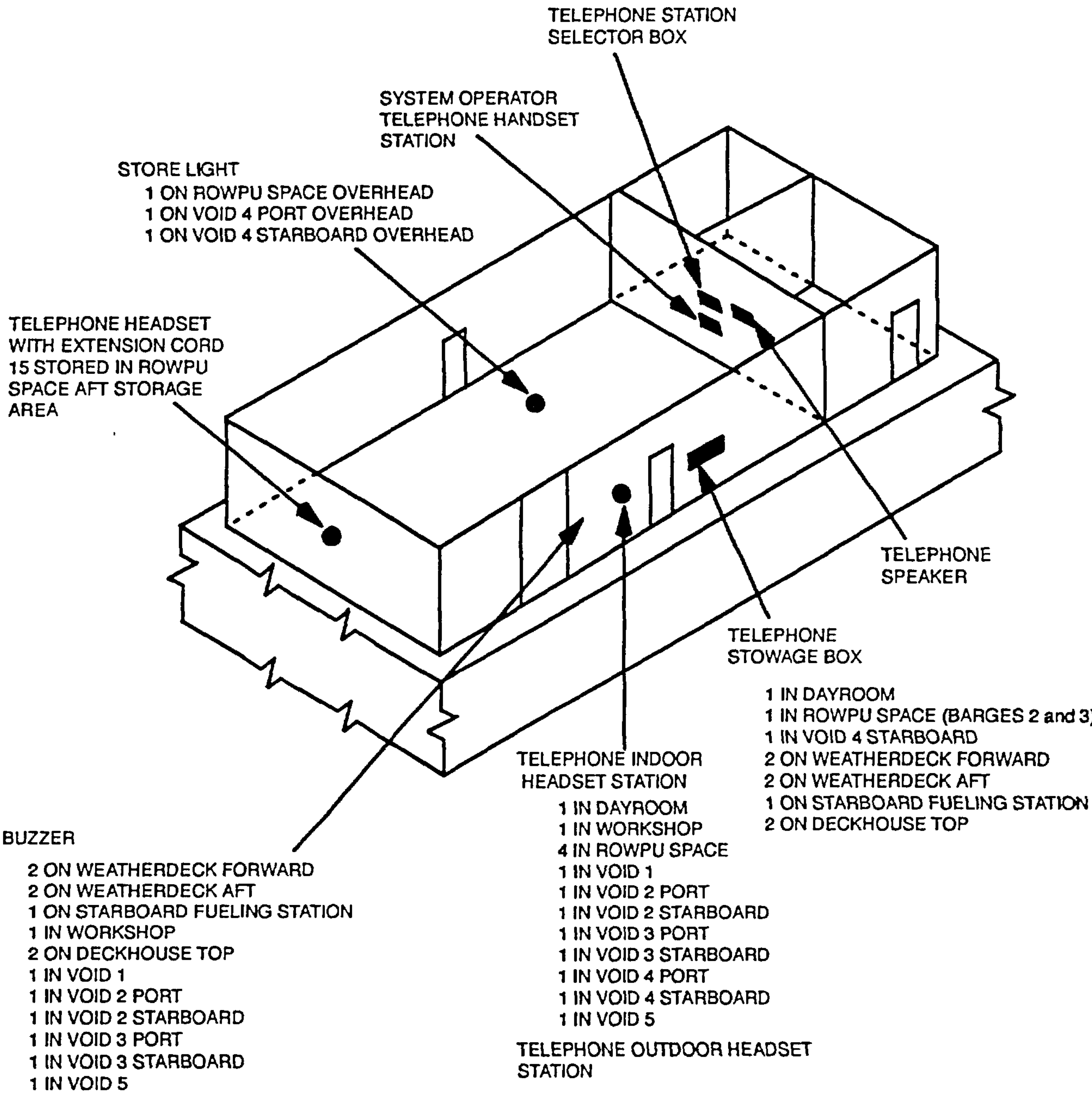
Input power requirement	120 Vac, 50/60 Hz
Light output	500,000 candlepower, 60 flashes/min, white

f. Buzzer

Input power requirement	120 Vac, 50/60 Hz

Table 5-4. Locations of Telephone Stations and Equipment

Location	Station	Equipment
Dayroom	Control station	1 buzzer selector box 1 headset station 1 stowage box 1 speaker
Workshop	Station 1	1 headset station 1 buzzer
ROWPU space	Station 2	4 headset stations: 1 near switchboard, 1 near EMS, 1 near ROWPU 1 control station, 1 near ROWPU 2 control station. 1 strobe light on overhead 1 stowage box
Void 2 port (chlorination)	Station 3	1 headset station 1 buzzer
Void 1 (bow crane hydraulic pump)	Station 4	1 headset station 1 buzzer
Void 3 port (SD pump)	Station 5	1 headset station 1 buzzer
Void 2 port, starboard (generators)	Station 6	2 headset stations; one in each void 2 buzzers; one in each void 2 strobe lights; one on each void overhead 1 stowage box in starboard
Void 5 (SD hydraulic pump)	Station 7	1 headset station 1 buzzer
Weatherdeck aft	Station 8	2 headset stations; one near each anchor winch 2 stowage boxes 2 buzzers
Deckhouse top	Station 9	2 headset stations; one forward, one aft 2 stowage boxes fore and aft 2 buzzers
Weatherdeck starboard (fuel oil 1 fill station)	Station 10	1 headset station 1 stowage box buzzer
Void 2 port and starboard	Station 11	2 headset stations 2 buzzers
Weatherdeck (anchor winch)	Station 12	2 headset stations; one near each anchor winch 2 buzzers



2 ON WEATHERDECK FORWARD IN STOWAGE BOX
2 ON WEATHERDECK AFT IN STOWAGE BOX
1 ON STARBOARD FUELING STATION IN STOWAGE BOX
2 ON DECKHOUSE TOP IN WATERTIGHT BOX

Figure 5-12. Telephone System Major Component Location

Table 5-5. Telephone System Major Components

Component /Quantity	Location	Function
Telephone power amplifier/1	Mounted in station selector box on aft bulkhead in dayroom	Amplifies calls from handset station so they can be heard at the headset stations
Telephone speaker/1	Located above operator's desk in dayroom	For converting signals from headset stations into sound
Telephone power control module/1	Mounted in station selector box on aft bulkhead in dayroom	Acts as regulator between power source and power amplifier
Telephone station selector box/1	Mounted on aft bulkhead in dayroom	For selecting telephone station (12 stations) to alert crew personnel by activating buzzer or strobe light, for controlling telephone power amplifier volume and for turning on/off 24 Vdc to telephone system
Telephone headset/15	Stored in the ROWPU space aft storage area	Allows crew personnel to receive incoming calls from system operator and transmit - messages (talk-back) when connected to associated headset station jack receptacle
Telephone station buzzer/14	Mounted throughout barge near headset stations	Alerts crew personnel at headset station that they are being paged
Telephone station strobe light/3	Mounted on overhead in center of ROWPU space and in void 4 port and starboard	Alerts crew personnel at headset station that they are being paged
Telephone indoor headset station/14	Mounted in dayroom, workshop, ROWPU space and each void	Allows crew personnel to plug in telephone headset and communicate with dayroom system operator or another headset station
Telephone outdoor headset station/7	Mounted on weatherdeck in 5 stowage boxes and on top of deckhouse in two watertight boxes	Allows crew personnel to plug in telephone headset and communicate with dayroom system operator or another headset station
Operator telephone handset station/1	Mounted on operator's desk in dayroom	Allows messages to be sent to and received from crew telephone stations

Table 5-5. Telephone System Major Components (Continued)

Component /Quantity	Location	Function
Telephone headset stowage box/10	2 on weatherdeck forward 1 in dayroom 1 in ROWPU space (Barges 2 and 3) 1 in void 4 starboard 1 on weatherdeck starboard (fuel oil fill) 2 on weatherdeck aft 2 on deckhouse top	For stowing headsets at telephone stations
Handset adapter module/1	Dayroom	Permits connection of telephone handset to telephone system

5-18 Description of operation

5-18.1 General. The telephone system has 11 major components: telephone station selector box containing power amplifier and power control module, speaker, headset, buzzer, strobe light, crew headset station, system operator handset station, 25-foot headset extension cord and headset stowage box. These components of the telephone system are used for paging between the dayroom system operator and crew personnel and for two-way communications between crew telephone stations. Various modes of communicating with this system are discussed in paragraphs 5-18.1.1 thru 5-18.1.3

5-18.1.1 Paging from system operator to crew personnel. When system operator in dayroom selects crew telephone station to be paged on telephone station selector panel and presses BUZZER switch on selector, station buzzer will sound and/or station strobe light will light.

5-18.1.1.1 Crewmembers, upon hearing buzzer or seeing strobe light, are alerted to connect their headset into headset station jack receptacle. To speak into headset microphone to let the system operator know that he is on line, the crewmember must press the PUSH-TO-TALK switch on the earphone. To listen to the system operator, the crewmember must release the PUSH-TO-TALK switch.

5-18.1.1.2 As soon as crewmember is on line, system operator stops buzzer/strobe by pressing BUZZER switch to OFF position. To speak, operator must remove telephone handset from cradle and speak into the handset microphone.

5-18.1.2 Paging from crew personnel to system operator. After crewmember plugs telephone headset into headset station jack receptacle, depresses PUSH-TO-TALK switch on earphone and speaks into microphone, his voice will be heard from dayroom speaker.

5-18.1.2.1 Upon hearing speaker page, system operator responds by selecting station to be communicated with on telephone station selector box, removes telephone handset from cradle and speaks into handset microphone.

5-18.1.2.2 Operator, using telephone handset, and crewmember, by pressing and releasing PUSH-TO-TALK button on earphone and speaking into headset microphone, can communicate.

5-18.1.3 Two-way communications between crew personnel. Crewmembers can communicate with each other after plugging telephone headsets into jack receptacles at headset stations.

5-19 Operating instructions

5-19.1 Operating controls and Indicators. Controls and indicators for the telephone system are shown in Figures 5-14 thru 5-17.

5-19.2 Prestart procedures. Following prestart procedures should be performed by operator before activating telephone system.

a. Perform before operation checks below:

(1) Make sure telephone system installation is complete.
(2) Check for corrosion or rust. Clean and touch up paint as necessary. See paragraph 5-7.2a.
(3) Make sure knobs or buttons are not missing, broken, or loose and controls operate properly.
(4) Check for loose plugs and jacks. Tighten if necessary.
(5) Check for loose mountings, hardware, brackets, etc. Tighten as necessary.
(6) Check for damage. Repair as necessary.

b. Make sure power switches are set to OFF position for all system operating equipment.

CAUTION

Make sure proper fuse ampere/voltage rating and type are installed in telephone equipment. If a larger ampere-rated fuse is used, this equipment will be damaged.

c. Make sure telephone power control module has a 0.5 A fuse in the fuse holder on the side of the telephone headset station selector (Figure 5-14).
d. Make sure circuit breakers are dosed (ON) in accordance with Table 5-6.

Table 5-6. Circuit Breakers

Equipment Supplied Power	Rating	Panel Circuit Breaker	Panel identification	Panel Location
Telephone system except headset station buzzers and strobe lights	24 Vdc	3P14	24 Vdc power panel	Workshop on aft bulkhead
Emergency light panel to provide power to emergency light panel	120 Vac	10P13	Power panel 3	ROWPU space on forward bulkhead
Headset buzzers and strobe light	120 Vac	10P13A-7	Emergency light panel	ROWPU space on forward bulkhead

5-19.3 Operating procedures. Telephone system normally requires a system operator in the dayroom. Normal operating procedures are described in the following paragraphs'

5-19.3.1 Talking with telephone station from operator station in dayroom

NOTE

Hold telephone handset approximately 1/2 to 1 inch from mouth for best results. When message is complete, hang up telephone handset on hook at mounting facility.

Any one of 12 crew telephone stations can be paged. Telephone stations 2, 6, 8, 9, 11, and 12 Include more than one telephone headset station.

a. On telephone station selector box (Figure 5-14), press telephone system PUSH-ON/PUSH-OFF button to supply 24 Vdc power to telephone system. Make sure white indicator light comes on.
b. On telephone station selector box, turn selector switch knob to station to be called.
c. On telephone station selector box, press BUZZER switch to ON position.

NOTE

Telephone headset station buzzer or strobe light at telephone station being paged is activated. Alarms alert crew to an Incoming call. Table 5-3 provides detailed headset station locations.

d. Operator removes telephone handset (Figure 5-15) from hook (hang-up switch) on side of radio operator's desk and checks that corresponding station is on line. Then, operator speaks into handset microphone.

NOTE

Telephone station being called should answer page using station location as a call sign.

e. When conversation is finished, system operator must return telephone handset to its cradle on the mounting facility.

5-19.3.2 Talking with system operator from crew telephone station. Perform following procedures when crewmembers at any telephone headset station use telephone system to talk with system operator in dayroom.

a. Connect telephone headset (Figure 5-16) to appropriate telephone headset station jack receptacle (Figure 5-16). Control volume by adjusting volume switch on headset station.

NOTE

Crewmember's voice is heard from dayroom speaker and speaker volume is adjusted by setting speaker volume switch on bottom of speaker (Figure 5-17) to desired loudness.

b. Press PUSH-TO-TALK switch on headset and speak into microphone using proper call signs. Release switch to hear system operator.
c. After system operator responds, send message.
d. Continue talking until communications are complete. Then, unplug telephone headset from headset station.

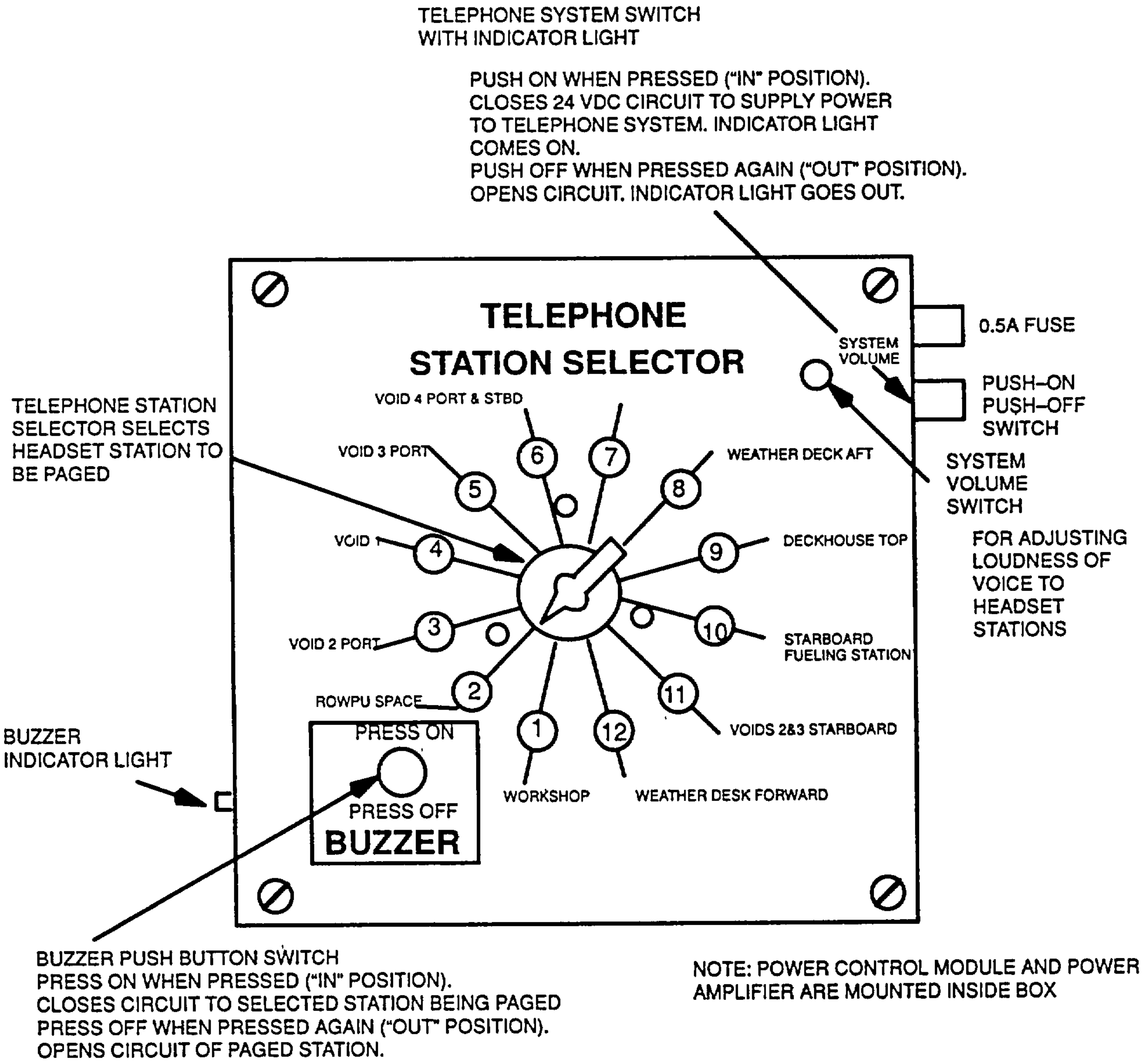


Figure 5-13. Telephone Station Selector Box Controls

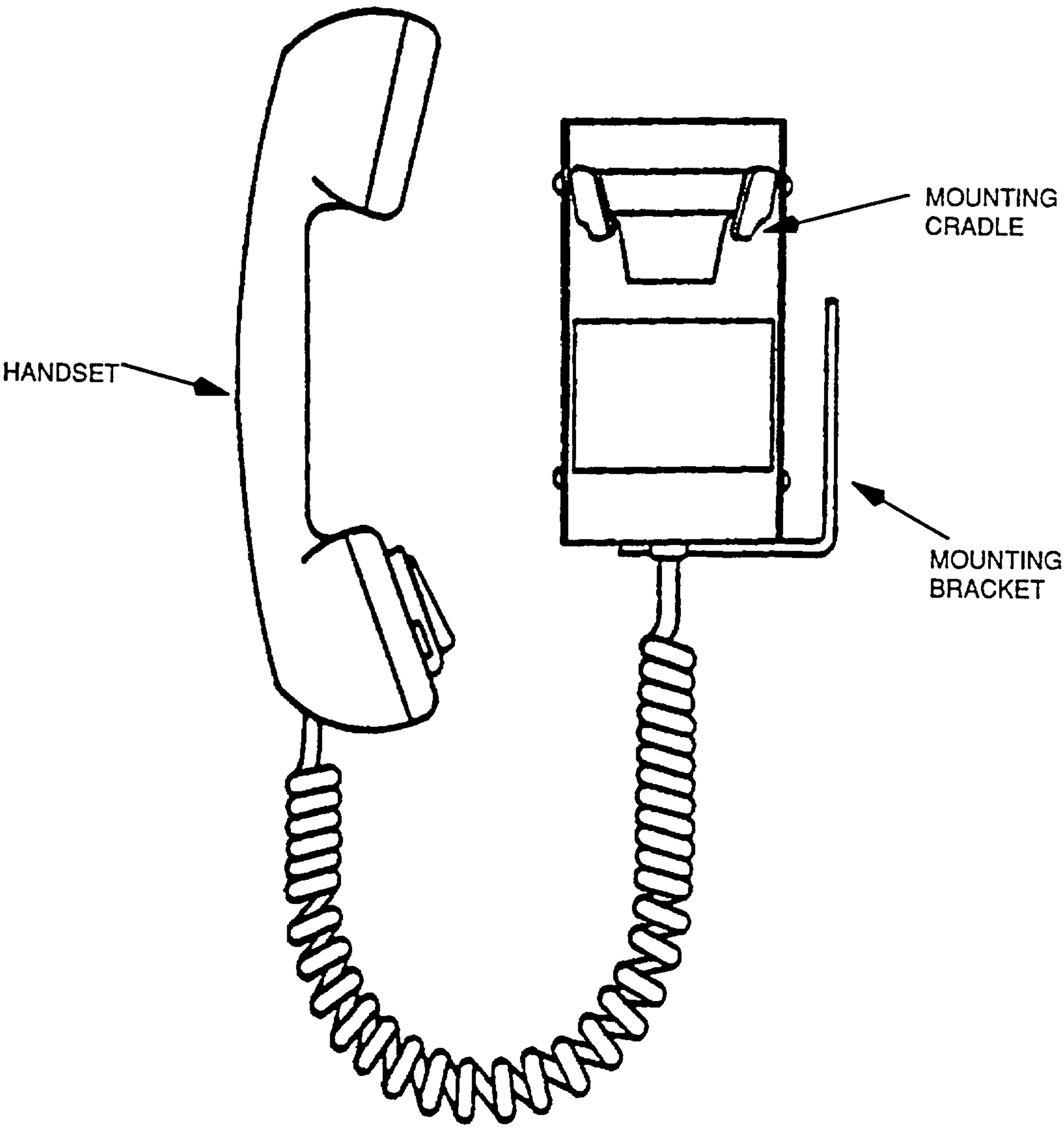


Figure 5-14. System Operator Telephone Handset Station

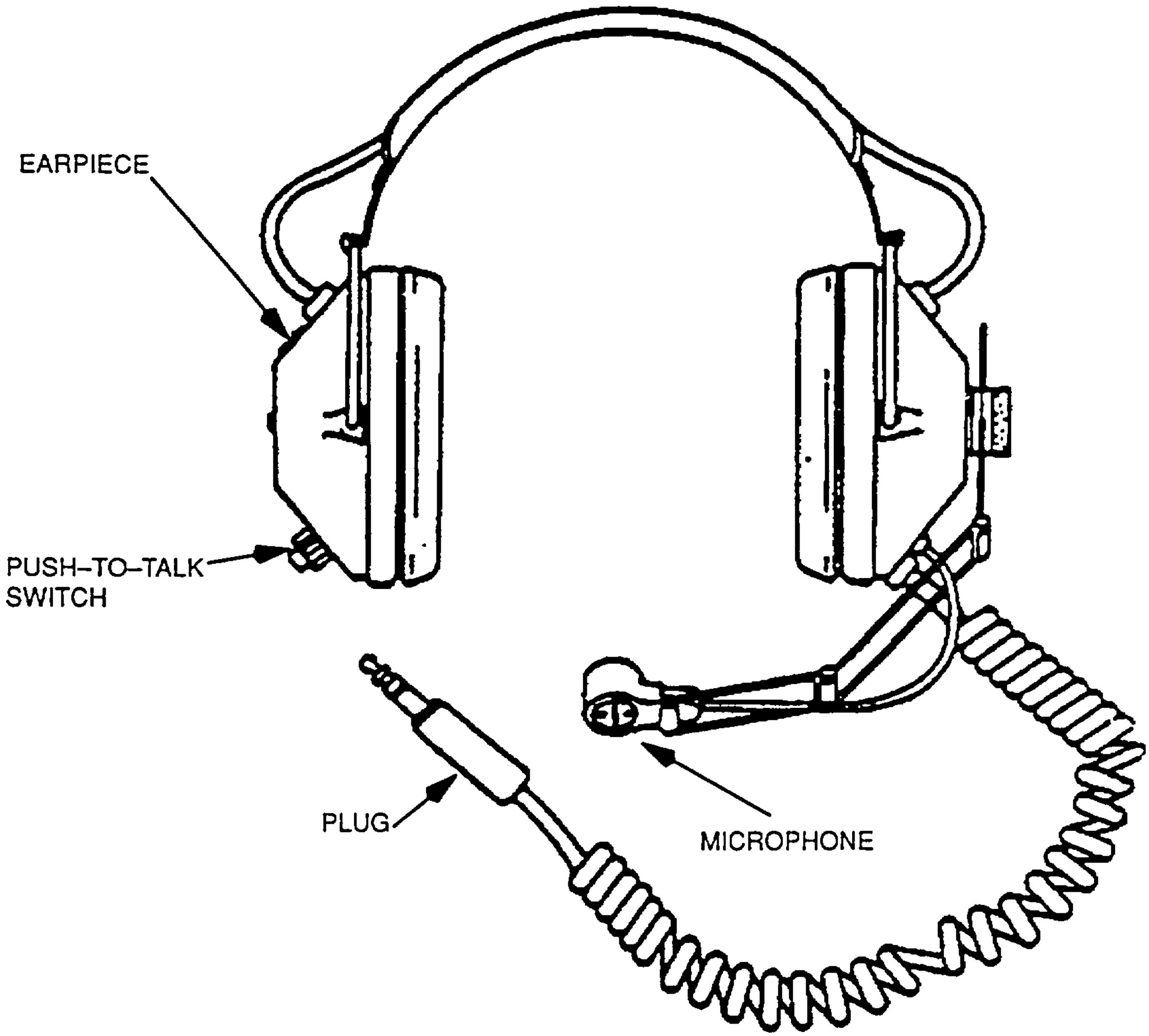
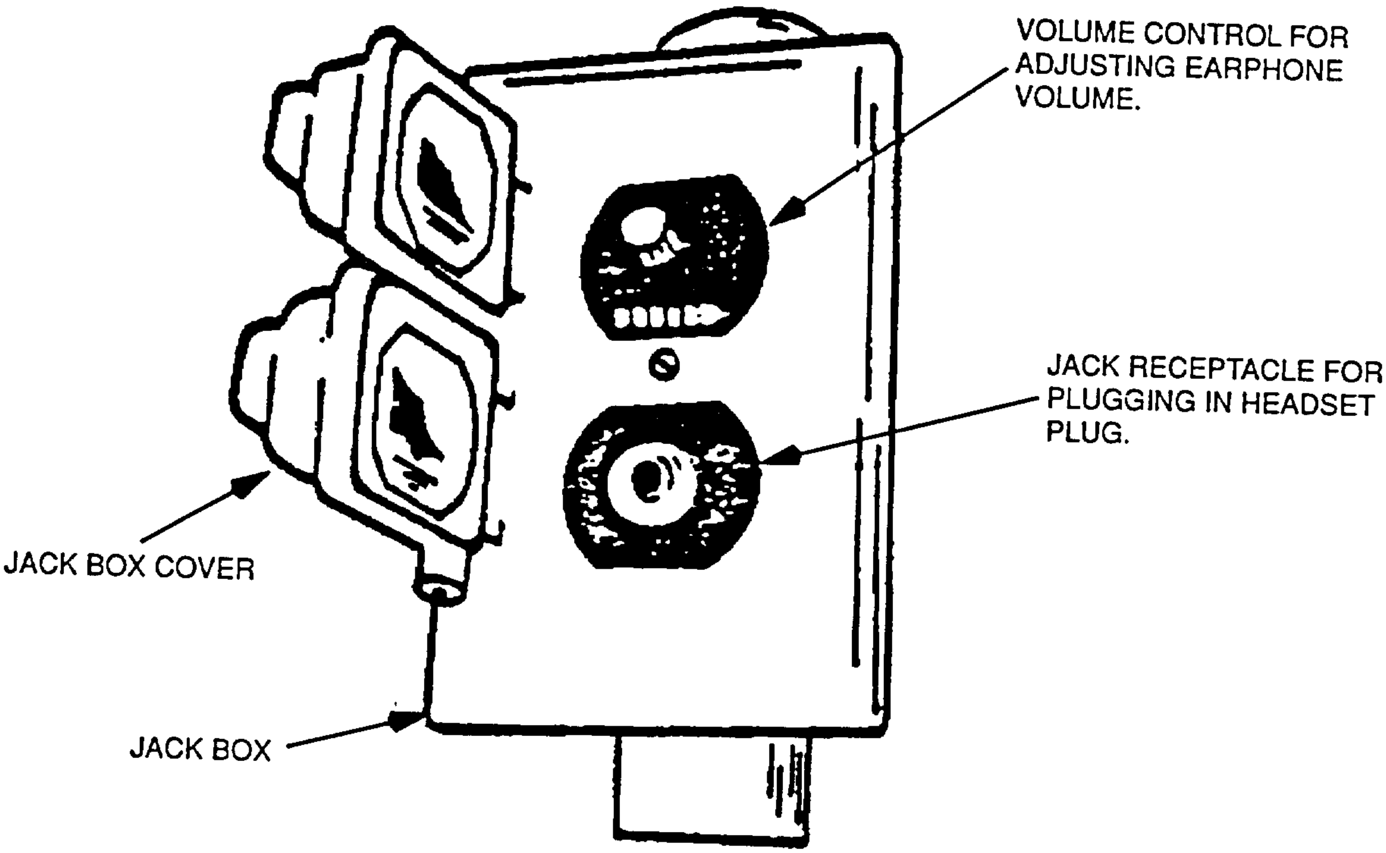


Figure 5-15. Telephone Headset Controls and Plug



NOTE:

HEADSET STATIONS ON BOW, STERN AND STARBOARD WEATHERDECK ARE INSTALLED IN STOWAGE BOXES. HEADSET STATIONS ON TOP OF DECK HOUSE FORE AND AFT ARE CONTAINED IN A WATERTIGHT BOX.

Figure 5-16. Telephone Headset Station

5-19.3.3 Talking between telephone stations. Crewmembers at any telephone station talk to other crewmembers at any other telephone station on line by following these procedures:

NOTE

Perform following procedures at front panel of the respective equipment unless otherwise noted. Telephone stations on line with each other from telephone station selector box are as follows: telephone stations 1-4, telephone stations 2 and 9-12, and telephone stations 2 and 5-8.

a. Connect telephone headset to appropriate telephone headset station jack receptacle.
b. Press PTT switch on earphone and speak into microphone using proper call sign. Control volume by adjusting VOLUME switch on headset station.

NOTE

Paged headset station should answer page with station location as a call sign.

c. After headset station responds, send message.
d. Continue talking until communications are complete. Then, unplug telephone headsets from headset station.

5-19.4 Shutdown procedures. When telephone system is to be shut down for any length of time, perform the following:

a. Make sure BUZZER switch on telephone buzzer station selector panel (Figure 5-14) is off.
b. Make sure telephone headsets with 25-foot extension cord are properly stored in either telephone stowage boxes or in ROWPU space aft storage area.
c. Press telephone system PUSH-ON/PUSH-OFF button to OFF (Figure 5-14). Make sure white indicator light goes out.
d. Open (OFF) circuit breakers 10P13A-7 on emergency light panel and 3P14 on 24 Vdc power panel.

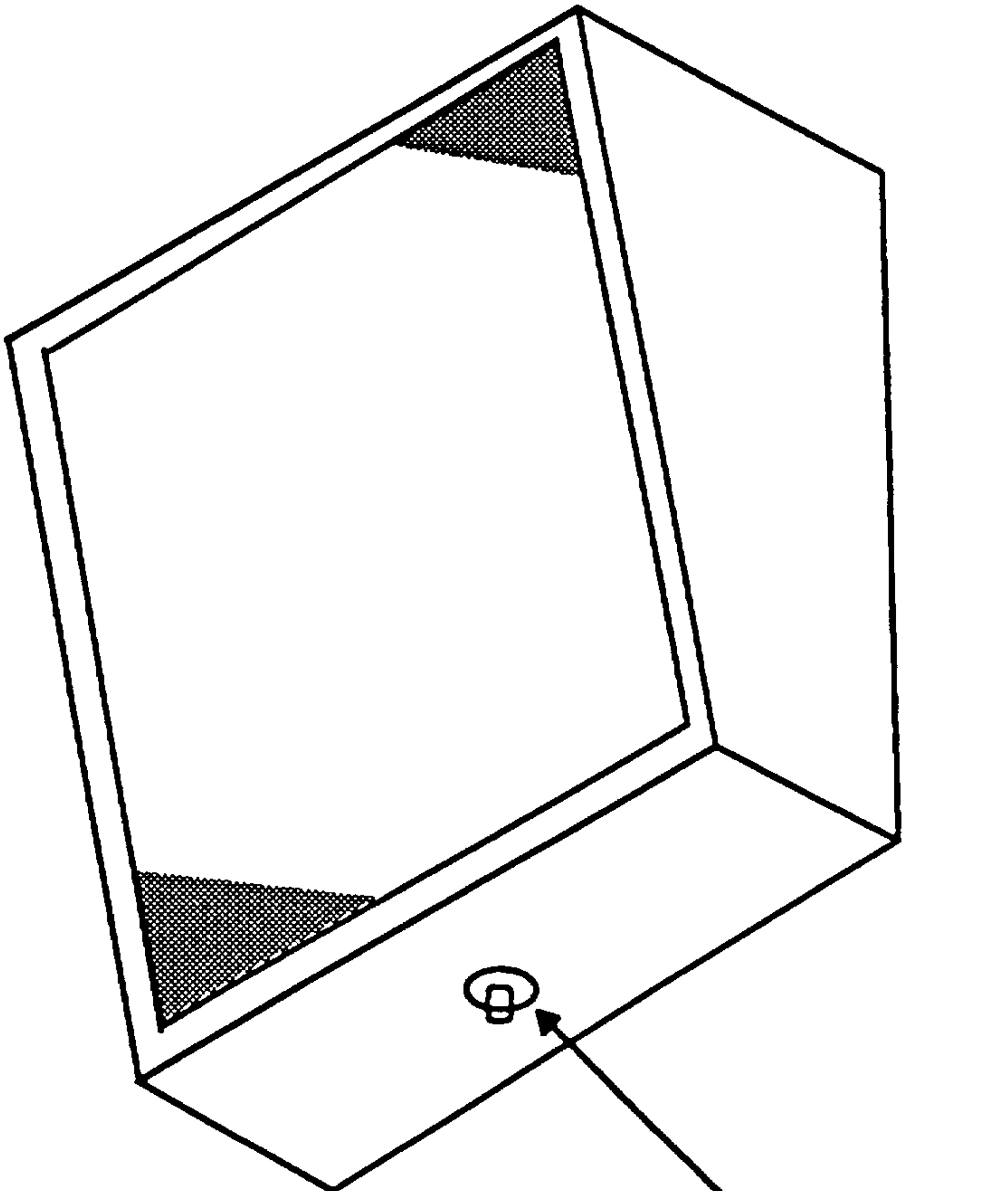


Figure 5-17. Telephone Speaker

CHAPTER 6 LIGHTING SYSTEM

Section I. General

6-1 General. The lighting systems onboard the barge provide interior and exterior lighting Normal and emergency interior lighting is provided In the deckhouse ROWPU space, dayroom, workshop, and voids. Exterior lighting consists of searchlights and floodlights for use at night or during reduced visibility. Lights on the weatherdecks and standard navigation and status lights are for use during ROWPU operations and barge towing Equipment specifications, maintenance information, and manufacturers' service manuals are contained In TM 55-1930-209-14&P-10.

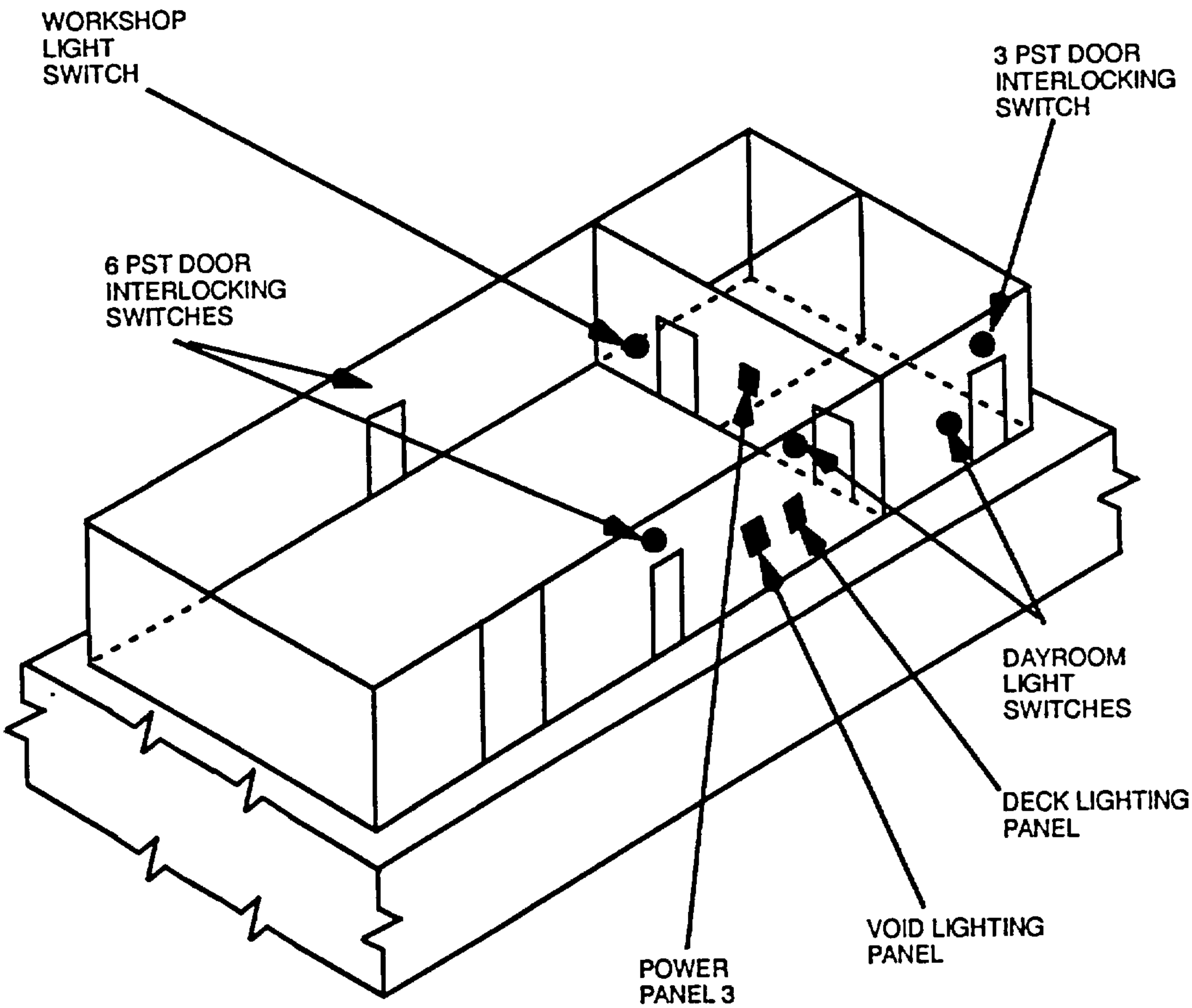
Section II. Interior lighting system

6-2 Description. The interior lighting system provides both normal and emergency lighting in the deckhouse ROWPU space, dayroom, workshop, and voids. The normal lighting system arrangement is shown In Figure 6-1, and components are listed in Table 6-1. The emergency lighting system arrangement is shown in Figure 6-2, and its components are listed in Table 6-2.

6-3 Description of operation. Power is provided to the normal interior lighting system in the deckhouse and voids by either service generator, the auxiliary generator, or shore power. ROWPU space and void lights are operated from their corresponding lighting panels by closing circuit breakers. Dayroom and workshop lights are operated and controlled from bulkhead-mounted rotary switches The ROWPU space port and starboard doors and dayroom door to the weatherdeck are each equipped with an interlocking switch that automatically turns off these lights when one of these doors is opened.

In the event that normal power is lost, an Inverter automatically converts 24 Vdc battery bank power to 120 Vac power. This power is supplied to the emergency panel for emergency lighting (fluorescent and red Incandescent lights) and for communications (marine radio and telephone system).

A green lamp (Barge 1) or blue lamp (Barges 2 and 3), located on the forward panel of the switchboard, indicates that emergency power from the battery bank is available. An emergency light switch is located on the switchboard and next to each door to the weatherdeck so that emergency lights can be readily turned ON/OFF.



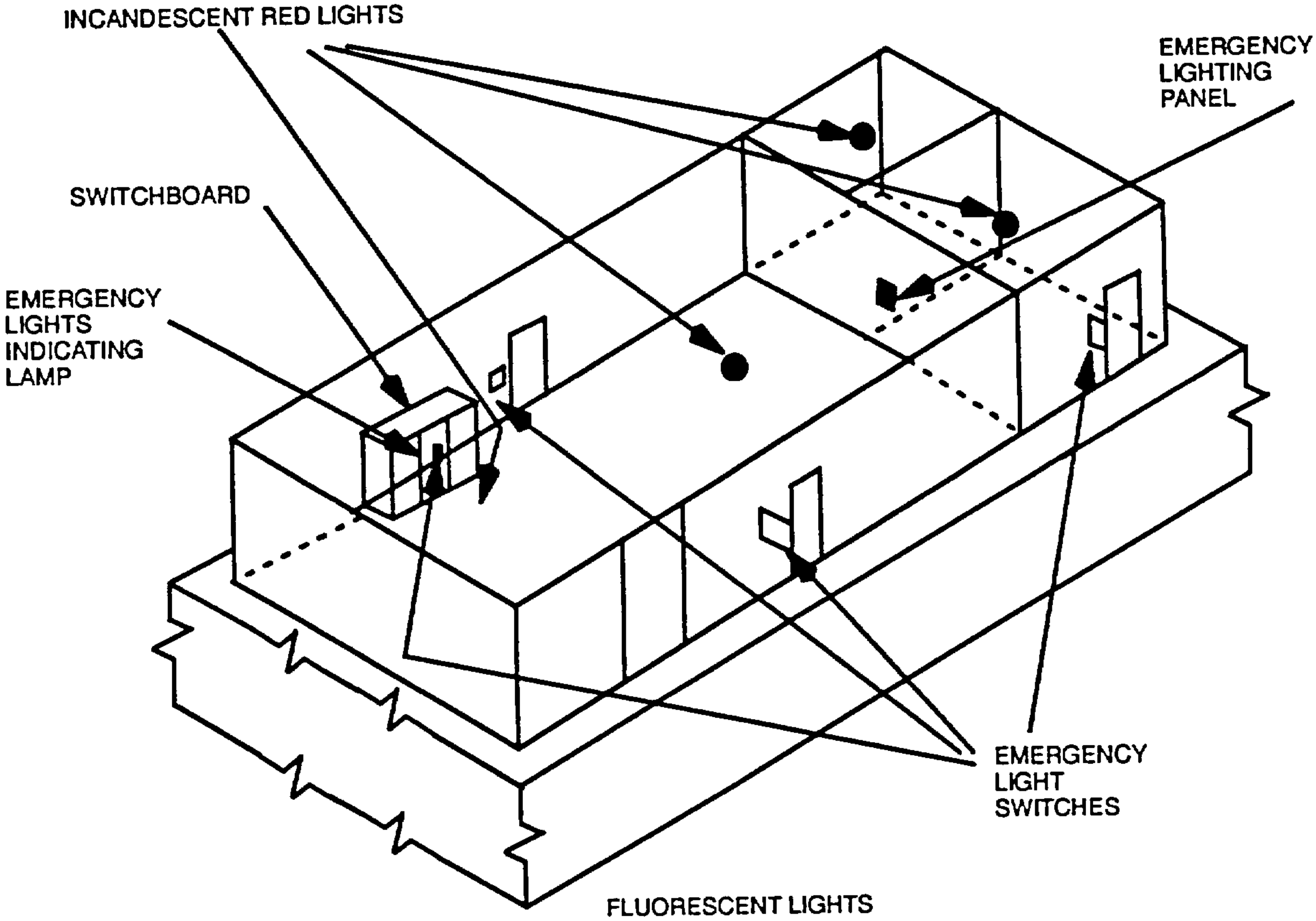
FLUORESCENT LIGHTS

33 In ROPWU space
4 in Dayroom
5 in Workshop
4 in Void 1
5 in Void 2 Port
4 in Void 2 Starboard
4 in Void 3 Port
3 in Void Starboard (Barge 1)
5 in Void 3 Starboard (Barges 2 and 3)
4 in Void 4 Port
4 in Void 4 Starboard
4 in Void 5 (Barge 1)
5 in Void 5 (Barges 2 and 3)

Figure 6-1. Normal Interior Lighting Arrangement

Table 6-1. Normal Interior Lighting System Components

Component	Location	Function
Power panel 3	ROWPU space on forward bulkhead	Supplies power to deck, void, and emergency lighting panels, exterior lights, and other deckhouse electrical equipment
Deck lighting panel	ROWPU space on starboard bulkhead forward, near dayroom door	Distributes power from power panel 3 circuit breaker 2P13 to ROWPU space, dayroom, and workshop normal lights, searchlights, and other deckhouse equipment
Void lighting panel	ROWPU space on starboard bulkhead forward	Distributes power from power panel 3 circuit breaker 3P13 to lights in voids normal and smoke detector
77 fluorescent lights	33 in ROWPU space 4 in dayroom 5 in workshop (includes light over workbench) 4 in void 1 5 in void 2 port 4 in void 2 starboard 4 in void 3 port 3 in void 3 starboard (Barge 1) 5 in void 3 starboard (Barges 2 and 3) 4 in void 4 port 4 in void 4 starboard 4 in void 5 (Barge 1) 5 in void 5 (Barges 2 and 3)	Provides normal lighting in deckhouse and voids
10A rotary snap switch	in workshop by door to ROWPU space (labeled WORKSHOP LIGHTS)	Turns workshop fluorescent lights ON/OFF
30A 3-way rotary snap switch	In dayroom by doors to ROWPU space and weatherdeck (labeled DAYROOM LIGHTS).	Turns dayroom lights on/off
3 PST door switch	Dayroom above starboard door	Automatically turns on normal lights in dayroom when door is closed, automatically turns off lights when door is opened
Two 6 PST door interlocking switches	In ROWPU space above port and starboard doors	Automatically turns on normal lights in ROWPU space when door is closed; automatically turns off lights when door is opened



6 in ROPWU space
1 in Dayroom
1 in Workshop
1 in Void 1 (Barge 1)
2 in Void 1 (Barges 2 and 3)
1 in Void 2 Port
1 in Void 2 Starboard
2 in Void 3 Port
2 in Void 3 Starboard
1 in Void 4 Port
1 in Void 4 Starboard
1 in Void 5

Figure 6-2. Emergency Interior Lighting Arrangement

Table 6-2. Emergency Interior Lighting System Components

Component	Location	Function
Emergency lighting panel	ROWPU space on forward bulkhead near power panel 3	Supplies power to ROWPU space dayroom, workshop and void emergency fluorescent and red lights
18 fluorescent lights (Barge 1) 19 fluorescent lights (Barges 2 and 3)	6 in ROWPU space 1 in dayroom 1 in workshop 1 in void 1 1 in void 2 port 1 in void 2 starboard 2 in void 3 port 2 in void 3 starboard 1 in void 4 port 1 in void 4 starboard 1 in void 5	Provides emergency lighting in deckhouse and voids
4 incandescent red lights	2 in ROWPU space 1 in workshop 1 in dayroom	Supplies lighting for night use in case fluorescent lights must be blacked out
4 emergency light toggle switches	2 in ROWPU space by port and starboard doors to weatherdeck. 1 on switchboard in ROWPU space. 1 in dayroom by door to weatherdeck	Turns emergency lights ON/OFF throughout barge
Green (Barge 1) or blue (Barges 2 and 3) indicator light	On forward panel of switchboard above emergency light toggle switch	Indicates that emergency power is available from battery bank

Controls/indicators	Figure
10A rotary snap switch (labeled WORKSHOP LIGHTS)	6-3
30A 3-way rotary snap switch (labeled DAYROOM LIGHTS)	6-4
Power panel 3 circuit breakers	6-5
Deck lighting panel circuit breakers	6-6
Void lighting panel circuit breakers	6-7
Emergency lighting panel circuit breakers	6-8

6-4 Operating instructions.

6-4.1 Operating controls and indicators. The controls and Indicators for the interior lighting systems are listed below. Rotary snap switches are shown In Figures 6-3 and 6-4. Power panels are shown in Figures 6-5 thru 6-8. Circuit breakers within these panels are also labeled, as shown, on the inside of the panel covers.

6-4.2 Prestart procedures

a. Perform the following before operation checks:

(1) Check for damaged, loose, or frayed cables, loose connections, and loose or missing fasteners. Repair, replace, or tighten as necessary.
(2) Clean lighting panels and switches with a dry, lint-free cloth or with a vacuum cleaner.

b. Close circuit breaker P13 on switchboard to supply power to power panel 3.
c. Close circuit breaker 13P13 on power panel 3 (Figure 6-5) to supply power to battery charger.
d. Close circuit breaker 10P13 on power panel 3 (Figure 6-5) to supply power to emergency panel.

6-4.3 Operating procedures

6-4.3.1 Normal lighting

a. ROWPU space. Close circuit breaker 2P13 on power panel 3 (Figure 6-5) to supply power to deck lighting. panel. Close circuit breakers 2P13-1 thru 2P13-4 on deck lighting panel (Figure 6-6) to supply power to fluorescent lights In ROWPU space. Door interlocking switches (blackout switches) automatically turn lights on when the port or starboard doors are closed and turn lights off when either door is opened. Red light stays on when a door is opened
b. Dayroom. Close circuit breaker 2P13 on power panel 3 (Figure 6-5) to supply power to deck lighting panel. Close circuit breaker 2P13-6 on deck lighting panel. Turn fluorescent lights ON In dayroom by operating either of the rotary dayroom light switches located by starboard or aft door. Door interlocking switch (blackout switch) automatically turns fluorescent lights ON when starboard door is closed and turns lights OFF when door is opened. Red light stays ON even when door is opened.
c. Workshop. Close circuit breaker 2P13 on power panel 3 (Figure 6-5) to supply power to deck lighting panel. Close circuit breaker 2P13-5 on deck lighting panel. Turn fluorescent lights ON in workshop by operating rotary workshop light switch located by door to ROWPU space.
d. Voids. Close circuit breaker 3P13 on power panel 3 (Figure 6-5) to supply power to void lighting panel. Close circuit breakers 3P13-1 thru 3P13-6 on void lighting panel (Figure 6-7) to turn lights ON In voids.
e. During operation checks. Perform following during operation checks:

(1) Check that all components are operating normally.
(2) Check for loose cables, loose connections, or missing securements and fasteners. Repair, replace or tighten as necessary.
(3) Check for burned-out bulbs. Replace as necessary.

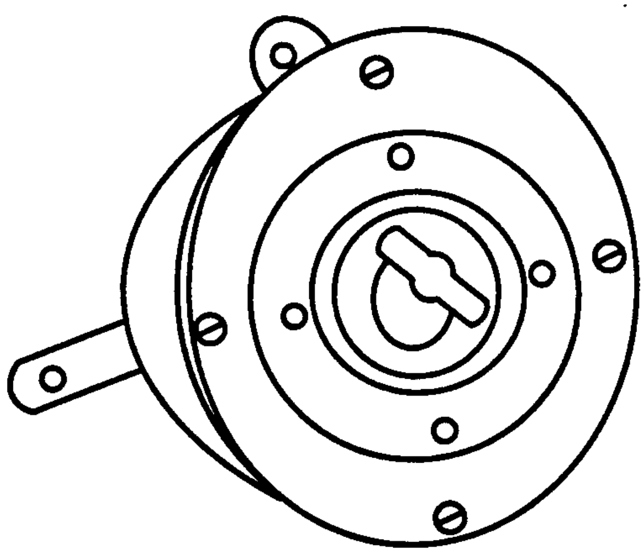


Figure 6-3. 10A Rotary Snap Switch (Barge 1 only)

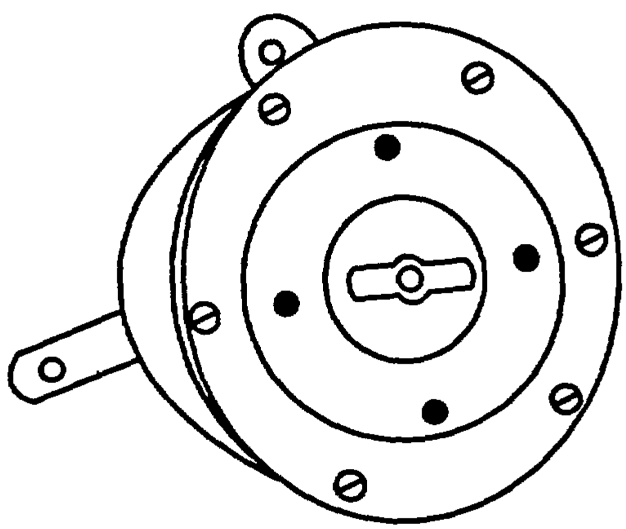
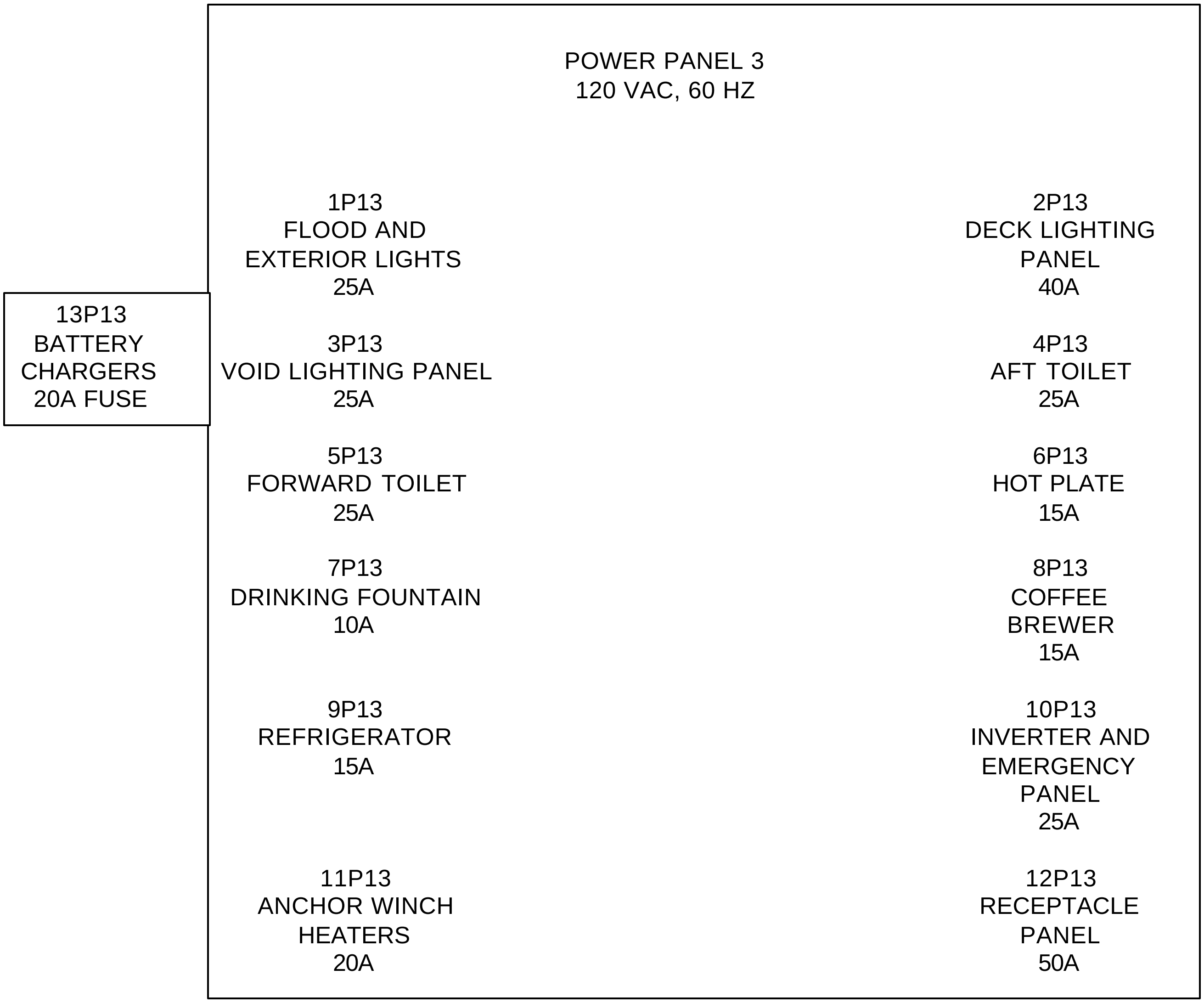


Figure 6-4. 30A 3-Way Rotary Snap Switch



LOCATED IN ROWPU SPACE ON FORWARD BULKHEAD

Figure 6-5. Power Panel 3

DECK LIGHTING PANEL
120 VAC. 60HZ

2P13-2 ROWPU SPACE STARBOARD CENTER LIGHTS 10A	2P13-1 ROWPU SPACE PORT LIGHTS 10A
2P13-4 ROWPU SPACE PORT CENTER LIGHTS 10A	2P13-3 ROWPU SPACE STARBOARD LIGHTS 10A
2P13-6 DAYROOM LIGHTS 10A	2P13-5 WORKSHOP LIGHTS 10A
2P13-8 PORT SEARCHLIGHT 10A	2P13-7 RANGE HOOD 10A
2P13-10 SPARE 10A	2P13-9 STARBOARD SEARCHLIGHT 10A
2P13-12 SPARE 10A	2P13-11 SPARE 10A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD

Figure 6-6. Deck Lighting Panel

VOID LIGHTING PANEL
120 VAC, 60HZ

3P13-2 VOID 2 PORT LIGHTS 10A	3P13-1 VOID 1 LIGHTS 10A
3P13-4 VOID 3 PORT LIGHTS 10A	3P13-3 VOID 2 STARBOARD LIGHTS 10A
3P13-6 VOID 4 PORT LIGHTS 10A	3P13-5 VOID 3 STARBOARD LIGHTS 10A
3P13-8 VOID 5 LIGHTS 10A	3P13-7 VOID 4 STARBOARD LIGHTS 10A
3P13-10 SPARE 10A	3P13-9 SMOKE DETECTOR 20A
3P13-12 SPARE 10A	3P13-11 SPARE 10A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD NEAR DAYROOM DOOR

Figure 6-7. Void Lighting Panel

EMERGENCY LIGHTING PANEL
120 VAC, 60HZ

10P13A-2 WORKSHOP, DAYROOM WHITE LIGHTS 10A	10P13A-1 ROWPU SPACE WHITE LIGHTS 10A
10P13A-4 WORKSHOP, DAYROOM RED LIGHTS 10A	10P13A-3 ROWPU SPACE RED LIGHTS 10A
10P13A-6 VOIDS 3.4 AND 5 WHITE LIGHTS 10A	10P13A-5 VOIDS 1 AND 2 WHITE LIGHTS 10A
10P13A-8 MARINE RADIO 10A	10P13A-7 STATION BUZZER 10A

LOCATED IN ROWPU SPACE ON FORWARD BULKHEAD NEAR POWER PANEL 3.

Figure 6-8. Emergency Lighting Panel

6-4.3.2 Emergency lighting. If the servicing power system fails, the emergency power system automatically keeps emergency lights (white fluorescent and red Incandescent) lit. As soon as the failure occurs, the 24 Vdc battery bank on top of the deckhouse supplies power to the inverter. The Inverter changes the 24 Vdc power to 120 Vac and supplies the emergency panel.

A green (Barge 1) or blue (Barges 2 and 3) light on the switchboard Indicates that emergency power from the 24 Vdc battery bank is available for emergency lighting in the event of power failure. When the circuit breakers listed below are closed, emergency lights can be turned ON or OFF by activating any of the four ON/OFF toggle switches. One switch is near the green (Barge 1) or blue (Barges 2 and 3) light, one near the dayroom starboard door, one near the ROWPU space port door, and one near the ROWPU space starboard door.

a. ROWPU space. ROWPU space white lights circuit breaker 10P13A-1 and ROWPU space red lights circuit breaker 10P13A-3 on emergency lighting panel (Figure 6-8).
b. Dayroom. Workshop, dayroom white lights circuit breaker 10P13A-2 and workshop, dayroom red lights circuit breaker 10P13A-4 on emergency lighting panel.
c. Workshop. Workshop, dayroom white lights circuit breaker 10P13A-2 and workshop, dayroom red lights circuit breaker 10P13A-4 on emergency lighting panel.
d. Voids. Voids 1 and 2 white lights circuit breaker 10P13A-5 and voids 3, 4, and 5 white lights circuit breaker 10P13A-6 on emergency lighting panel.
e. During operation checks. Perform operation checks in paragraph 6-4.3.1.e.

6-4.4 Shutdown procedures

6-4.4.1 Normal lighting

a. Turn ROWPU space fluorescent lights OFF by opening (OFF) circuit breaker 2P13-1 thru 2P13-4 on deck lighting panel (Figure 6-6).
b. Turn dayroom fluorescent lights OFF by operating either of the rotary snap switches in the dayroom or by opening circuit breaker 2P13-6 on deck lighting panel.
c. Turn workshop fluorescent lights OFF by operating rotary snap switch in workshop or by closing circuit breaker 2P13-5 on deck lighting panel.
d. Turn fluorescent lights in the voids OFF by opening circuit breakers 3P13-1 thru 3P13-8 on void lighting panel (Figure 6-7).

6-4.4.2 Emergency lighting. To turn all emergency lights OFF (fluorescent and red), operate any of the four emergency light toggle switches, circuit breakers, Inverter, or inverter circuit breaker.

Section III. Exterior lighting system

6-5 Description. The exterior lighting system provides lighting for navigation, night operations, and lighting on the weatherdeck. The system's arrangement is shown in Figure 6-9, and its components are listed in Table 6-3.

6-6 Description of operation. Power is provided to the exterior side lights, floodlights, and searchlights by either service generator, the auxiliary generator, or shore power. Exterior side lights are operated from bulkhead-mounted rotary switches located In the ROWPU space. Floodlights are also operated from bulkhead-mounted rotary switches. Searchlights are operated from base-mounted rotary switches.

Power is provided to the shore discharge hose deployment status lights, anchor light, and navigation lights by the 24 Vdc power panel. All of these lights are operated by closing circuit breakers on the 24 Vdc power panel.

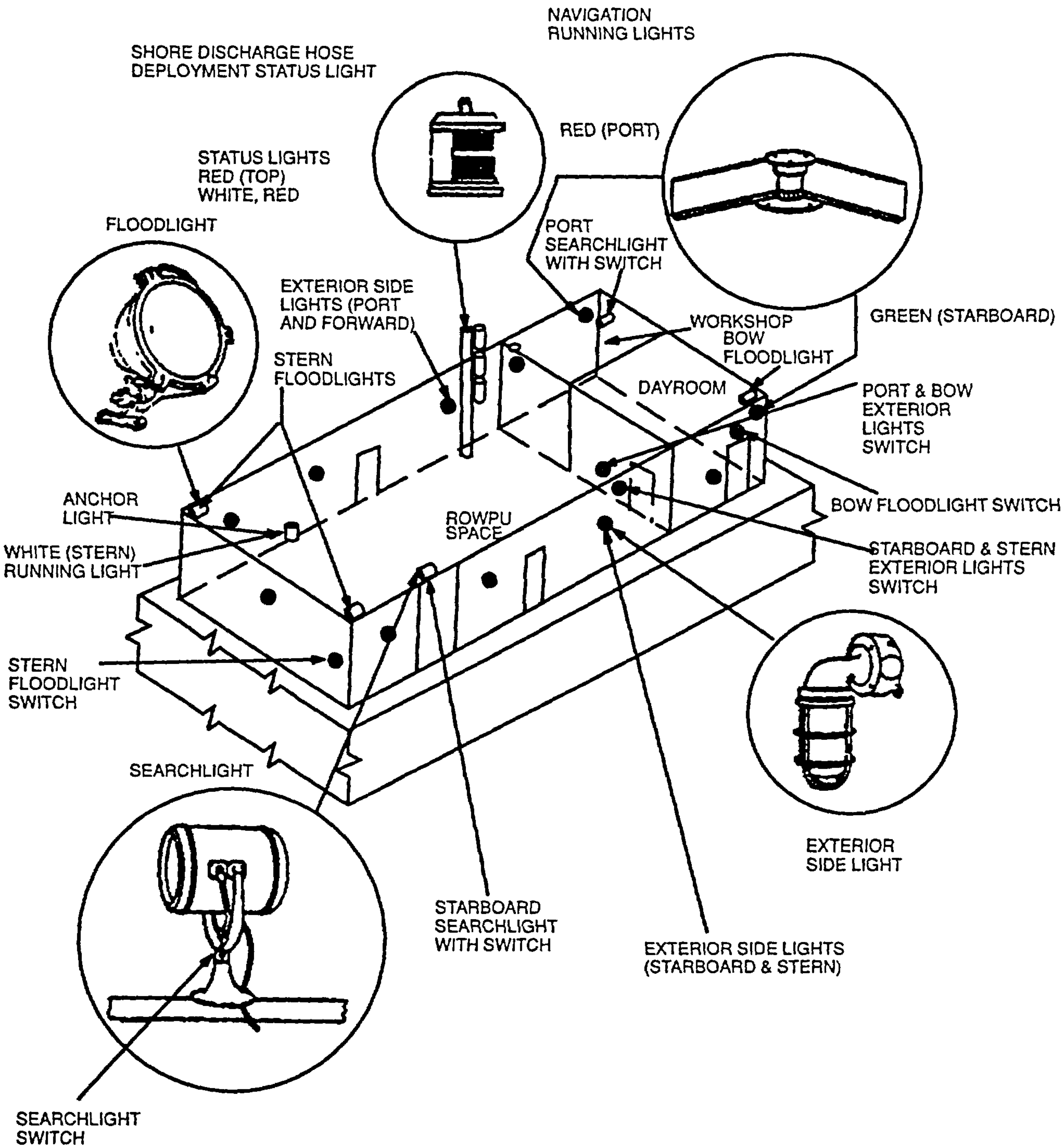


Figure 6-9. Exterior Lighting System Arrangement

Table 6-3. Exterior Lighting System Components

Component	Location	Function
10 exterior side lights	Exterior of deckhouse: 1 on forward (bow) bulkhead 4 on port bulkhead 4 on starboard bulkhead 1 on aft (stern) bulkhead	Provide lighting for weatherdeck
4 on/off rotary snap switches labeled PORT & BOW EXTERIOR LIGHTS, STARBOARD & STERN EXTERIOR LIGHTS, BOW FLOODLIGHT, and STERN FLOODLIGHTS	1 on forward bulkhead in ROWPU space	Turns port and bow exterior lights on/off
	1 on forward bulkhead in ROWPU space	Turns bow and starboard exterior lights on/off
	1 on exterior of deckhouse on bow	Turns bow floodlight on/off
	1 on exterior of deckhouse on stern	Turns two stern floodlights on/off
2 switches on searchlights	1 on base of each searchlight	Turns searchlight on/off
3 floodlights	1 on bow 2 on top of deckhouse aft (one port, one starboard)	Provide lighting for deck and starboard side
2 searchlights	On top of deckhouse: 1 port side forward 1 starboard side aft	Provide lighting for bow and stern areas and used for signaling
3 shore discharge hose deployment status lights (1 white, 1 red)	On forward mast	Provide warning that discharge hose is deployed to shore
Anchor light	Aft on top of deckhouse on center line	Indicates that barge is anchored
Green (starboard) navigation running lights	Exterior of deckhouse on starboard side forward	Navigation light
Red (port) navigation running light	Exterior of deckhouse on portside forward	Navigation light
White (stern) navigation running light	Aft on top of deckhouse on center line	Navigation light

6-7 Operating Instructions

6-7.1 Operating controls and Indicators. The controls and indicators for the exterior lighting system are listed below. Power panel covers are labeled as shown in Figures 6-5 thru 6-8 and 6-10. Circuit breakers within these panels are also labeled, as shown, on the inside of panel covers.

Controls/indicators	Figure
Rotary snap switches (labeled as PORT & BOW EXTERIOR LIGHTS, STARBOARD & STERN EXTERIOR LIGHTS, BOW FLOODLIGHT and STERN FLOODLIGHTS).	6-3 6-4
Local on/off switch on each searchlight	6-11
Power panel 3 circuit breakers	6-5
Deck lighting panel circuit breakers	6-6
24 Vdc power panel circuit breakers	6-10

6-7.2 Prestart procedures. Perform before operation checks as given in paragraph 6-4.2a.

6-7.3 Operating procedures

6-7.3.1 Exterior side lights

a. Close circuit breaker P13 on switchboard to supply power to power panel 3.
b. Close circuit breaker 1 P13 on power panel 3 to supply power to exterior lights and floodlights.
c. Turn one bow and four port exterior lights ON by operating PORT & BOW EXTERIOR LIGHTS rotary switch located in ROWPU space by dayroom door.
d. Turn one aft and four starboard exterior lights ON by operating STARBOARD & STERN EXTERIOR LIGHTS rotary switch located in ROWPU space by dayroom door.

6-7.3.2 Floodlights

a. Perform steps a and b in paragraph 6-7.3.1.
b. Turn bow floodlight ON by operating BOW FLOODLIGHT rotary switch located on weatherdeck on deckhouse forward bulkhead.
c. Turn aft floodlights ON by operating STERN FLOODLIGHTS rotary switch located on weatherdeck on deckhouse aft bulkhead.

6-7.3.3 Searchlights

a. Close circuit breaker P13 on switchboard to supply power to power panel 3.
b. Close circuit breaker 2P1 3 on power panel 3 (Figure 6-5) to supply power to deck lighting panel (Figure 6-6).
c. Turn on port (forward) searchlight by dosing circuit breaker 2P13-8 on deck lighting panel. Operate rotary ON/OFF switch located on searchlight base (Figure 6-11).
d. Turn on starboard (aft) searchlight by dosing circuit breaker 2P13-9 on deck lighting panel. Operate rotary ON/OFF switch located on searchlight base.
e. Rotate searchlight as desired to illuminate target.

6-7.3.4 Shore discharge hose deployment status lights

NOTE

When shore discharge hose is deployed during periods of darkness, maritime regulations require that status lights be shown on forward mast in following sequence and scheme: red on top, white in middle, and red on bottom. During daylight hours, black signal shapes must be displayed on forward mast in following sequence and scheme: round on top, diamond in middle, and round on bottom.

a. Plug three status light plugs into receptacle on top of deckhouse.

b. Close circuit breaker 5P14 on 24 Vdc power panel (Figure 6-10) to turn red and white status lights ON.

6-7.3.5 Anchor light. Close (ON) circuit breaker 7P14 on 24 Vdc power panel (Figure 6-10) to turn white anchor light ON.

NOTE

When barge is anchored at night, maritime regulations require that a white anchor light be displayed.

6-7.3.6 Navigation running lights. Close circuit breaker 2P14 on 24 Vdc power panel (Figure 6-10) to turn navigation lights ON (starboard side green light, portside red light, and white stem light).

6-7.4 Shutdown procedures

6-7.4.1 Exterior side lights

a. Turn bow and port exterior lights OFF by operating PORT & BOW EXTERIOR LIGHTS rotary switch located in ROWPU space by dayroom door.
b. Turn aft and starboard exterior lights OFF by operating STARBOARD & STERN EXTERIOR LIGHTS rotary switch located in ROWPU space by dayroom door.

6-7.4.2 Floodlights

a. Turn bow floodlight OFF by operating BOW FLOODLIGHT rotary switch located on weatherdeck on deckhouse forward bulkhead.

b. Turn aft floodlights OFF by operating STERN FLOODLIGHTS rotary switch located on weatherdeck on deckhouse aft bulkhead.

6-7.4.3 Searchlights. Turn the rotary ON/OFF switch located on searchlight base to OFF.

6-7.4.4 Shore discharge hose deployment status lights. Turn red and white status lights OFF by opening circuit breaker 5P14 on 24 Vdc power panel (Figure 6-10).

6-7.4.5 Anchor light. Tun anchor light OFF by opening circuit breaker 7P14 on 24 Vdc power panel.

6-7.4.6 Navigation running lights. Turn navigation lights OFF by opening circuit breaker 2P14 on 24 Vdc power panel.

6-7.4.7 After operation checks

a. Turn off lights that are not needed.
b. Check for damaged, loose or frayed cables, loose connections, or missing securements and fasteners. Repair, replace, or tighten as necessary.
c. Clean lighting panels and switches with a dry, lint-free cloth or with a vacuum cleaner.

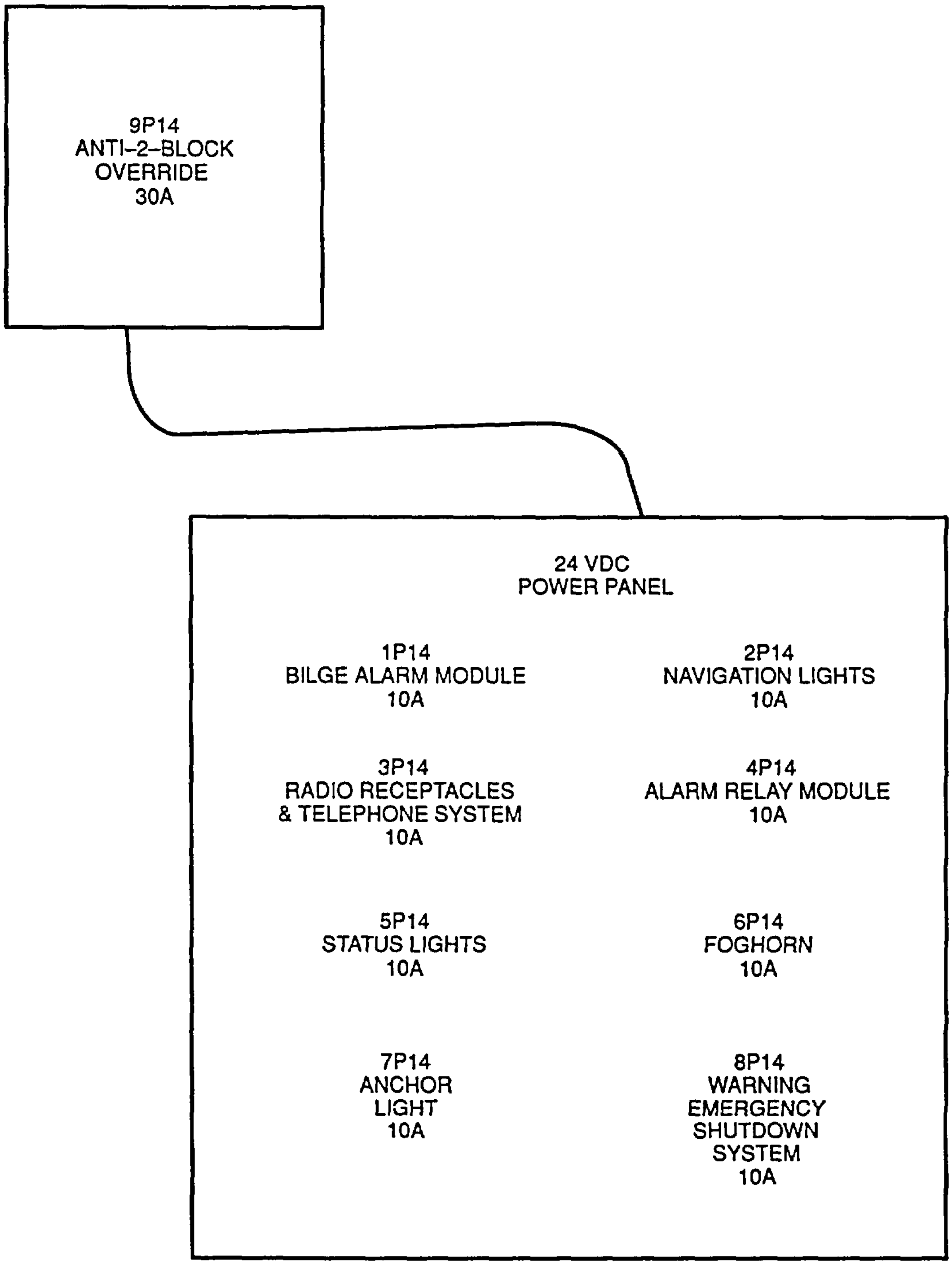
Section IV. Emergency shutdown

6-8 General. The barge has two emergency shutdown modes (Chapter 3). One mode shuts down Individual systems such as the ventilation system or a diesel high-pressure pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns. either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems Any system emergency shutdown that stops a generator supplying power to the switchboard also turns off the lighting system When the lighting system is off because of an emergency shutdown situation, emergency interior lighting Is provided by the 24 Vdc battery bank (paragraph 6-4.3.2). Exterior lighting requirements are provided automatically from the 24 Vdc battery bank to the shore discharge hose deployment status lights, the anchor light, and the navigation running lights when these lights are turned ON at the 24 Vdc power panel (Figure 6-10).

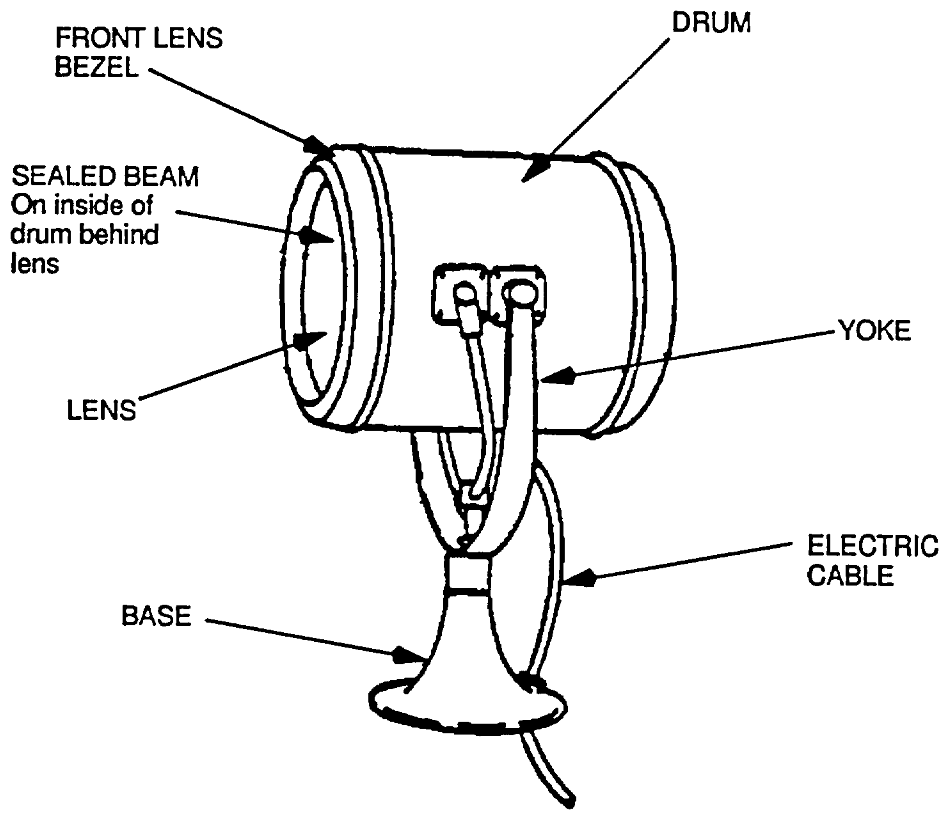
Emergency total shutdown red buttons are located as follows'

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system emergency shutoff buttons
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck
- Inside ROWPU space port door to weatherdeck



LOCATED IN WORKSHOP ON AFT BULKHEAD

Figure 6-10. 24 Vdc Power Panel



NOTE:

One searchlight Is located on top of deckhouse on the forward port comer, the other near the aft starboard comer. A rotary on/off switch Is located on the base of each searchlight.

Figure 6-11. Searchlight

CHAPTER 7 VENTILATION, HEATING, AND AIR CONDITIONING SYSTEMS

Section I. General

7-1 General. Ventilation system provides fresh air circulation In the deckhouse and voids with 17 hatches and 10 ventilation fans. The Heating and Air Conditioning System (HAC) controls air temperature in the workshop and dayroom Equipment specifications, maintenance information and manufacturer's service manuals are in TM 55-1930-209-14&P-16

Section II. Deckhouse ventilation system

7-2 Description. The deckhouse is provided with fresh air circulation by manually operated hatches and electrically driven fans Fresh air is supplied by opening 17 louvered hatches (Figure 7-1), 10 port and 7 starboard. (Doors may also be opened.) Air circulation is increased by using six exhaust fans on the deckhouse top (Figure 7-2). These are controlled by circuit breakers on power panel 2 (Figure 7-3) and motor controllers on port and starboard bulkheads In the ROWPU space. Fan motors and louvered hatches can be used in different combinations to control air movement The deckhouse ventilation system also includes electrical wiring, controls, and an electrical emergency shutoff. Installation of this system is shown in drawings referenced in Appendix A. Major components are listed in Table 7-1.

7-3 Capabilities. This system provides sufficient change of air In the deckhouse to maintain safe working conditions under normal operations

7-4 Performance characteristics. Each of the six exhaust fans on the deckhouse top moves air at the rate of 14,000 cubic feet per minute (cfm) at 1/2-inch static pressure.

7-5 Operating instructions

7-5.1 Operating controls and indicators

a. Circuit breakers controlling power to six deckhouse ventilation fans are on power panel 2 on deckhouse starboard bulkhead forward of sliding door Figure 7-3 shows location of circuit breakers for specific fans.

b. Six fans are controlled by electric controllers with ON/OFF toggle switches. Raise toggle switches to start fans. Lower toggle switches to stop fans. Location of controllers is provided in paragraph 7-5.3.1 and In Figure 7-4.

7-5.2 Prestart procedures

a. Open ventilation hatches as desired to provide fresh air ventilation There are 10 hatches on port and 7 on starboard. Secure hatch covers in open position with pins and cotter keys.

b. Make sure that air ducts are free of obstructions and not severely dented or damaged.

c. Visually inspect fans and motors to make sure they are not damaged, fan blades have sufficient clearance, motors and fans are properly secured, and electrical connections are tight.

d. Make sure switchboard circuit breaker P8 is closed to provide power to power panel 2.

e. Make sure power panel 2 circuit breakers 1 P8 thru 6P8 are closed to provide power to six roof-mounted exhaust fan motors. Power panel 2 is on ROWPU space starboard bulkhead forward of sliding door.

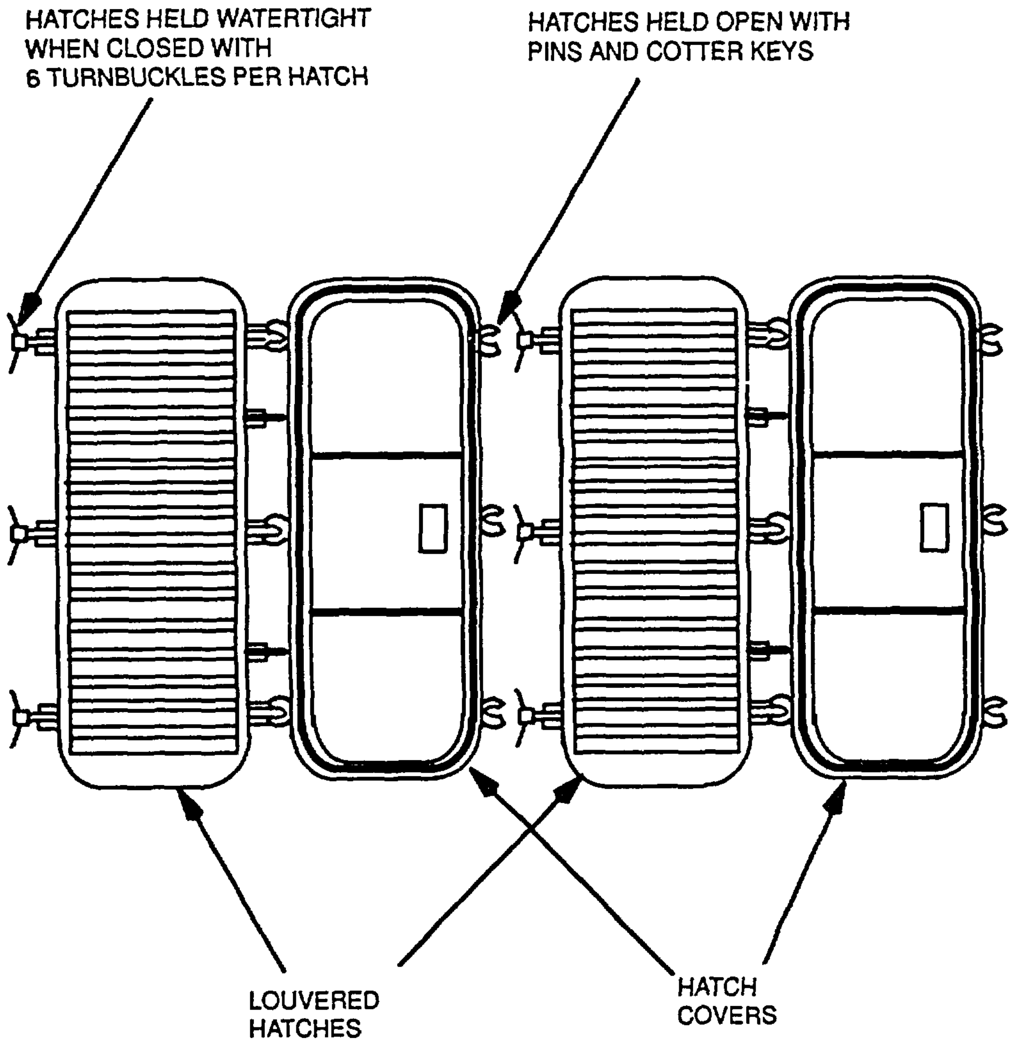
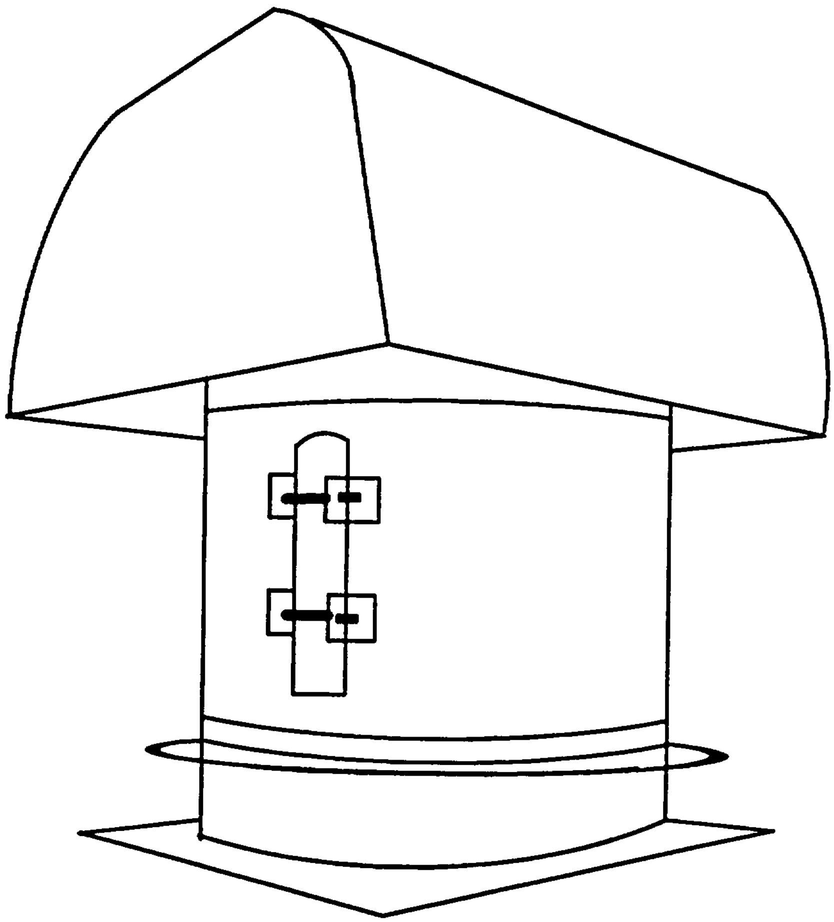


Figure 7-1. Example of Light-Proof Louvered Hatches on Deckhouse Port and Starboard Bulkheads



Note: Exhausts air from ROWPU space.

Figure 7-2. Example of Covered Fan Motors on Deckhouse Top

POWER PANEL 2
440 VAC, 60 HZ

1PB ROWPU SPACE VENTILATION VENT FAN 1 15A	2P8 ROWPU SPACE VENTILATION FAN 2 15A
3P8 ROWPU SPACE VENTILATION VENT FAN 3 15A	4PB ROWPU SPACE VENTILATION FAN 4 15A
5P8 ROWPU SPACE VENTILATION VENT FAN 5 15A	6P8 ROWPU SPACE VENTILATION FAN 6 15A
7P8 STARBOARD VOIDS VENTILATION FAN 7 15A	8P8 PORT VOIDS VENTILATION FAN 8 15A
9P8 VOID 4 STARBOARD VENTILATION FAN 9 15A	10P8 VOID 4 PORT VENTILATION FAN 10 15A

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD OF SLIDING DOOR
POWER INPUT FROM SWITCHBOARD CIRCUIT BREAKER P8

Figure 7-3. Power Panel 2, 440 Vac

Table 7-1. Major Components of Deckhouse Ventilation System

Component	Quantity	Function	Location
Watertight hatches	17	Control supply of fresh air entering deckhouse	10 on deckhouse port and 7 on deckhouse starboard
Light-proof louvers	17	Prevent light penetration through open louvers	Inside deckhouse watertight hatches
Hooded roof for fans 1 thru 6	6	Exhaust air from ROWPU space	On deckhouse top
Fan motor controllers	6	Control fan motors 1 thru 6	In ROWPU space, fans 1, 3, and 5 on starboard, bulkhead, fans 2, 4, and 6 on port bulkhead
Emergency shutdown button	1	Provides emergency shutdown of ventilating fan motors	Second button from left on row of seven RED buttons on starboard bulkhead aft of door
Power panel 2	1	Controls ventilating system fans in deckhouse and voids	Starboard bulkhead forward of sliding door

7-5.3 Operating procedures

7-5.3.1 Increasing ventilation. Push controller ON switches to start ROWPU space ventilating fans Operate fans (Figure 7-4) as desired to provide ventilation.

a. Fan controllers on starboard bulkhead are located as follows'

(1) Fan 1 controller is aft of side door.

(2) Fan 3 controller is forward of sliding door.

(3) Fan 5 controller Is aft of sliding door.

b. Fan controllers on port bulkhead are located as follows:

(1) Fan 6 controller is aft of side door.

(2) Fan 4 controller is farther aft from side door.

(3) Fan 2 controller is near air compressor.

7-5.3.2 Decreasing ventilation. To control circulation, push controller switches to OFF to stop fans as desired Close any or all 17 ventilation hatches as necessary.

7-5.4 Shutdown procedures

7-5.4.1 Normal shutdown for less than 72 hours

a. Turn off deckhouse ventilating fans by pushing controller switches to OFF.

b. Close ventilation hatches as desired.

7-5.4.2 Normal shutdown for more than 72 hours

a. Turn off deckhouse ventilating fan motors by pushing controller switches to OFF.
b. Close and secure 17 ventilation hatches.
c. Open power panel 2 circuit breakers 1P8 thru 6P8.
d. Open switchboard circuit breaker P8.

7-5.4.3 Emergency shutdown

7-5.4.3.1 General. The barge has two emergency shutdown modes. One mode shuts down individual systems such as the ventilation system or a diesel HP pump and the other mode shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Seven red system shutdown buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These system shutdown buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, 20 kW SAG, SSG 1, and SSG 2.

Six red total shutdown buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system shutdown buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck * Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck * Inside dayroom door to weatherdeck.

7-5.4.3.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shutdown either the ventilation system or all operating systems.
b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.
c. When emergency button is reset, ventilation system must be restarted by performing procedures in TM 55-1930-209-14&P-16.

NOTE

Emergency shutdown of ventilation system also automatically shuts down chlorination system. When pushed, the ventilation system emergency shutdown button opens switchboard circuit breaker P8, which shuts off electricity to power panel 2. Circuit breakers on this panel, which provide power for 10 ventilating fans (Figure 7-3), will trip OFF, and individual fan motor controllers will also go to OFF. When power Is cut to fan motors that provide ventilation to voids, Including void 2 port where chlorination system Is located, an electrical interlock In void fan 8 turns off chlorination system.

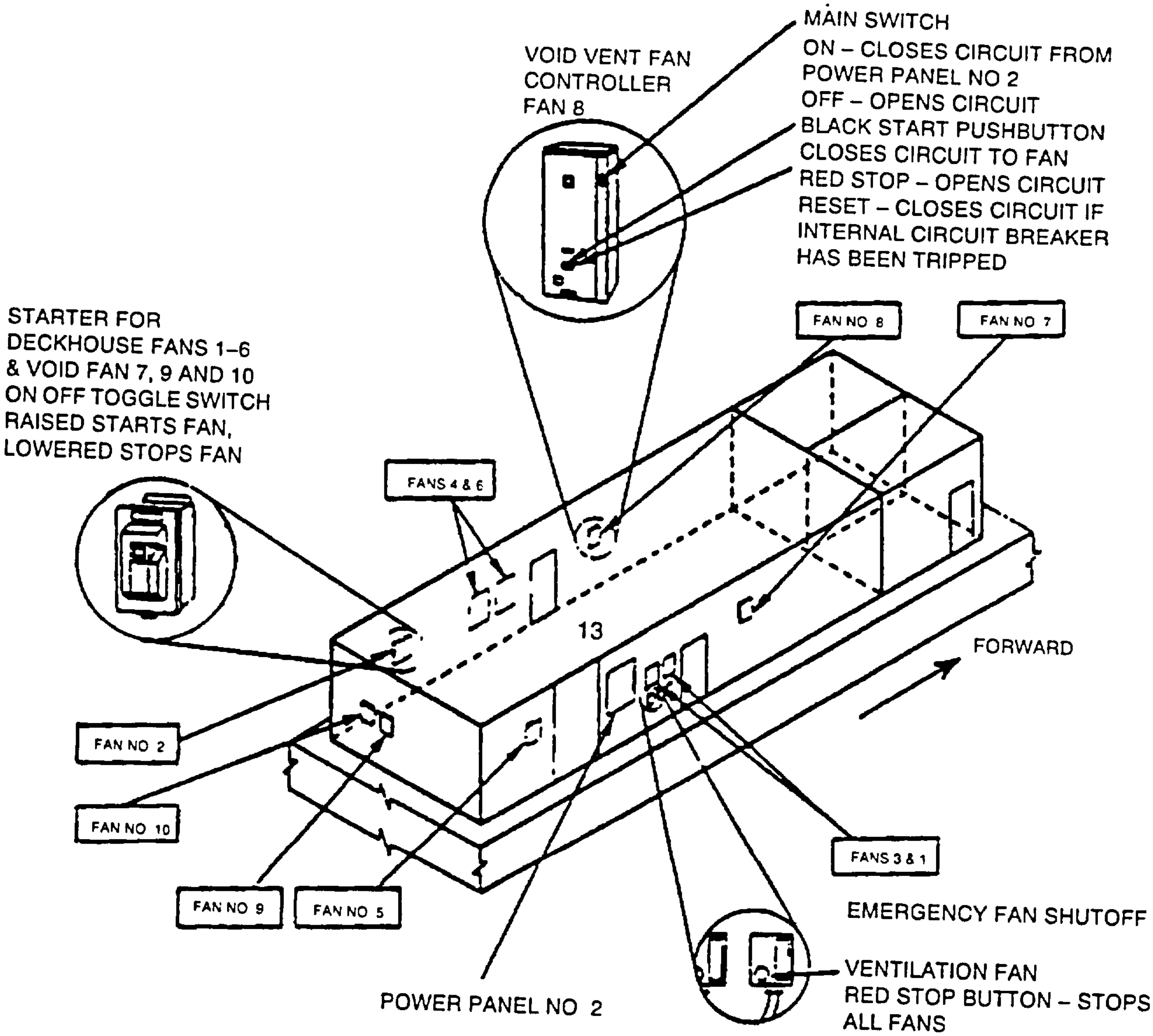


Figure 7-4. Ventilation System Operating Controls

Section III. Voids ventilation system

7-6 Description. The void areas are provided with forced fresh air ventilation by electrically driven fans. Two fans mounted high on deckhouse port and starboard bulkheads (Figure 7-5) provide ventilation to eight void areas, void 1 In bow, voids 2 port and starboard, voids 3 port and starboard, voids 4 port and starboard and void 5 in stern In addition, two fans mounted In ducting at rear of ROWPU space (Figure 7-6) exhaust hot air from voids 4, which contain three diesel generators. Two louvered hatches, with covers and ducting, provide fresh air Intake from the stern weatherdeck into voids 4 -one in port and the other in starboard. The voids ventilation system also includes air ducts, electrical wiring, controls, and both mechanical and electrical emergency shutoffs. Major components are listed in Table 7-2.

7-7 Capabilities. This system provides sufficient change of air In the voids to maintain safe working conditions under normal operations.

7-8 Performance characteristics. Two fans mounted on port and starboard bulkheads each move air at the rate of 1887 cfm at 1/2 inch static pressure. Generator exhaust fans each move air from voids 4 at the rate of 8500 cfm at 1.06 inches static pressure

7-9 Operating instructions

7-9.1 Operating controls and indicators

a. Circuit breakers 7P8 thru 10P8 controlling power to four voids ventilation fans are on power panel 2 on deckhouse starboard bulkhead forward of sliding door. Figure 7-3 shows location of circuit breakers for specific fans.

b. Voids ventilation fans 7, 9, and 10 are controlled by electric controllers with ON/OFF toggle switches. Raise toggle switches to start fans. Lower toggle switches to stop fans. Starter/controller locations are shown In Figure 7-4.

c. Voids ventilation fan 8 contains an electrical interlock for chlorination system and requires slightly different procedures than for other voids ventilation fans. To start this fan, first move ON/OFF switch on top front of controller to ON, then raise toggle switch to start fan. To stop this fan, lower toggle switch and then move controller switch to OFF. This controller also contains a reset button that, when pushed, resets the Internal circuit breakers for this fan and the electrical supply for the chlorination system.

7-9.2 Prestart procedures

a. Open blower inlet covers high on exterior sides of ROWPU space and secure in open position with drop chains (Figure 7-7).

b. Remove two large, flat cover plates on louvered air Intake hatches on deckhouse stern bulkhead exterior (Figure 7-5). Secure with bolts to special storage mounting brackets on either-side of ventilator Intakes. These covers must be removed before starting fan motors 9 and 10 and diesel generators in voids 4.

c. Open all eight emergency ventilation shutoff valves (Figure 7-8). Six of these are on sides of ROWPU space, one in dayroom, and one mounted overhead in void 4 port. Handles should be in vertical position in deckhouse and parallel to air duct in void 4 port. Emergency ventilation shutdown valves are located In ventilation ductwork as follows:

(1) Void 1 - dayroom near starboard bulkhead
(2) Void 2 starboard - ROWPU space near starboard bulkhead
(3) Void 3 starboard - same as void 2 starboard farther aft
(4) Void 4 starboard - same as void 3 starboard farther aft

Table 7-2. Major Components of Voids Ventilation System

Component	Quantity	Function	Location
Mushroom exhaust air roof outlets	2	Exhaust air from voids 4 port and starboard	On topdeck for fans 9 and 10
Ventilating fans (vertical)	2	Exhaust air from voids 4 port and starboard	In ROWPU space near aft bulkhead
Ventilating fans (horizontal)	2	Blow forced air into voids port and starboard	In ROWPU space high on
bulkheads			
Round blower covers with fittings	2	Protect fan motors, provide air intake	In ROWPU space high on port and starboard bulkheads
Fan motor controller with interlock	1	Controls fan motor 8	In ROWPU space on port bulkhead forward of door
Fan motor controllers	3	Control fan motors 7, 9, and 10	1 on deckhouse starboard bulkhead, 2 on deckhouse aft bulkhead
Ventilation emergency button	1	Provides emergency shutdown of all ventilating fan motors	Second button from left on row of seven RED buttons located starboard bulkhead aft of door
Power panel 2	1	Controls ventilating system fans in voids and deckhouse	ROWPU starboard bulk-head forward of sliding door
Louvered air intake ventilation hatches	2	Provides fresh air to voids 4 for diesel engines	Aft deckhouse bulkhead
Louvered hatch covers	2	Provides weathertight seal on air intake ventilation hatches	Aft deckhouse bulkhead

(5) Void 2 port - ROWPU space near port bulkhead

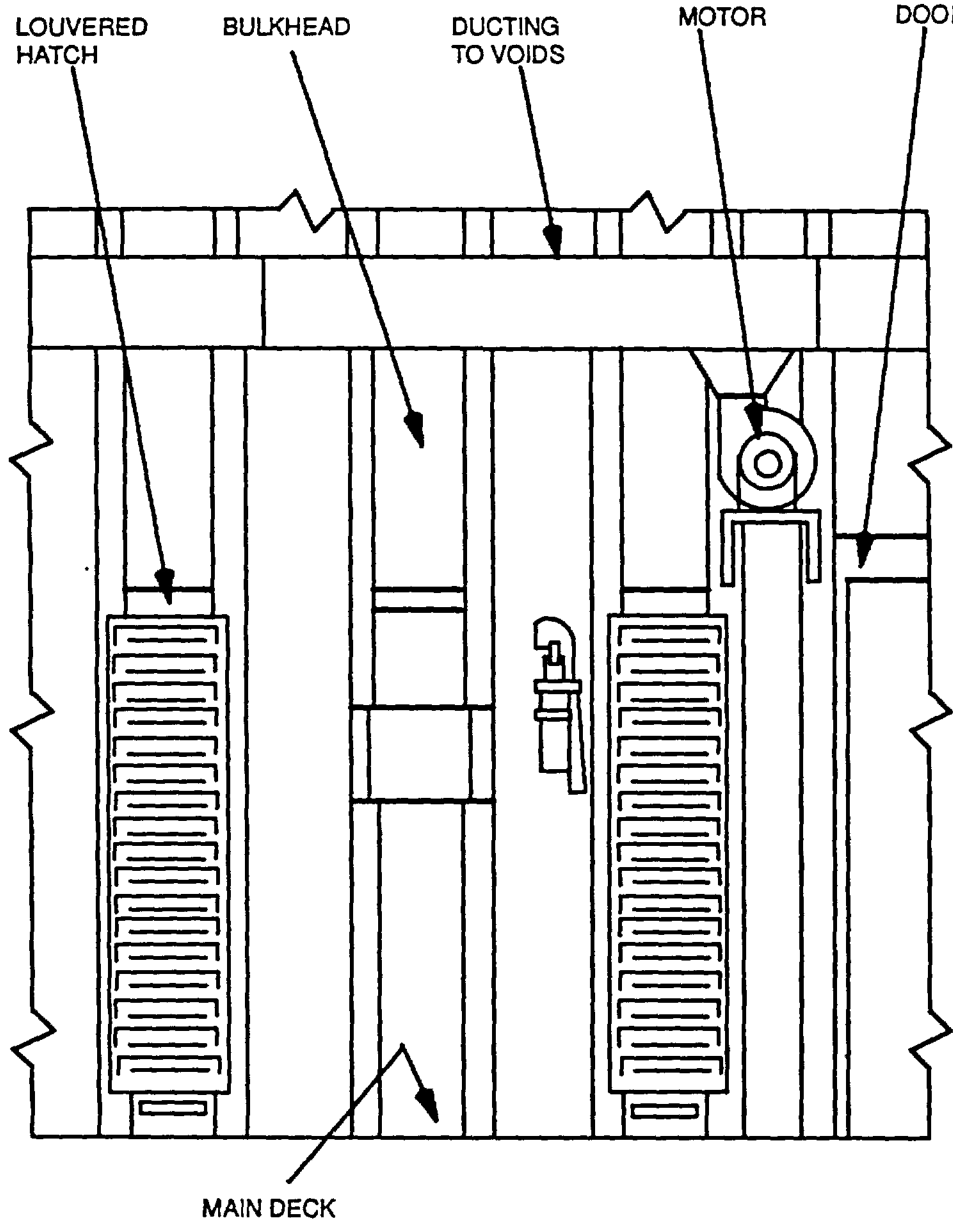
(6) Void 3 port - same as void 2 port farther aft

(7) Void 4 port - same as void 3 port farther aft

(8) Void 5 - overhead in void 4 port. This is a branch from void 4 port, so dosing void 4 port also shuts off air to void 5.

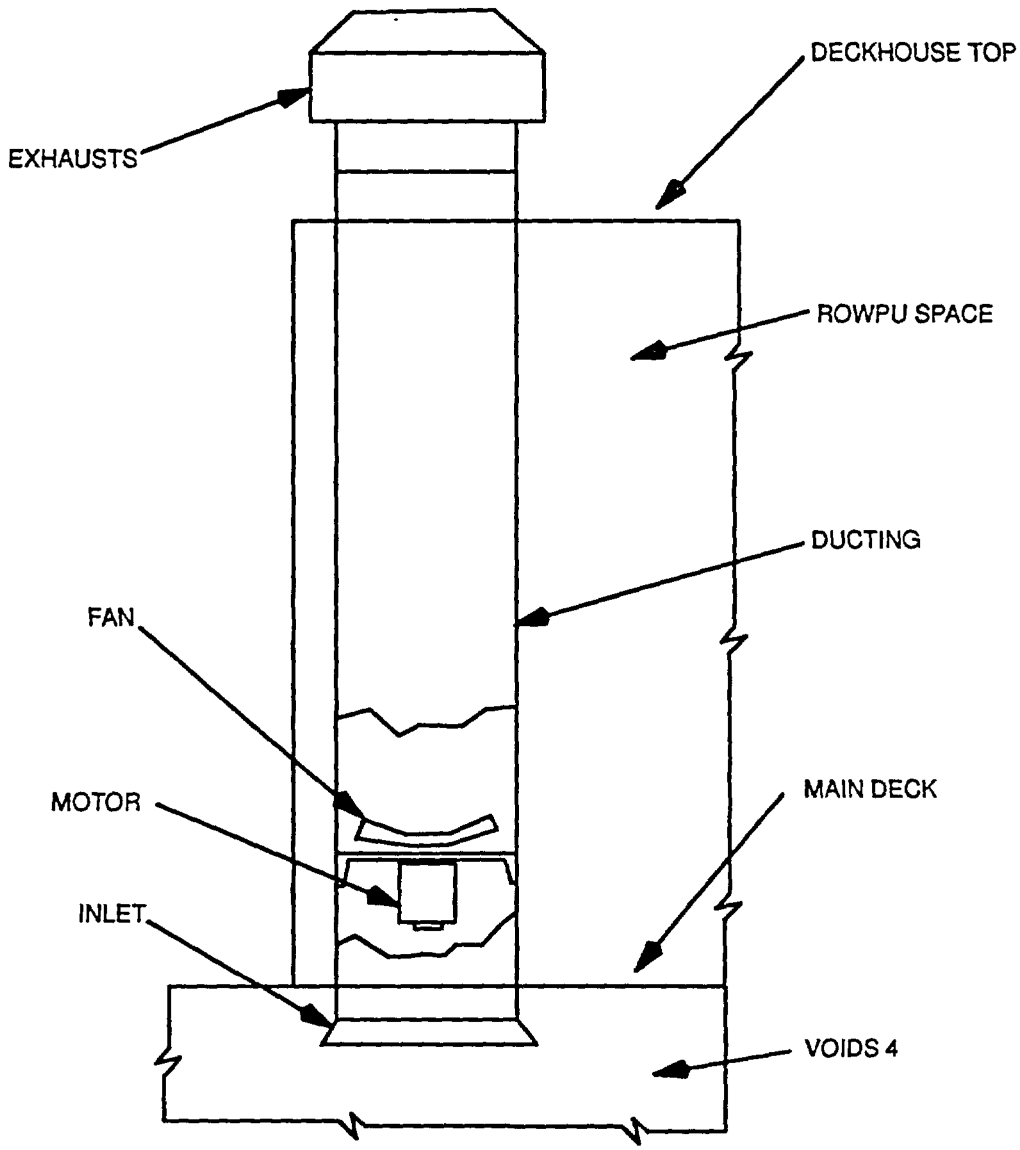
d. Close switchboard circuit breaker P8 to provide power to power panel 2.

e. Make sure power panel 2 circuit breakers 7P8 thru 10P8 (Figure 7-3) are dosed.



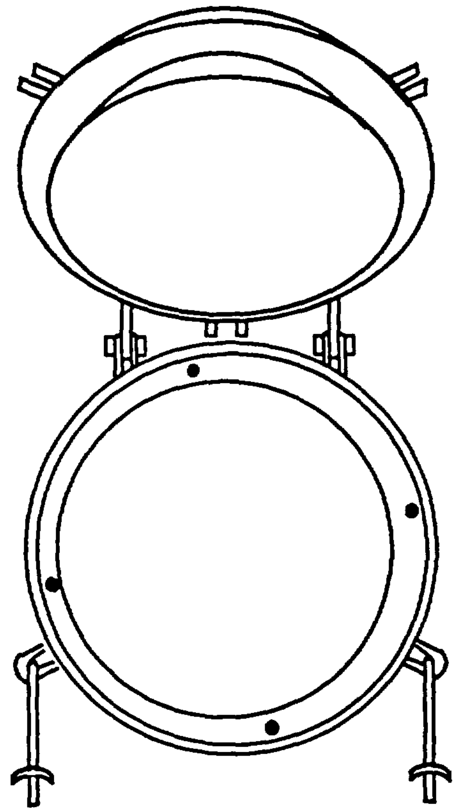
Note: Provides forced air ventilation into all voids

Figure 7-5. Voids Ventilation Fan Motors on Port and Starboard Deckhouse Bulkheads (Portside Shown)



Note: Exhaust air from voids 4 through fans to ducting and outlet on deckhouse top.

Figure 7-6. Example of Vertical Fan Motors near ROWPU Space Aft Bulkhead



Note: Provides weatherproof covers for voids ventilation fan motors

Figure 7-7. Example of Round Blower Covers on Port and Starboard Bulkhead Exteriors

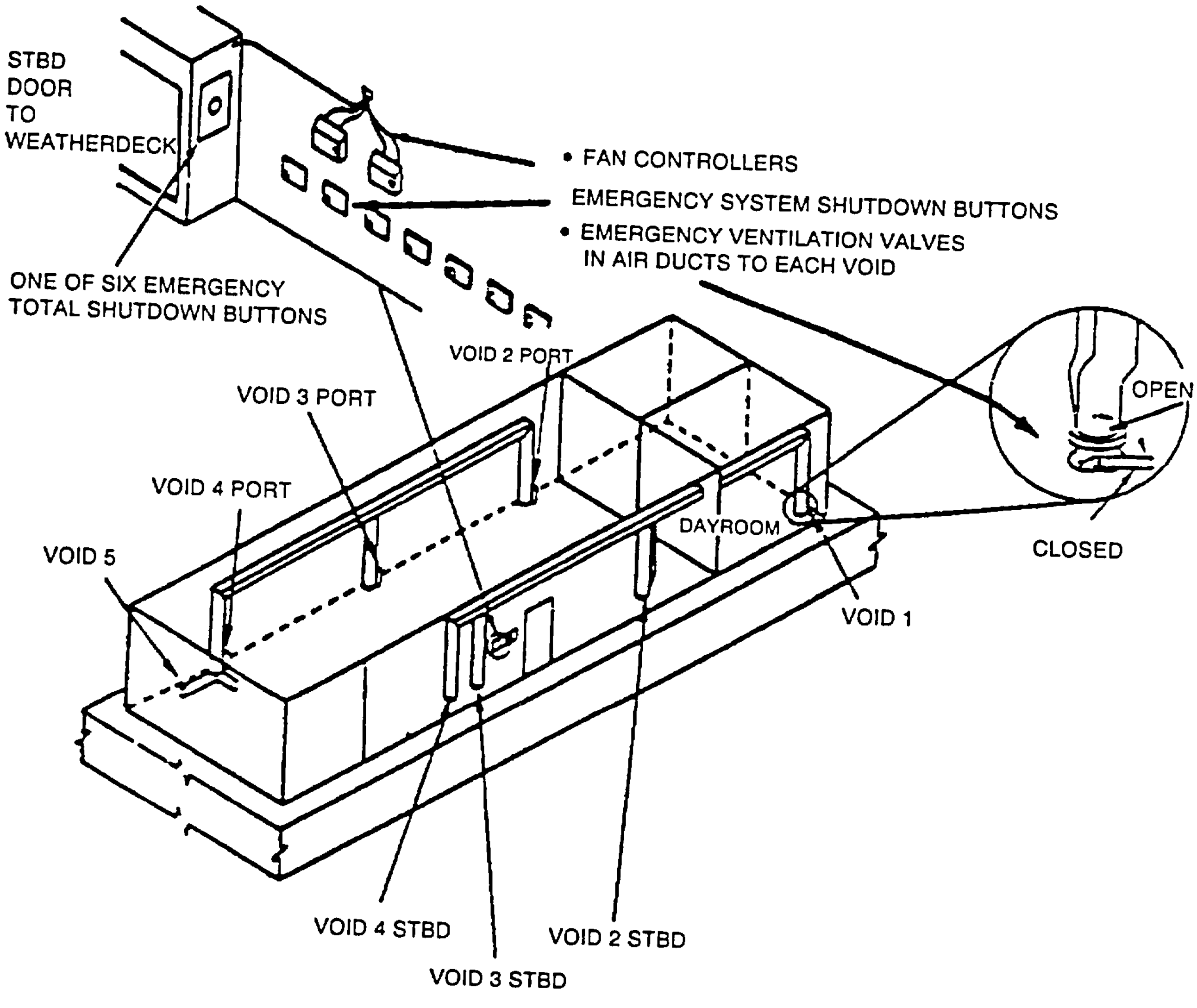


Figure 7-8. Voids Ventilation Emergency Shutdown Controls

7-9.3 Operating procedures

a. Turn on fan 7 by raising starter switch to ON on starboard deckhouse bulkhead forward of side door. This supplies fresh air to void 1 and starboard side of voids 2, 3, and 4.

b. Turn on fan 8 by raising starter switch to ON and then pushing black START button on controller located on port bulkhead forward of door. This supplies air to portside of voids 2, 3, and 4, and to void 5.

c. Turn on fans 9 and 10 by raising controller switches to ON on ROWPU space stem bulkhead. This exhausts air from voids 4, which contain three diesel-powered generators.

7-10 Shutdown procedures

WARNING

Do NOT turn off voids ventilating fans while personnel are in voids or equipment In voids Is operating.

NOTE

Shutdown of voids ventilation system automatically turns off chlorination unit.

7-10.1 Normal shutdown for less than 72 hours

a. Turn off fan 7 by lowering starter switch to OFF.

b. Turn off fan 8 by pushing OFF button on controller and turning switch on side of controller to OFF.

c. Turn off fans 9 and 10 by lowering controller switches to OFF.

7-10.2 Normal shutdown for more than 72 hours

a. Perform shutdown procedures in paragraph 7-10.1 above.

b. Lower blower inlet covers high on exterior sides of ROWPU space and secure in dosed position with bolts and wingnuts. Make sure seals are in good condition and fit properly.

c. Secure two large, flat ventilator intake covers on deckhouse stem bulkhead exterior. Secure with bolts all around outside edge of covers and tighten wrench tight.

d. Open power panel 2 circuit breakers 7P8 thru 10P8.

e. Open switchboard circuit breaker P8.

7-10.3 Emergency shutdown

7-10.3.1 General. Details in Chapter 3 explain the barge's emergency shutdown systems, how they affect the ventilation system, and how they interact with the chlorination system. In addition to the electrical shutdown modes for both ventilation systems, the voids ventilation system also has a mechanical shutoff in the ventilation passage for each void area. The locations are listed in paragraph 7-9.2 and indicated in Figure 7-8.

7-10.3.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shutdown either the ventilation system or all operating systems.

b. Shut off air to voids 1 thru 4 by dosing emergency shutoff valves on both sides of deckhouse. When dosed, handles are in horizontal position (Figure 7-8).

c. Shut off air to void 5 by dosing emergency shutoff valve on overhead in void 4 port. When dosed, handle should be at right angle to ductwork. Since this air duct branches off from duct for void 4 port, dosing emergency shutoff for void 4 port also shuts off air to void 5.

d. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

e. When emergency button is reset, ventilation system must be restarted by performing procedures in paragraphs 7-9.2 and 7-9.3.

Section IV. Heating and air conditioning (HAC) system

7-11 Description. The dayroom and workshop are provided with heated and cooled air from an HAC unit on the forward bulkhead in the workshop. This unit forces either heated or cooled air through overhead ductwork into the workshop and dayroom. Bulkheads in both rooms are well insulated so that a reasonable temperature is maintained. The control to select either heating or air conditioning (AC) is on upper right side of box containing heating element above the AC unit (Figure 7-9). The AC controls (Figure 7-10) are on front of the unit. The heating unit, located in ductwork above the AC unit, uses an electrically powered element. Both heating and AC use the blower fan in the AC unit to move air into the dayroom and workshop. The thermostat for the heating portion of this system is on the port bulkhead in dayroom near the refrigerator receptacle. Both dayroom and workshop are also equipped with a mushroom-style, nonpowered ventilator in the deckhouse top.

The AC unit's watercooling condenser is provided seawater from one of two sources. If seawater pumps in void 2 starboard are operating, and the proper valves open, they provide seawater for cooling the AC condenser and for cooling the chlorination unit. When these pumps are not operating, seawater for cooling is provided by an AC cooling water pump. This pump draws seawater from the forward seachest through a set of AC seawater strainers in void 2 port and provides water for cooling both the AC unit and the chlorination unit. For details, see TM 55-1930-209-14&P-2, Seawater Systems.

Installation of this system is shown in drawings referenced in Appendix A. Components are listed in Table 7-3.

7-12 Capabilities. This system provides sufficient heating or cooling to maintain the dayroom and workshop at normal working temperatures.

7-13 Special limitations. The HAC system is designed to heat and cool the workshop and dayroom only. Doors from workshop and dayroom to ROWPU space and weatherdeck must be closed when this system is in operation. Failure to do so overloads the system and will lead to its early failure.

7-14 Performance characteristics. The AC unit provides up to 60,000 Btu of cooling per hour, and the heating unit provides heat equivalent of 15 kW.

7-15 Operating Instructions

7-15.1 Operating controls and Indicators

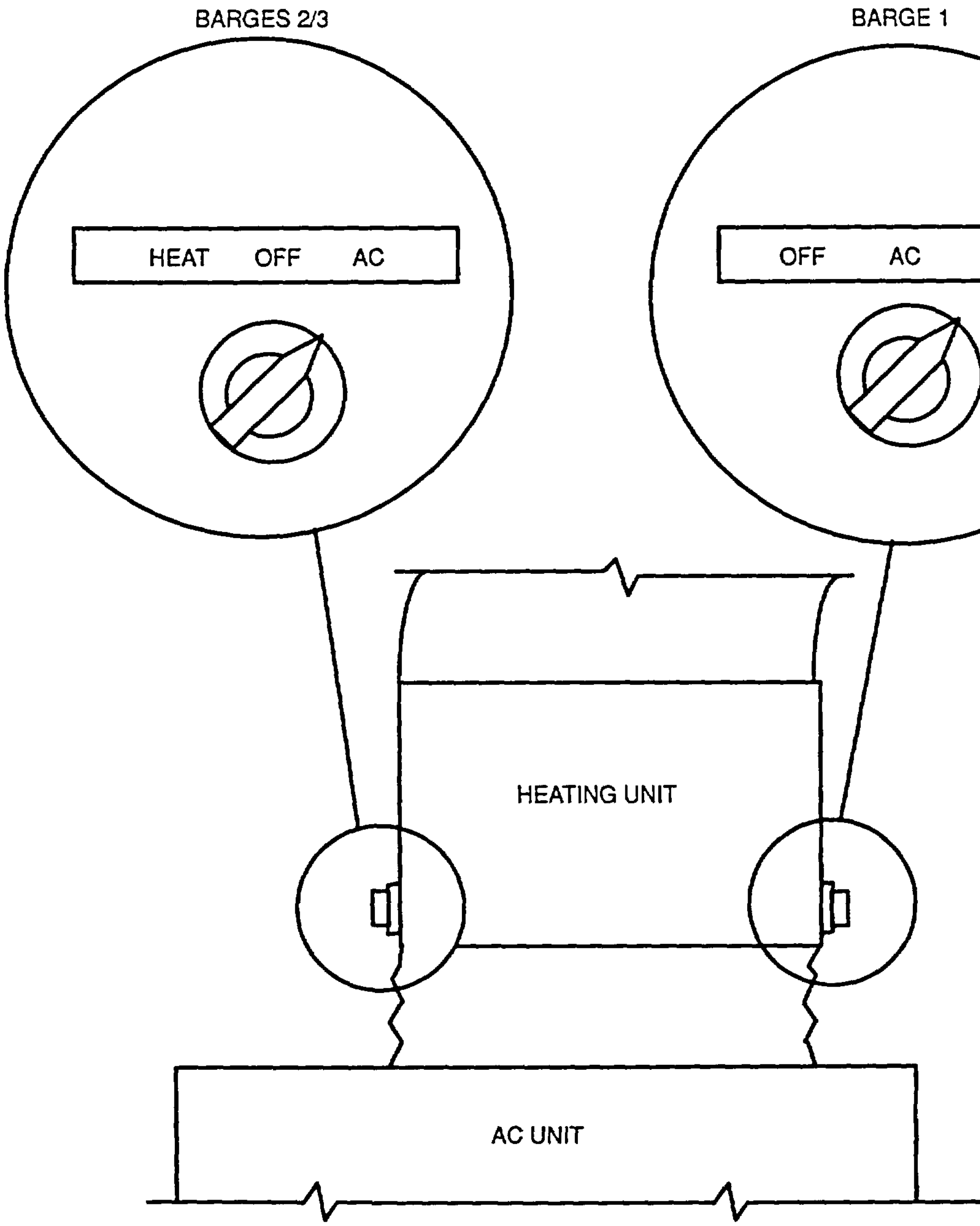
a. Heating and AC selector switch (Figure 7-9). On side of heating element box above AC unit. Selects OFF, AC or HEAT by rotating switch.

b. AC controls (Figure 7-10). On front of AC unit in workshop.

(1) Left switch controls fan and AC unit with settings of OFF/FAN/COOL. OFF position turns off both fan and AC. FAN position turns fan on for use with either AC or heating element. COOL position turns on AC and fan.

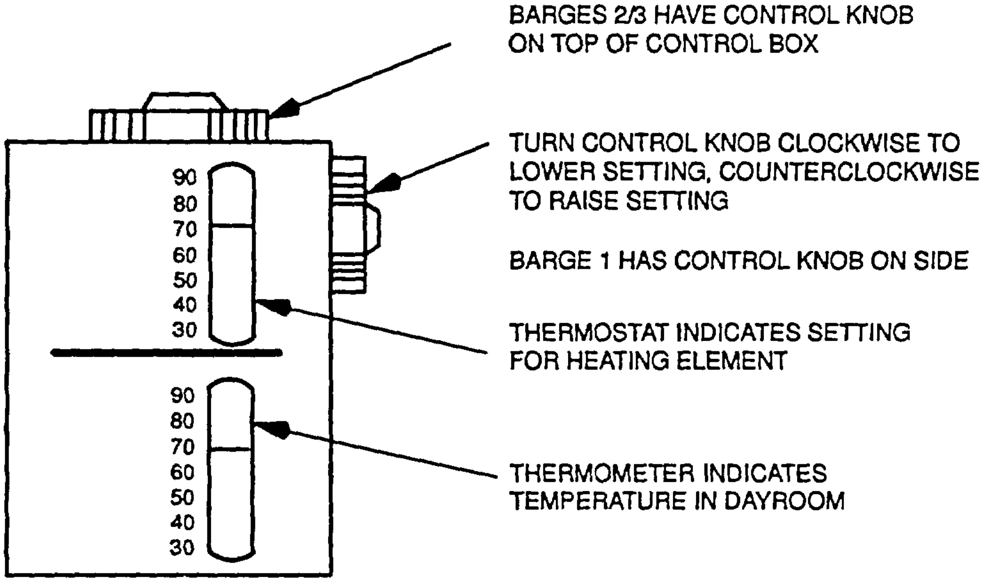
(2) Right switch selects amount of cooling to be obtained from AC unit. Turn clockwise to increase cooling, counterclockwise to decrease cooling.

(3) AC electrical switch. Switch handle sticks out of lower right comer of AC unit bottom front panel. Tums electric power ON (upper position) or OFF (lower position).

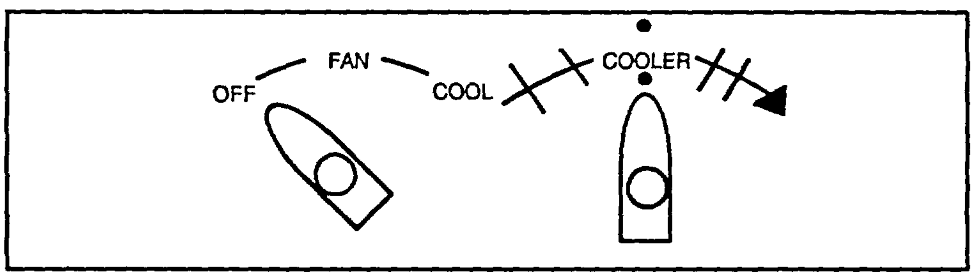


Selector switch, on heating element above AC unit in workshop, selects unit to be used. After unit has been selected, use controls shown in Figure 7-4.

Figure 7-9. Heating and AC Selector Switch



Heating element thermostat on longitudinal bulkhead in dayroom aft of refrigerator receptacle. Controls only heating element.



Air conditioning controls on front of AC unit in workshop.

Figure 7-10. Heating and AC System Controls

Table 7-3. Major Components of Heating and Air Conditioning System

Component	Quantity	Function	Location
5-ton marine air conditioner	1	Provides cooled air for workshop and dayroom	On workshop forward bulkhead
In-line heating element	1	Heats air in workshop and dayroom	In air plenum above AC unit in workshop
Air outlets	2	Directs air flow	1 in workshop; 1 in dayroom
Air ventilators	2	Allows air to exit from workshop/dayroom	On deckhouse top, 1 in workshop, 1 in dayroom
Thermostat	1	Controls heating element	On dayroom bulkhead near refrigerator receptacle
HEAT/COOL/ OFF switch	1	Selects heating or cooling	On side of heating element housing above AC unit in workshop
AC control unit	1	Selects AC or fan only	On front of AC unit in workshop
Cooling pump motor controller		Controls cooling pump	On centerline bulkhead in void 2 port

c. Heating element controls (Figure 7-10). On dayroom port bulkhead aft of refrigerator. Thermostat control on upper portion of control box sets temperature desired from heating element. Bottom portion of control box displays a thermometer indicating temperature in the dayroom.

NOTE

The following controls and indicators are part of the seawater system but are critical to operation of the AC unit. For details see TM 55-1930-209-14&P-2 Seawater Systems.

d. Seawater valves SW3 and SW27 in void 2 port (Figure 7-11). SW3 controls water flow from forward seachest to seawater strainer 3 and SW27 controls flow of cooling water from seawater strainer 3 to cooling water pump.

e. Seawater valve SW28, in void 1 underneath AC unit (Figure 7-11). Controls flow of cooling water from cooling water pump to AC unit.

f. Seawater pressure gauges and associated valves SW35 (seawater strainer 3 pressure in) and SW36 (seawater strainer pressure out) in void 2 port. Gauges show seawater pressure going into strainer 3 and seawater pressure coming out of strainer 3. A pressure differential of 2 pounds per square inch (psi) or more indicates that the strainer must be switched and the dogged strainer basket cleaned. See TM 55-1930-209-14&P-2, Seawater Systems, for details. Valves control water pressure to pressure gauges and should normally remain open.

g. Seawater valve SW47 in void 2 port (Figure 7-11). Controls flow of seawater from cooling pump to chlorination unit.

h. Seawater valve SW48 in void 2 port. Controls flow of seawater from seawater pumps to air conditioning unit and chlorination unit.

i. Cooling water pump controller on centerline bulkhead in void 2 port (Figure 7-11). Controls electrical power to cooling water pump.

7-15.2 Prestart procedures

CAUTION

Keep doors to ROWPU space and weatherdeck closed. Failure to do so overloads HAC system and can lead to early failure.

a. Close doors to ROWPU space and weatherdeck and make sure they remain dosed when this system is being used.

b. Using vent handle extension stored in the dayroom, open HAC outlets in workshop and dayroom. Make sure they are free from obstructions.

c. Using vent handle extension stored in dayroom, adjust round watertight ventilator outlets in deckhouse top of workshop and dayroom.

d. Clean all components, including ventilator outlets, and make sure components are not damaged.

e. Close switchboard circuit breaker P5 to provide electricity to power panel 1.

f. Make sure power panel 1 circuit breaker 5P5 is dosed.

g. If AC unit is to be used and seawater pumps are NOT operating, set seawater valves as follows: (Figure 7-11)

(1) Open SW3, SW27, SW28, SW35 and SW36.
(2) Close SW47.

h. If AC unit is to be used and seawater pumps ARE OPERATING, set seawater valves as follows: (Figure 7-11)

(1) Open SW48, 47 and 28.
(2) Close SW27 and SW3.

7-15.3 Operating procedures

7-15.3.1 AC unit

a. If seawater pumps are NOT operating, push black START button on AC cooling water pump controller on centerline bulkhead in void 2 port. If seawater pumps ARE operating, do NOT activate AC cooling water pump.

b. Turn OFF/AC/HEAT selector switch to AC. Switch is on side of heating element above AC unit (Figure 7-9).

c. Turn AC electrical switch to ON (up position). Switch handle protrudes from AC unit in lower right comer of front bottom panel.

d. Turn left switch OFF/FAN/COOL to COOL (Figure 7-10) on AC controls on front of unit.

e. Turn right cooler switch on AC controls clockwise to obtain desired amount of cooling. (Clockwise increases cooling, counterclockwise decreases cooling.) If unit has been operating within previous 30 minutes, a safety delay switch may activate and AC compressor will not come on for 5 minutes.

f. System is thermostatically controlled and cycles on and off as necessary to maintain amount of cooling selected with right-hand switch on AC controls. Check temperature indicated on thermometer in dayroom. Adjust cooler switch on AC unit to maintain desired temperature.

g. Monitor seawater strainer 3 pressure shown on the two gauges activated by SW35 and SW36. If difference in pressure is more than 2 psi, seawater strainer 3 must be switched and dogged basket cleaned. See TM 55-1930-209-14&P-2, Seawater Systems, for these procedures.

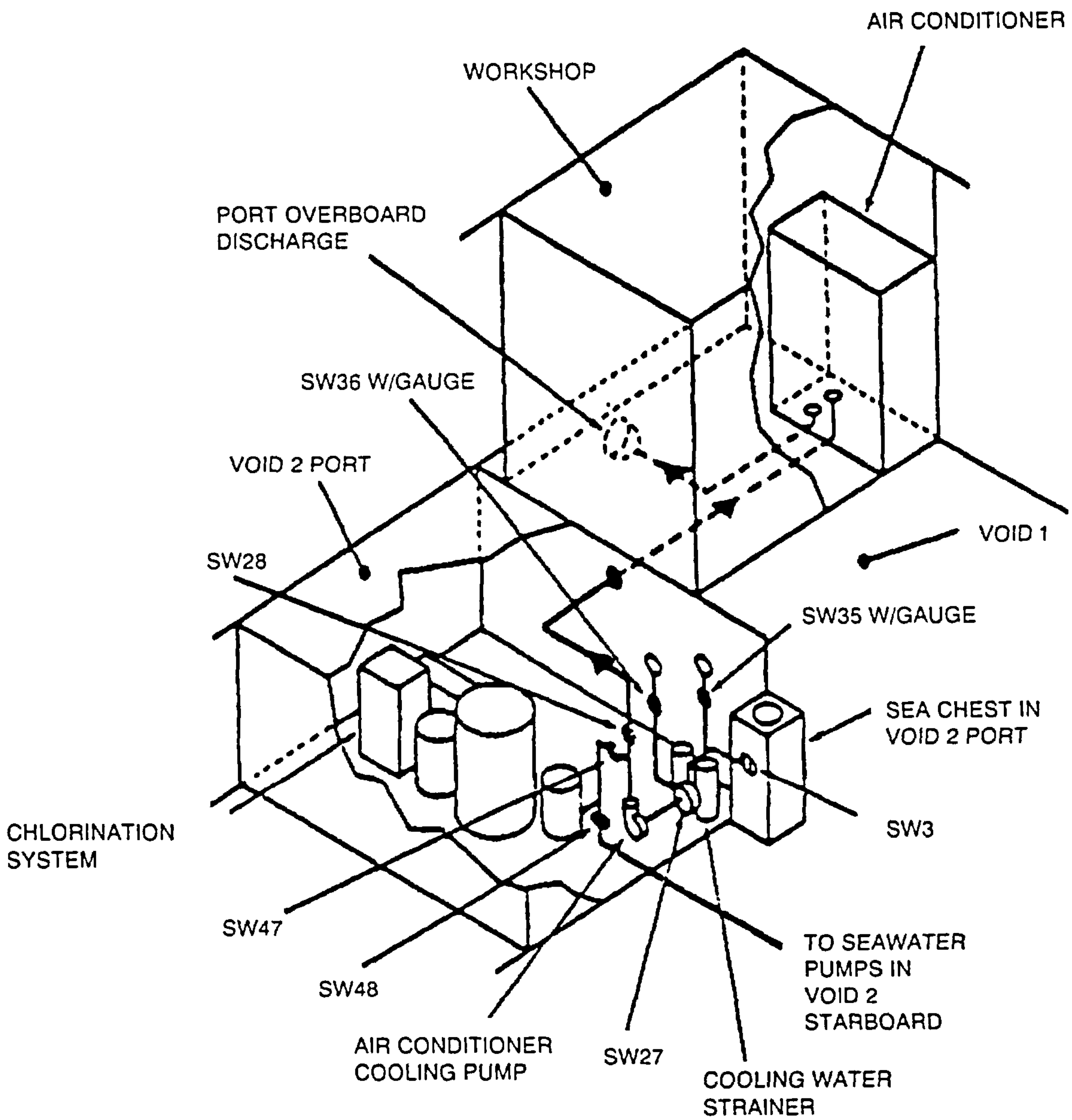


Figure 7-11. Location of Seawater Valves Affecting AC Unit

7-15.3.2 Heating unit

a. Turn OFF/FAN/COOL switch to FAN (Figure 7-10).

b. Turn AC electrical switch to ON (up position).

c. Turn OFF/FAN/COOL switch to FAN (Figure 7-10)

d. Set desired temperature on heater thermostat, in dayroom near refrigerator receptacle, by moving lever on right side up or down (Figure 7-10).

e. Make sure fan motor in AC unit comes on to move hot air into workshop and dayroom.

7-15.4 Shutdown procedures

7-15.4.1 AC unit

a. Rotate right cooler switch on AC controls fully counterclockwise to unload compressor (Figure 7-10).

b. Turn left OFF/FAN/COOL switch on AC controls to OFF.

c. Turn selector switch to OFF (Figure 7-9).

d. Turn HEAT/OFF/AC switch to OFF (down position).

e. If seawater pumps are NOT operating and cooling water pump is NOT being used to supply water to chlorination unit, turn cooling water pump off and close seawater valves SW3, SW27, SW28, SW35 and SW36.

f. If seawater pumps are NOT operating and cooling water pump is supplying water to chlorination unit, close SW28.

g. If seawater pumps are operating, dose seawater valve SW47.

7-15.4.2 Heating unit

a. Turn thermostat to lowest possible setting by moving control lever to bottom of its travel (Figure 7-10).

b. Turn left OFF/FAN/COOL switch on AC controls to OFF.

c. Turn HEAT/OFF/AC selector switch to OFF (Figure 7-9).

d. Turn AC electrical switch to OFF (down position).

7-15.5 Emergency shutdown

7-15.5.1 General. The barges have two emergency shutdown modes (Chapter 3). One mode shuts down individual systems such as the ventilation system or a diesel high pressure pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Emergency system shutdown red buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These seven emergency system shutoff buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG1, and SSG2.

Emergency total shutdown red buttons are located as follows.

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system emergency shutoff buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck.
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

7-15.5.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.

b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

c. After emergency button Is reset, HAC must be restarted by performing procedures in 7-15.2 and 7-15.3.

Section V. ROWPU space and voids heating system

7-16 Description. On ROWPU Barge 1 only, ROWPU space and voids are provided with 12 forced air heaters installed throughout the barge (Figure 7-12). There are four heaters installed in the RO space and one Installed In each void. Heater controls are located on the front of each electrically powered unit (Figure 7-13). The major components of this system are:

a. Electric space heater, Model No. 20743 0-3, 3 kW, 440 Vac, 3 ph, 60 Hz, quantity of 12.
b. Power panel No. 4. 440 Vac, 3 ph, 3 W, 10 circuits, quantity of 1.

7-17 Capabilities. This heating system provides sufficient heating to maintain an ambient air temperature above 320F during cold weather conditions.

7-18 Special limitations. The forced air heaters are Installed to provide sufficient heat to prevent freezing in the ROWPU space and voids only.

7-19 Performance characteristics. Each unit provides the heat equivalent of 3 kW which is equal to 36 kW of heat for the 12 heaters.

7-20 Operating instructions

7-20.1 Operating controls and indicators

a. Heater controls (Figure 7-13).

(1) ON/OFF selector switch. Move the selector switch to the up position to turn heater OFF and to the down position to turn heater ON.

(2) Thermostat. The thermostat dial operating range Is marked for 40°F to 100°F. Rotate the control knob to the desired heating temperature.

(3) Manual reset switch. The manual reset hi-limit thermostat switch is set to open at 350°F and close at 40°F when it is reset.

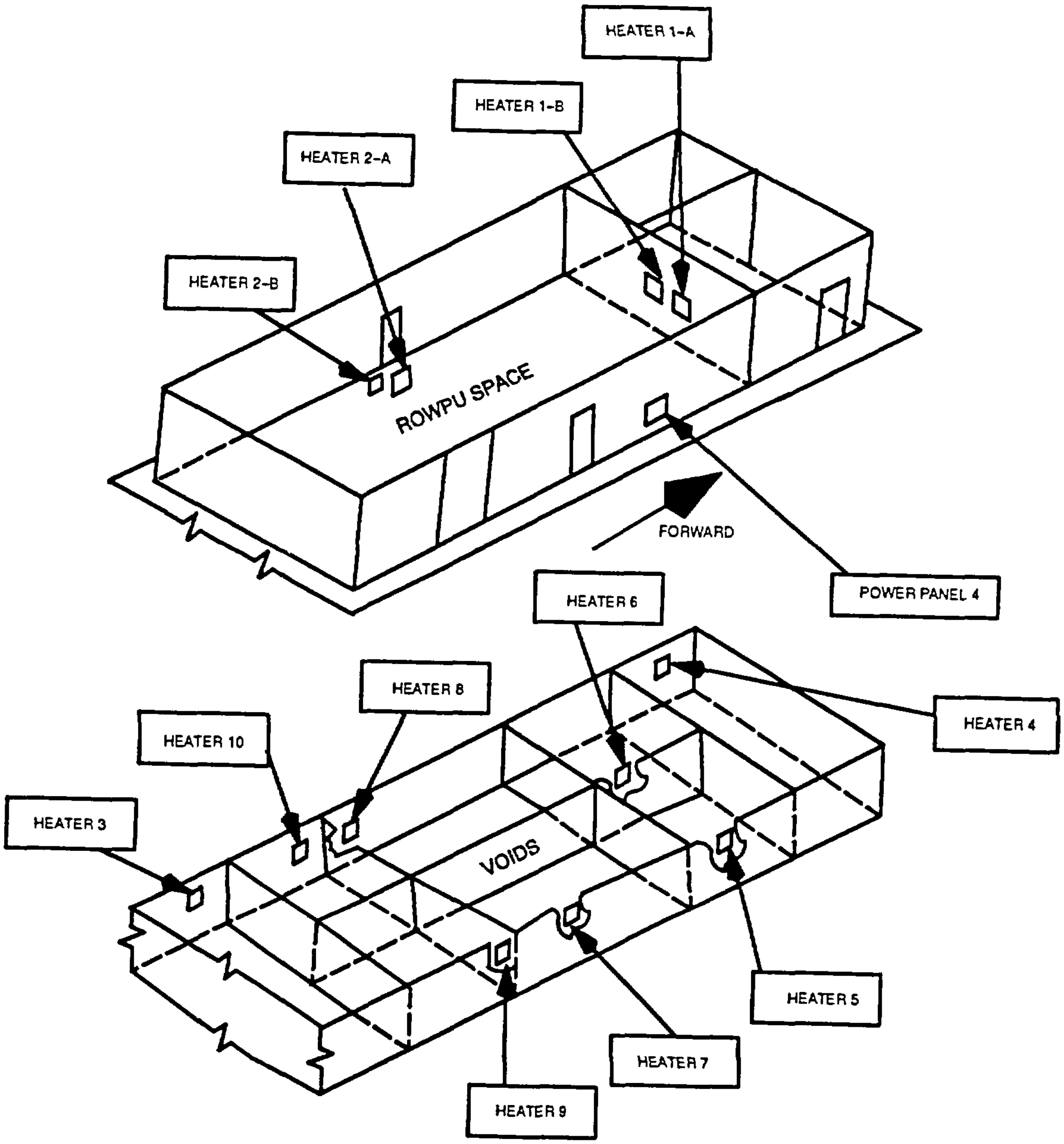


Figure 7-12. Heating Systems Locations (Barge 1).

b. Power distribution.

(1) Barge 1 switchboard distribution panel (Figure 7-14) distributes electrical power for the forced air heaters to power panel 4 Circuit breaker P19.

(2) Power panel 4 (Figure 7-15) provides electrical power for each of the 12 forced air heaters using circuit breakers 1P19 thru 10P19. Electrical power for all 12 heaters may be shut off at the switchboard distribution panel circuit breaker P19 Electrical power to any of the 12 heaters can be shut down Individually at power panel 4 by turning off circuit breakers 1 P19 thru 10P19, as required.

7-20.2 Prestart procedures

a. Make sure the space around the heater being used Is unobstructed.

b. Make sure switchboard circuit breaker P19 is closed.

c. Check the heater being used for damage. Clean heater louvers and heater exterior shell as required Report any discrepancies to shift leader or bargemaster for correction.

7-20.3 Operating procedures. To prevent ROWPU equipment and water piping from freezing during cold weather conditions, turn forced air heater ON as required.

a. Set thermostat to desired temperature setting

b. Turn ON/OFF selector switch to ON.

c. If heater is ON but falls to operate, press manual reset hi-limit thermostat button. This thermostat functions as a circuit breaker. If heater fails to restart, turn heater selector switch to OFF and check for cause of failure.

7-20.4 Shutdown procedures

a. Forced air heater normal shutdown procedure is to turn the ON/OFF selector switch to the OFF position.

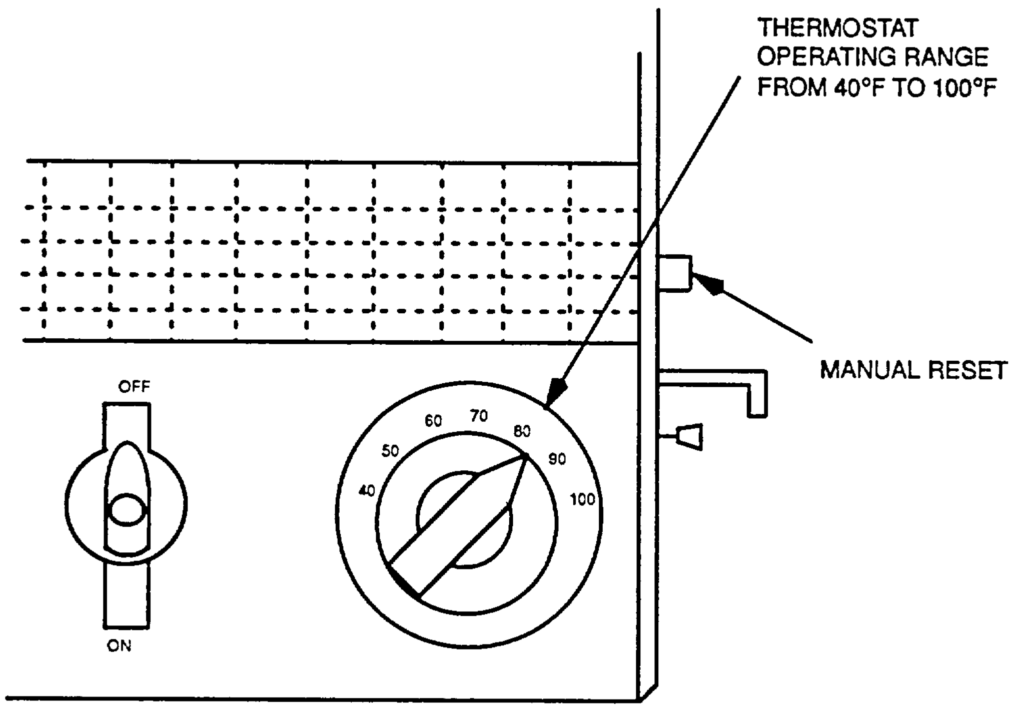
b. Electrical power can also be cut off to the heaters by opening circuit breaker P19 or to any individual heater by opening any circuit breaker 1P19 thru 10P19 (paragraph 7-20.1).

7-20.5 Emergency shutdown

7-20.5.1 General. Paragraph 3-7.9.1 explains the barge's emergency shutdown systems. Any of the total shutdown buttons will cut off power to all of the forced air heaters on Barge 1. Any of the individual system shutdown buttons that shut down a generator supplying power to the switchboard will also shut down all of the forced air heaters.

7-20.5.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either all operating systems or the generator supplying power to the switchboard.
b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in ready position.
c. When emergency button Is reset. Forced air heaters must be restarted by performing procedures in paragraph 7-20.3.



ON/OFF selector switch on front of each unit.

Use the thermostat knob to control operating range from 40 degrees F to 100 degrees F.

Figure 7-13. Heater Controls

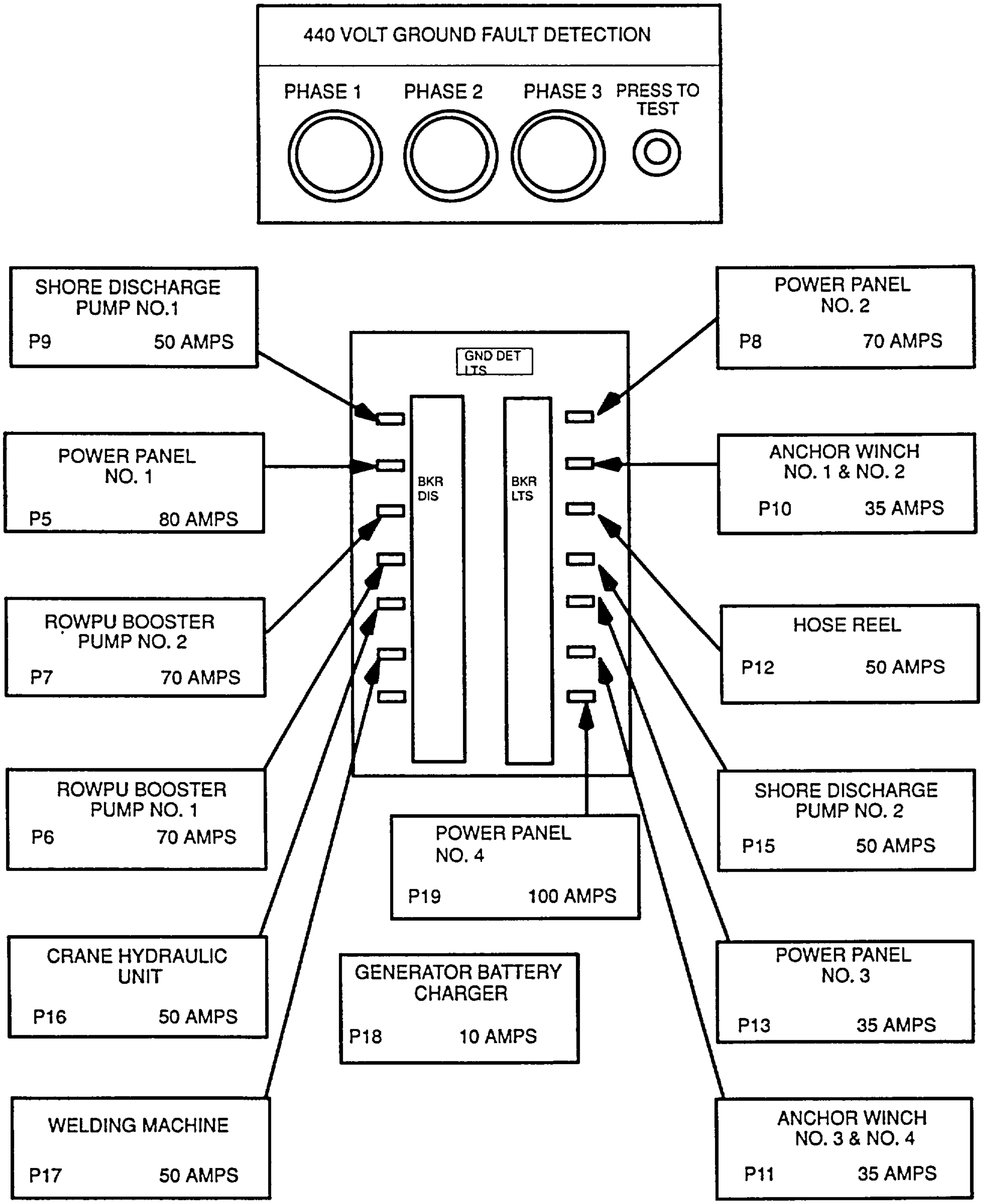


Figure 7-14. Switchboard Distribution Panel (Barge 1)

POWER PANEL 4
440 VAC, 60 HZ

1P19 HEATER 1-A FND STBD HEATER 1-B FWD PORT ROWPU SPACE	2P19 HEATER 2-A AFT STBD HEATER 2-B AFT PORT ROWPU SPACE
E3P19 HEATER 3 VOID 5	4P19 HEATER 4 VOID 1
5P19 HEATER 5 VOID 2 STBD	6P19 HEATER 6 VOID 2 PORT
7P19 HEATER 7 VOID 3 STBD	8P19 HEATER 8 VOID 3 PORT
9P19 HEATER 9 VOID 4 STBD	10P19 HEATER 10 VOID 4 PORT

LOCATED IN ROWPU SPACE ON STARBOARD BULKHEAD FORWARD OF DOOR TO WEATHER-DECK. POWER INPUT FROM SWITCHBOARD CIRCUIT BREAKER P19.

Figure 7-15. Power Distribution Panel 4,440 Vac (Barge 1)

CHAPTER 8 EQUIPMENT MONITORING SYSTEM (EMS)

Section I. General

8-1 General. The EMS monitors operation of several equipment components and displays this data on a video monitor. It also uses alarms to alert crewmembers when an operating condition goes beyond a preset range.

8-2 Description. EMS main components are the alarm/casualty monitoring equipment, two 12-volt dry cell batteries, a battery charger, two strobe lights, two horns, and a buzzer. Additional information about EMS major components is in table 8-1. The alarm/casualty monitoring equipment consists of various sensors and switches, a main processor, keyboard, video monitor, alarm relay module, main power switch, and bilge alarm module. A block diagram of EMS components is shown in Figure 8-1. Figure 8-2 shows the arrangement of these components on the barge. Equipment specifications, maintenance information, and manufacturer's service manuals are contained in TM 55-1930-209-14&P-11.

8-3 Capabilities. The EMS main processor unit can accept information from as many as 168 different inputs (9 rate, 63 analog, and 96 switches). On the barge, however, only 39 are used: 1 rate, 13 analog, and 25 switches. Table 8-2 lists various EMS switches and sensors, their locations, and types of video monitor display. The keyboard and video monitor make up the station from which an operator selects and views any page of monitored information, acknowledges alarms, and sets or changes alarm conditions.

8-4 Special limitations. The system is designed to operate only between 32 and 131^{o} F.

Section II. Description of operation

8-5 General. Sensors and switches monitor operating conditions of various items of equipment onboard, such as amount of drinking water in storage tanks, temperature of diesel engine cooling water, etc. This data is sent to main processor, which displays it on one of eight display pages on video monitor. The system in normal operation continuously displays each display page for approximately 9 seconds and then automatically moves on to a new page. A display page is either a bargraph to indicate a varying quantity (e.g., amount of drinking water) or a lighted block to indicate that an item is being monitored and is operating normally. In an alternate mode, the operator selects a specific display page to observe by pressing the appropriate keyboard button. When a sensor detects a value that exceeds acceptable operating conditions, the main processor starts flashing that particular display at double intensity. It also activates remote alarms (horns, strobe lights, and buzzer) alerting crewmembers that corrective action is required. When the crew acknowledges the situation, alarms stop and displays on video monitor stop flashing. They continue to be displayed at double intensity until condition that caused the alarm is corrected.

8-6 Power supply. Two rechargeable 12-volt gel cell batteries, connected in series, provide a 24 Vdc supply for the EMS. A battery charger keeps these batteries fully charged. The 24 Vdc power panel provides power for horns, strobe lights, and buzzer. When an abnormal condition exists, the main processor energizes a relay that connects this power source to these alarms.

Table 8-1. Equipment Monitoring System Main Components

Component	Quantity	Function	Location
Main processor	1	Receives and processes data from sensors and keyboard, displays data on video monitor and activates two strobe lights, two horns and buzzer	ROWPU space, forward bulkhead
Keyboard	1	Selects page for viewing on video monitor, acknowledges alarms, in edit mode sets time and data, activates/deactivates sensors and sets alarm and reference points	ROWPU space, forward bulkhead under video monitor
Video monitor	1	Displays data processed by main processor in display page formats	ROWPU space, forward bulkhead above keyboard
Alarm relay	1	Activates alarms in ROWPU space and dayroom on signal from main processor	ROWPU space under keyboard
Bilge alarm module	1	Activates alarms on deckhouse top on signal from bilge sensors	ROWPU space, outboard of main processor
Horn	2	Sounds warning to crew in ROWPU space and weatherdecks that an abnormal condition exists	One on mast on deckhouse top, one in ROWPU space on forward bulkhead (Barge 1) and on overhead (Barges 2 and 3)
Strobe light	2	Flashes warning to crew that an abnormal condition exists	One with each horn
Buzzer	1	Sounds warning to crew in dayroom that abnormal condition exists	Dayroom, aft bulkhead
12-volt gel cell battery	2	Connected in series, provides 24 Vdc power to EMS	ROWPU space, under main processor
Battery charger	1	Maintains batteries at full charge	ROWPU space, under main processor
Main power switch	1	Maintains batteries at full charge. Provides or disconnects power to monitoring system from batteries	ROWPU space, near main processor

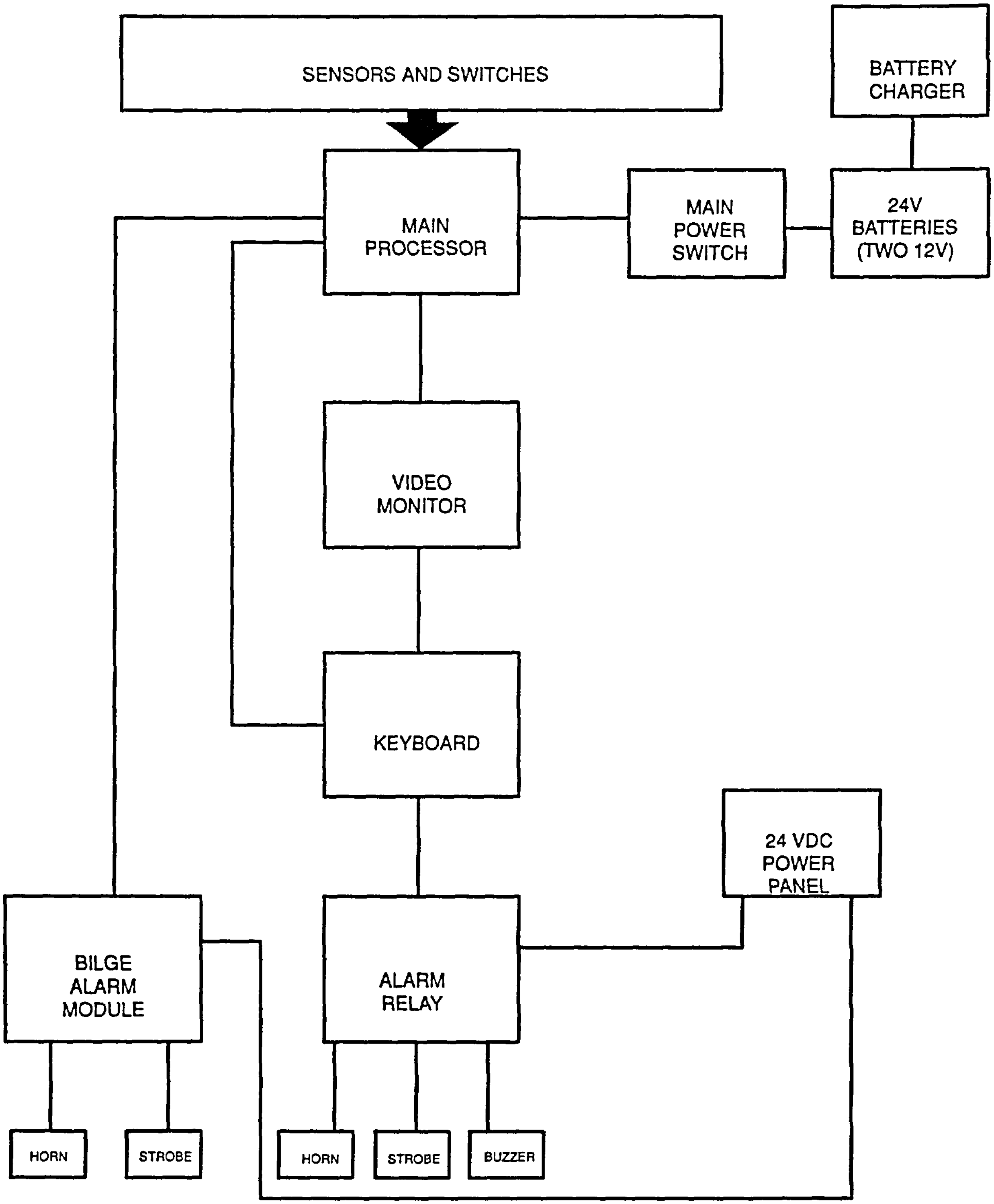


Figure 8-1. Equipment Monitoring System Block Diagram

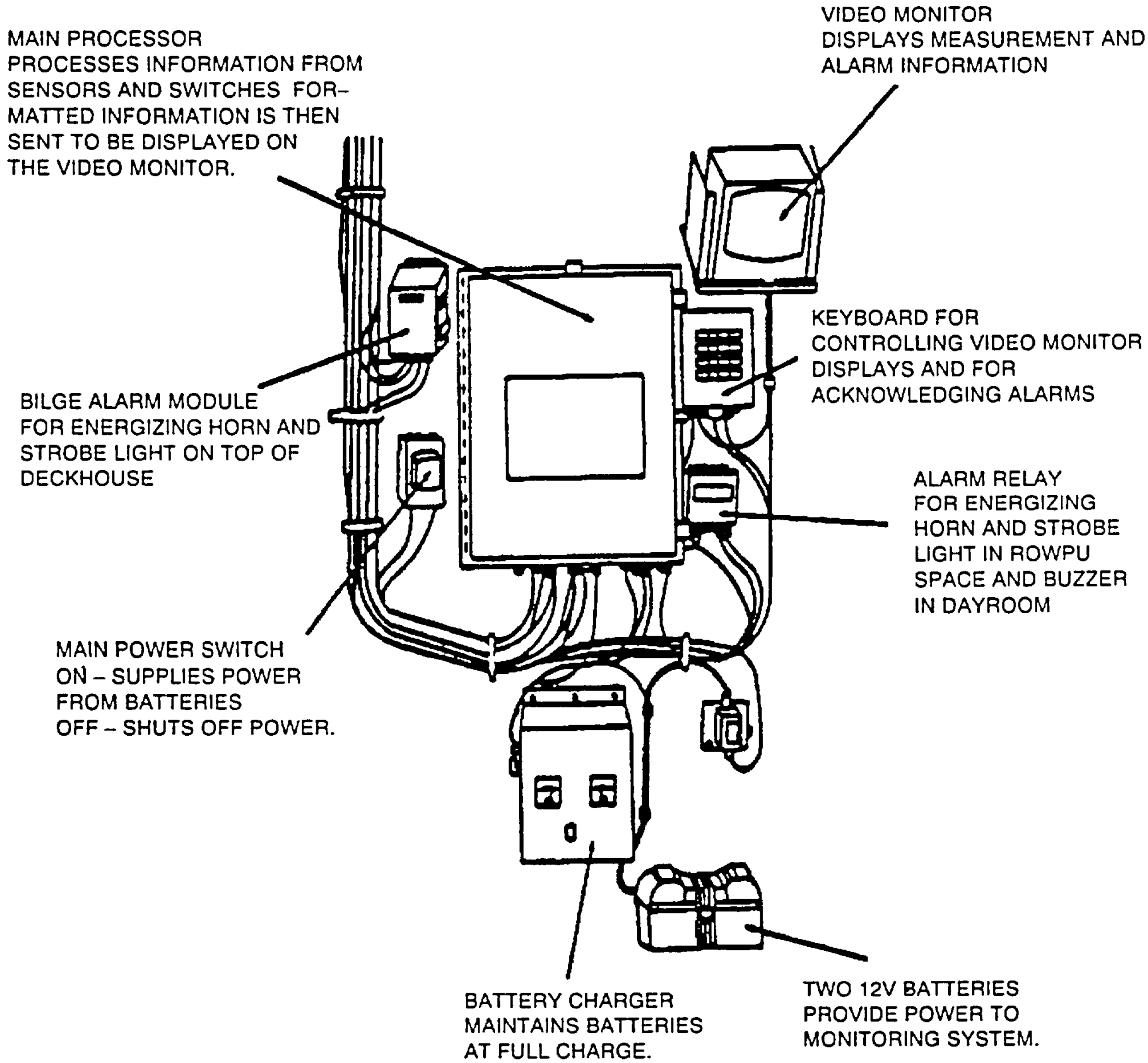


Figure 8-2. Equipment Monitoring System Arrangement

Table 8-2. Equipment Monitoring System Sensor Data

Type	Data Sensed	Qty	Location	Display
Analog	Amount of drinking water in storage tanks	4	One in each drinking water storage tank	Fig 8-3
Analog	Product water salinity (ROWPU #1 & ROWPU #2)	2	One on each RO block	Fig. 8-4
Analog	Drinking water salinity (FW DISCHG)	1	Discharge pump output	Fig 8-4
Switch	Chlorination unit operating status	1	Chlorination unit	Fig 8-5
Switch	Chlorination unit power supply failure	1	Chlorination unit	Fig. 8-5
Switch	Recirculating pump operating status	1	Chlorination unit	Fig 8-5
Rate	Drinking water discharge rate	1	Discharge pump output	Fig. 8-5
Analog	Drinking water discharge pressure	1	Discharge pump output	Fig 8-5
Switch	High sludge tank level	1	Sludge tank	Fig 8-5
Switch	High fuel oil level tank	2	One in each fuel oil storage	Fig 8-6
Switch	High water temperature	5	One on each diesel engine	Figs 8-6 & 8-7
Switch	Low oil pressure	5	One on each diesel engine	Figs. 8-6 & 8-7
Switch	High bilge liquid level	9	One in each void except 2 in void 1	Fig. 8-8
Analog	Drinking water chlorine content	1	Drinking water line downstream of mixer	Fig 8-9
Analog	Metering pump percentage of stroke capacity	1	Chlorination system metering pump	Fig 8-9
Analog	Amount of fuel in main fuel tanks	2	One on each fuel oil main storage tank	Fig 8-10
Analog	Amount of water in ballast tank	1	On ballast tank	Fig 8-10

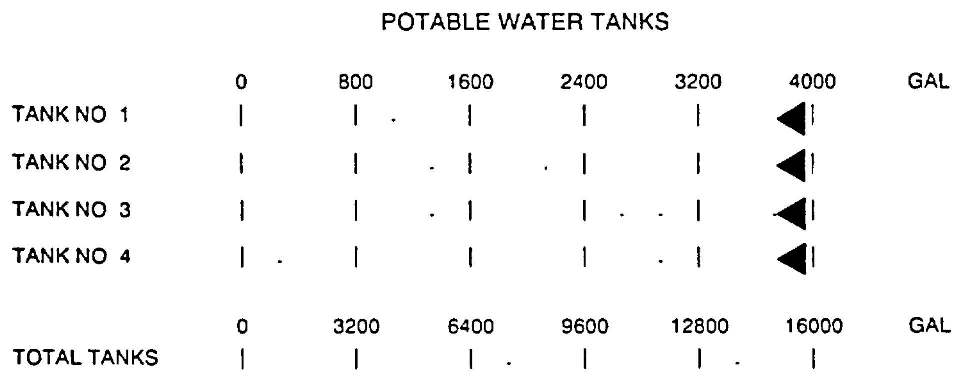


Figure 8-3. Potable Water Tanks Display Page

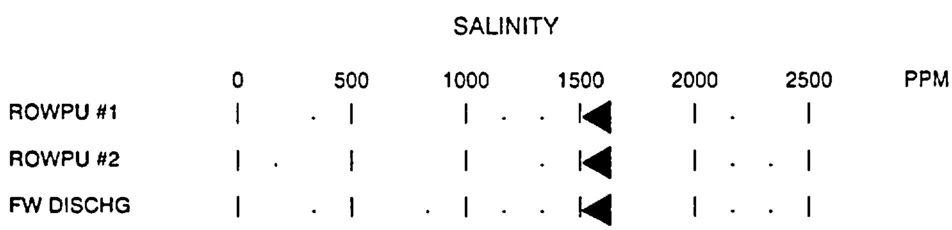


Figure 8-4. Salinity Display Page

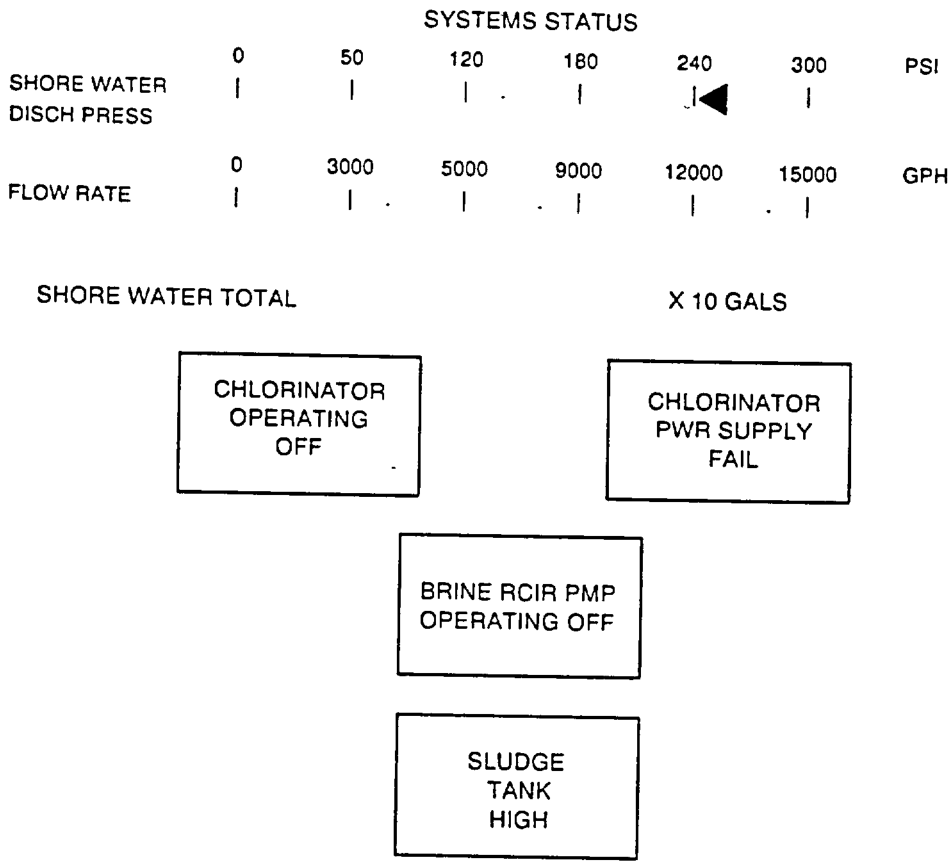


Figure 8-5. System Status Display Page

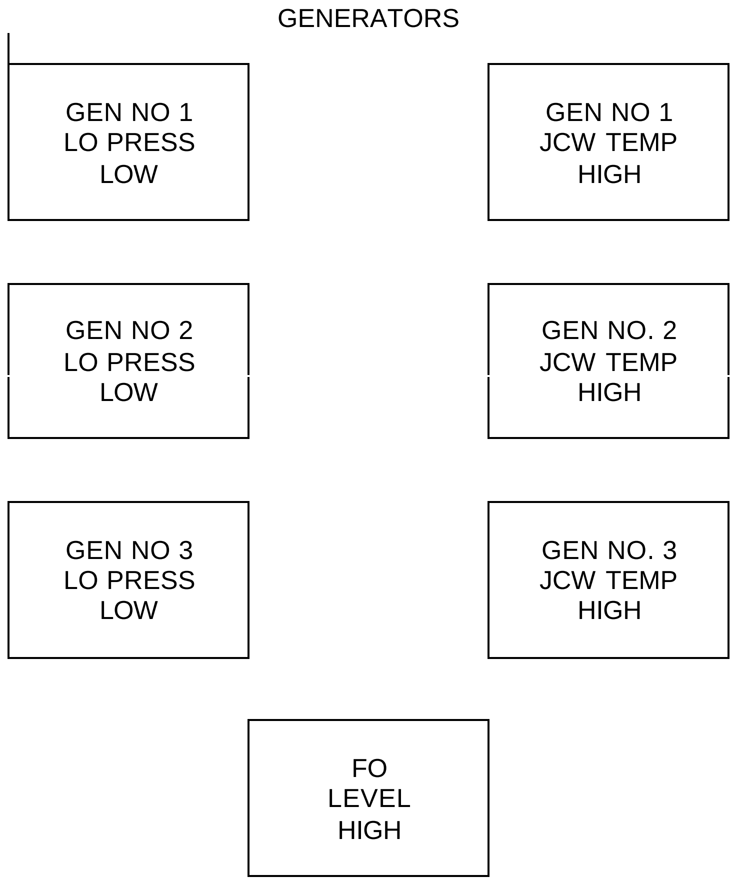


Figure 8-6. Generator Alarms Display Page

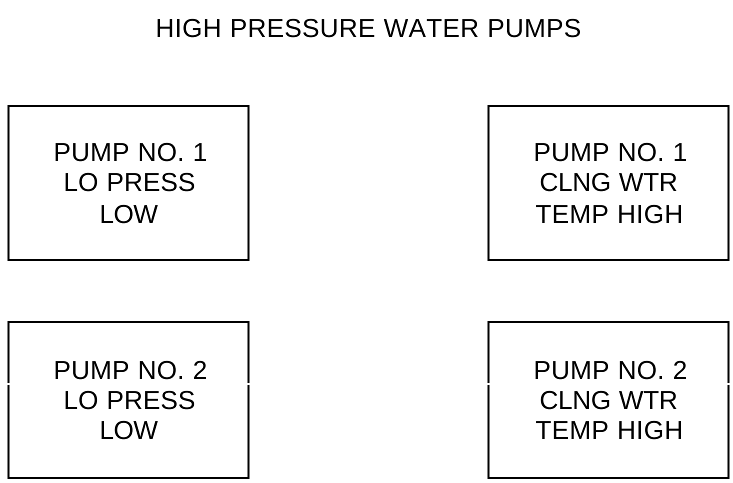


Figure 8-7. High Pressure Water Pumps Display Page

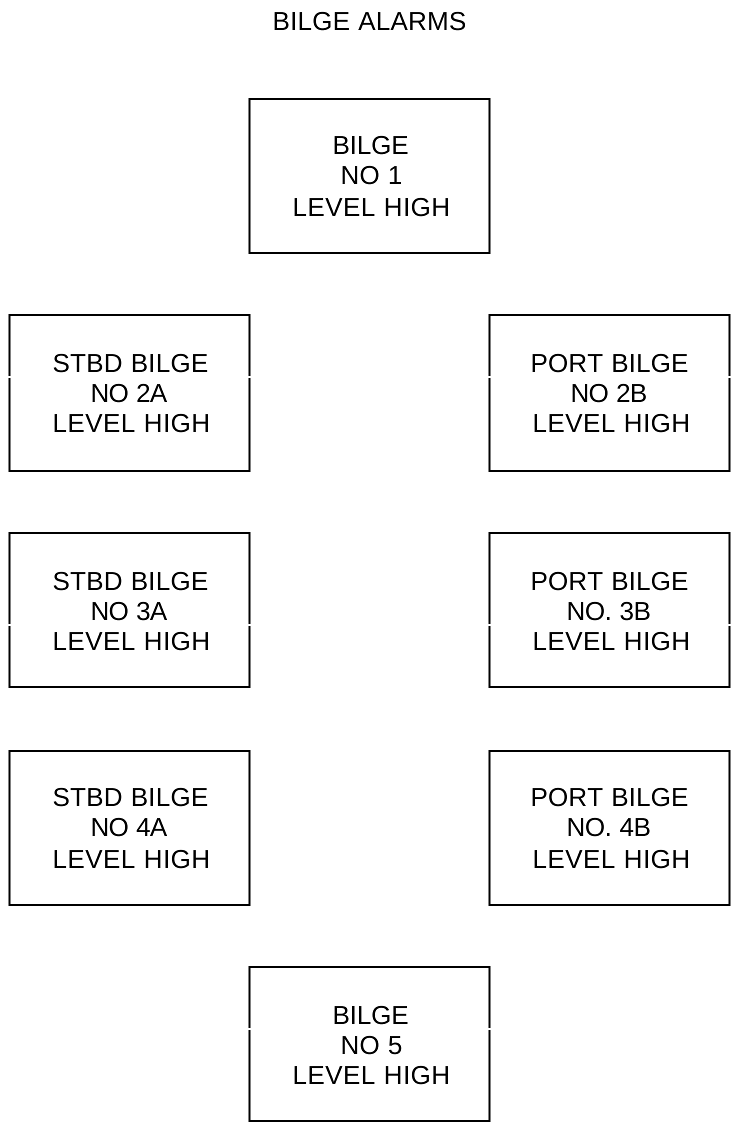


Figure 8-8. Bilge Alarms Display Page

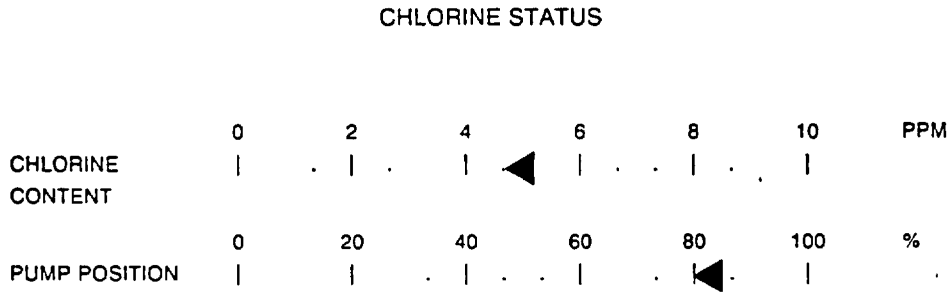


Figure 8-9. Chlorine Status Display Page

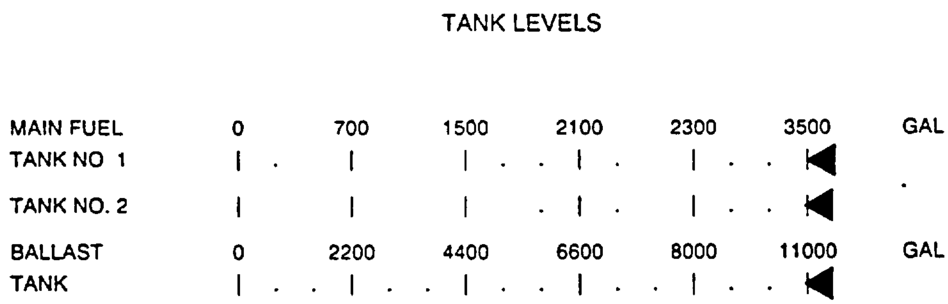


Figure 10-10. Tank Levels Display Page

Section III. Operating instructions

8-7 Operating controls and indicators. See Table 8-3.

8-8 Prestart procedures. Before starting EMS, do the following:

a. Check that batteries are secure, electrical cable fittings are tight and coated with anti-corrosion grease. Correct as necessary.

b. Check major components (EMS components, battery charger, battery bank) for damage and loose fittings or wires. Correct as necessary.

c. Clean components as necessary.

8-9 Operating procedures

8-9.1 Startup procedures

a. Before pushing main switch ON in step b, do the following:

(1) Make sure 24 Vdc power panel circuit breakers 1 P14 and 4P14 are dosed (ON).

(2) On battery charger (Figure 8-14), set HIGH/FLOAT switch to FLOAT position for normal charging or HIGH position for rapid recharging of batteries. Check that voltage is in appropriate range.

CAUTION

Do not allow battery charger to remain on HIGH setting for more than 24 hours of operation.

b. Push main power switch ON (Figure 8-2).

c. If red POWER ON light on video monitor does not come on, turn video monitor on by using switch behind lower front panel.

d. If still no display on video monitor, main processor is turned OFF. Turn ON main processor by opening main processor door and use switch on edge of the door (Figure 8-12).

e. If these switches are ON, and video monitor does not turn on, troubleshoot according to TM 55-1930-209-14&P-11.

f. When turned on, allow EMS about 5 to 10 minutes warmup before display pages appear on video monitor.

g. Perform keyboard lamp test as follows:

NOTE

Keyboard lamp test may be run anytime edit mode is not in use without affecting monitoring.

(1) Press EDIT key.

(2) Press keyboard key 6 (option KEYBOARD LAMP TEST)

(3) Make sure all keyboard keys except ACK key light and alarms activate. Replace any bad lamps according to TM 55-1930-209-14&P-11.

(4) Press EDIT key to complete test and initiate monitoring.

Table 8-3. EMS Operating Controls and indicators

Component	Figure	Location
24 Vdc power panel	8-11	Workshop, aft bulkhead
Main power switch	8-2	ROWPU space, forward bulkhead
Main processor power switch	8-12	Edge of unit door
Video monitor switch	*	Behind front panel below screen
Video POWER ON light	*	Right side of video monitor below screen
Keyboard	8-13	Below video monitor
Battery charger voltmeter	8-14	Front of battery charger
Battery charger ammeter	8-14	Front of battery charger
HIGH/FLOAT charge switch	8-14	Front of battery charger
POTABLE WATER TANKS display	8-3	Video monitor page
SALINITY display page	8-4	Video monitor
SYSTEM STATUS display page	8-5	Video monitor
GENERATORS display page	8-6	Video monitor
HIGH PRESSURE WATER PUMPS display page	8-7	Video monitor
BILGE ALARMS display page	8-8	Video monitor
CHLORINE STATUS display page	8-9	Video monitor
TANK LEVELS display page	8-10	Video monitor
Horn	*	One on deckhouse top, one on ROWPU space forward bulkhead
Strobe light	*	One at each horn
Buzzer	*	Dayroom bulkhead

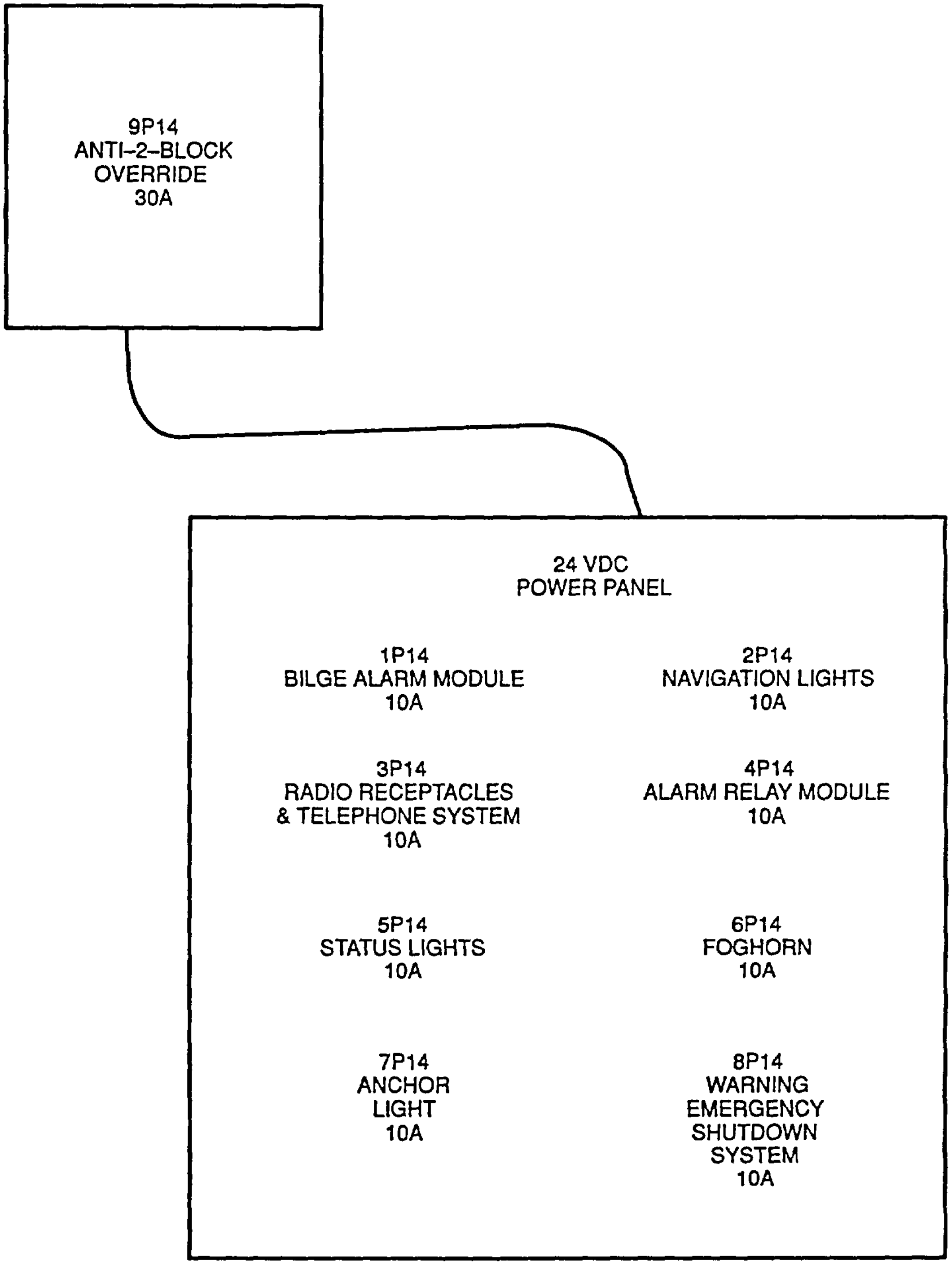
* Figure not provided

h. Check EMS internal temperature by following these procedures:

CAUTION

Optimum operating conditions require temperature inside processor be maintained between 32 and 131°F.

(1) Press EDIT key on keyboard. Video monitor displays a menu listing 6 options.
(2) Press keyboard key 4 (option SYSTEMS STATUS PAGE) and EMS internal temperature shows on video monitor.
(3) If temperature is not within acceptable range, shutdown EMS according to paragraph 8-9.6 and take corrective action to cool main processor. See paragraph 8-9.7, Operating under extreme conditions.
(4) Press EDIT key to return to normal monitoring function.
(5) Check temperature inside main processor anytime temperature in ROWPU space indicates possible damage to EMS.



LOCATED IN WORKSHOP ON AFT BULKHEAD

Figure 8-11. 24 Vdc Power Panel

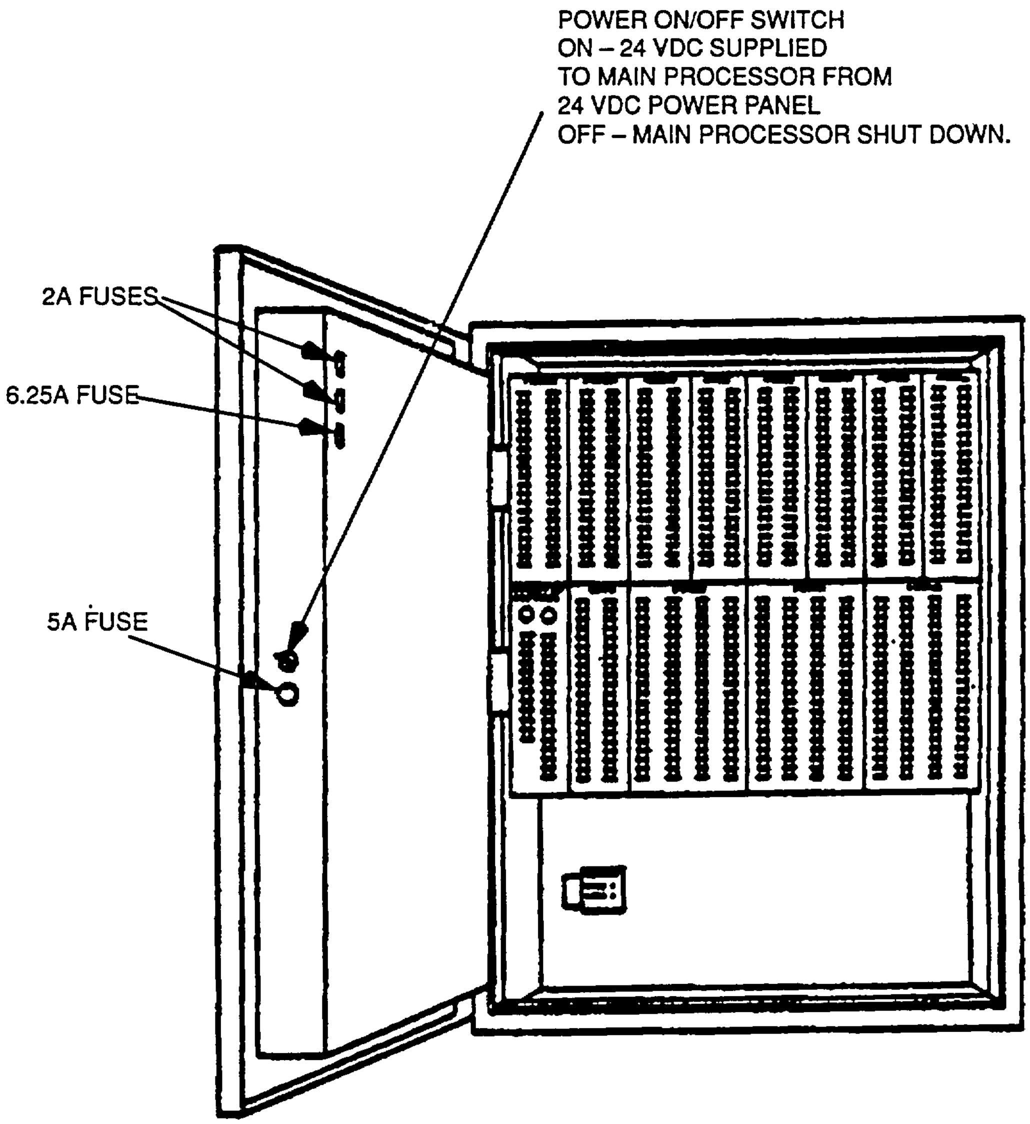


Figure 8-12. Equipment Monitoring System Main Processor

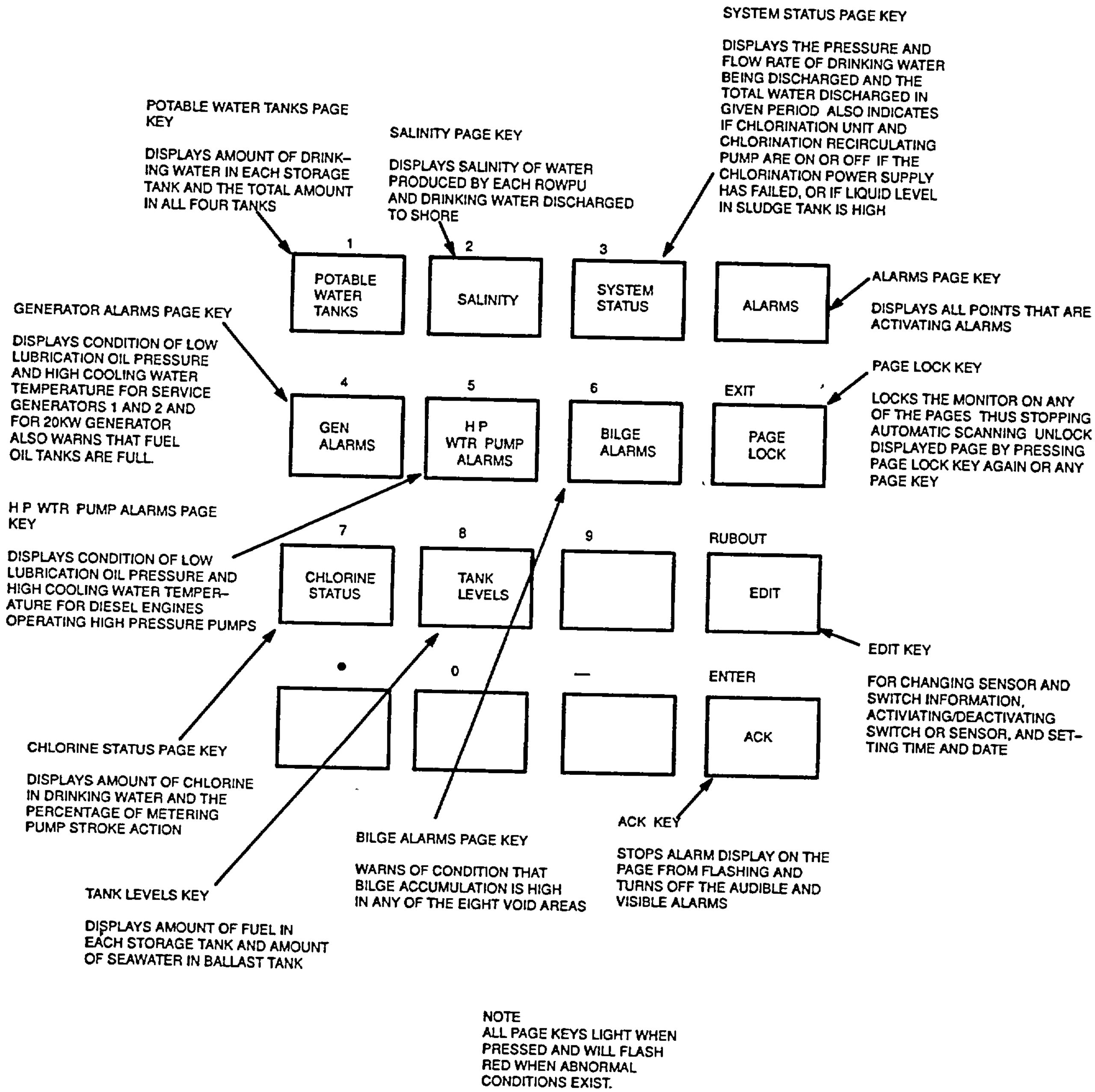
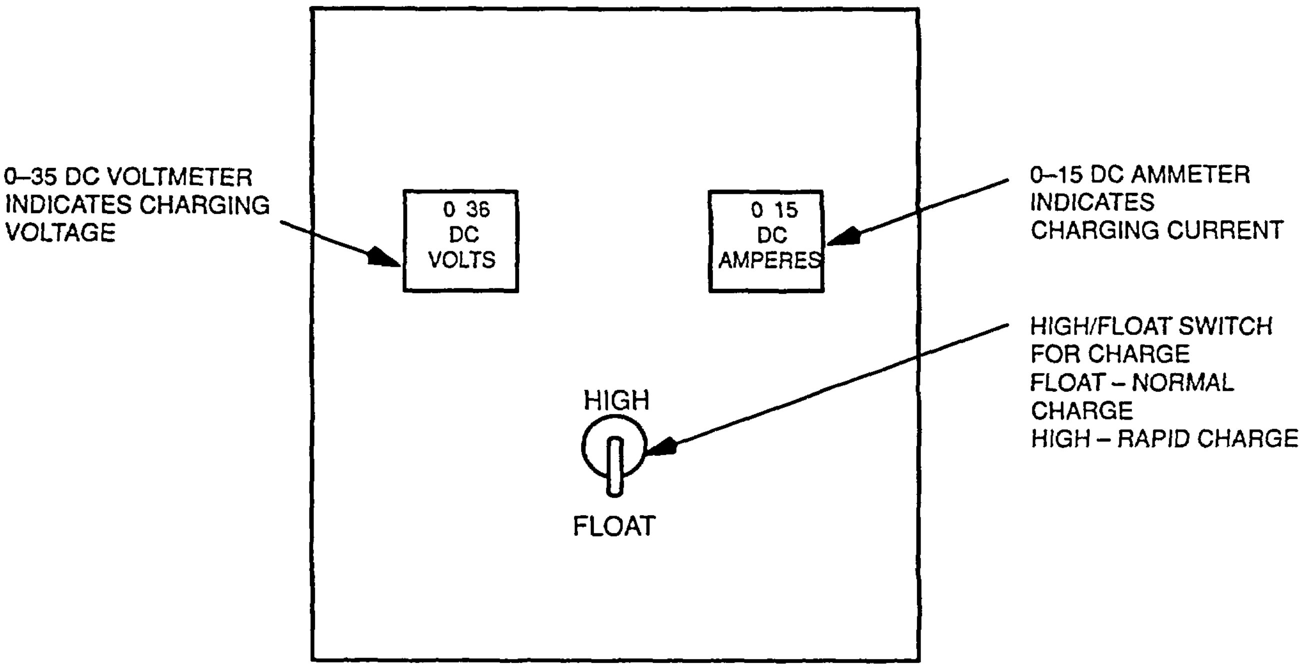


Figure 8-13. Equipment Monitoring System Keyboard



NOTE: LOCATED IN ROWPU SPACE ON FORWARD BULKHEAD BELOW ALARM/ CASUALTY SYSTEM

Figure 8-14. Main Processor Battery Charger

8-9.2 Normal operating procedures

NOTE

When EMS starts operating, each of eight display pages shows on video monitor for about 9 seconds and then EMS automatically moves to next display page. This automatic scanning continues until a keyboard display page key is pressed or EMS activates alarms. If EMS detects an abnormal condition, video monitor stops scanning display pages, shows ALARM SUMMARY display page and EMS activates alarms.

a. If EMS activates alarms, acknowledge alarms by following procedures in paragraph 8-9.3
b. For continuous viewing of one display page rather than the 9 second viewing per display page shown on automatic scanning, press keyboard key for desired display page.

NOTE

Selected display page remains on video monitor for 2 or 3 minutes before automatic scanning starts again.

c. While viewing display page, make sure time and date displayed on screen are correct. If not correct, reset according to procedures in paragraph 8-9.4.2.5
d. If more time is needed to view selected display page, press PAGE LOCK keyboard key. Make sure PAGE LOCK key turns blue.
e. To unlock DISPLAY PAGE, press another display page key or press PAGE LOCK key. Make sure PAGE LOCK key blue light goes out.

NOTE

If PAGE LOCK key is pressed, automatic scanning will begin immediately. If DISPLAY PAGE key is pressed, automatic scanning will begin 2 to 3 minutes after key is pressed.

8-9.3 Alarm acknowledgment. Anytime a sensor detects a value outside acceptable limits (abnormal situation), EMS activates alarms indicating this requires immediate operator attention.

8-9.3.1 Abnormal conditions are indicated in four ways:

a. Horn and flashing strobe light are activated in ROWPU space and on mast on deckhouse top, buzzer sounds in dayroom, and alarm sounds on keyboard.
b. Video monitor automatically switches to ALARMS SUMMARY display page, which displays all conditions causing alarms. Listing starts with condition most recently causing alarm. This condition is shown in bright (double intensity), flashing characters.
c. Keyboard key corresponding to display page where alarm point is located flashes red.
d. Bar or block display of the alarmed point on display page corresponding to red flashing key shows alarm condition in bright (double intensity), flashing characters. However, this is not immediately noticeable until flashing red key is pressed.

8-9.3.2 To acknowledge alarms sounded by EMS:

a. Press key that is flashing red. This makes video monitor change from ALARMS SUMMARY display page to display page showing alarm-causing sensor, which will be displayed as bright (double intensity), flashing characters.

b. Press ACK (acknowledge) key. This silences keyboard and external alarms, providing there are no other alarm conditions to be acknowledged. The key for display page containing acknowledged alarm changes from flashing red to white, and bar or block display indicator stops flashing, but remains at double intensity until condition is corrected.

c. If there are other alarm conditions, repeat steps a and b until all have been acknowledged. Determine and correct condition that caused alarm.

NOTE

Bar or block portion of display page, previously being displayed at double intensity, returns to normal intensity when alarm condition is corrected.

8-9.4 System editing. Keyboard, with video monitor, sets time and date, activates or deactivates sensors and sets display page information, including alarm points. These functions are performed when edit mode is selected by pressing EDIT key on keyboard. EDIT key lights and changes keyboard functions to those shown in black above each key (Figure 8-13). POTABLE KEY now has a value of "1," SALINITY key 8 has a value of 2," etc., like a calculator keyboard. These keys, now serving as numbers, change settings in EMS during edit mode.

NOTE

During each step of edit mode, instructions in the form of menus or prompts are shown on video monitor. Follow these menus or prompts and EMS will not be damaged. While editing, should alarms be activated, press EXIT key and then ACK key to acknowledge alarms. While editing, to return to normal monitoring, press EXIT key.

8-9.4.1 Accessing edit mode

a. Press EDIT keyboard key (Figure 8-13). Make sure key lights and following edit menus appears on video monitor.

MENU

TO SELECT OPTION, PRESS KEY BELOW NUMBER

1 - PRINT LAST PAGE
2 - PRINT ALL PAGES
3 - PRINT ALARMS
4 - SYSTEMS STATUS PAGE
5 - SYSTEM EDIT
6 - KEYBOARD LAMP TEST

NOTE

The above menu is called the "basic menu" to differentiate from an "edit menu" and from "prompts."

b. Ignore options 1, 2, and 3. They do not apply to ROWPU barge application.

c. If temperature reading inside main processor is desired, push keyboard key 4 (GEN ALARMS) now functioning as a number 4. This selects option 4-SYSTEMS STATUS PAGE, which in ROWPU barge application of the EMS, selects procedures for obtaining internal EMS temperature. Follow procedures in paragraph 8-9.1.h.

d. To perform keyboard lamp test, push keyboard key 6 (BILGE ALARMS) now functioning as a number 6. This selects option 6 KEYBOARD LAMP TEST. Follow procedures in paragraph 8-9.1g.

e. Push keyboard key 5 (H.P. WTR. PUMP ALARMS) now functioning as number 5. This selects option 5-SYSTEM EDIT. Make sure following is displayed on video monitor:

ENTER EDIT ACCESS COMBINATION

NOTE

This combination prevents unauthorized entry into EMS programs. Two levels of editing are available, level 1 and level 2. The bargemaster has access combination for each.

f. Contact bargemaster to obtain access combination or combinations for use. Proceed to paragraph 8-9.4.2 if level 1 edit access is desired or paragraph 8-9.4.2.3 if level 2 edit access is desired.

8-9.4.2 Level 1 editing. Select level 1 editing by entering access combination for level 1 edit. Following display appears:

EDIT MENU

TO SELECT OPTION, PRESS KEY BELOW NUMBER

1 - ACTIVATE/DEACTIVATE SENSORS
2 - ACTIVATE/DEACTIVATE SWITCHES
3 - ACTIVATE/DEACTIVATE/PRESET TOTALIZERS
4 - SET TIME/DATE
5 - EDIT SCHEDULE LOG

NOTE

In above display, SENSORS are bargraph displays such as SALINITY (Figure 8-4). SWITCHES apply to block displays such as GENERATORS (Figure 8-6). Option 3 applies only to TOTAL TANKS bargraph on POTABLE WATER TANKS display page (Figure 8-3). Option 4 sets time and date on EMS internal clock which displays this information on bottom of display pages. Option 5, only for systems with a printer, is not used on ROWPU barges.

8-9.4.2.1 Using EDIT MENU option l to activate/deactivate sensors

NOTE

Deactivating a sensor stops main processor from monitoring that particular sensor. Deactivation may be desirable when a sensor is malfunctioning, displaying incorrect information, and activating alarms when no problem exists. When a sensor is deactivated, the word DEACTIVATED appears in place of the bargraph. After sensor is repaired or replaced, sensor is reactivated. The word DEACTIVATED disappears and sensor readout again appears on video monitor.

a. Select EDIT MENU option 1 to activate/deactivate sensors by pushing keyboard key 1. Following prompt appears on screen:

SELECT PAGE TO EDIT
BY PRESSING CORRESPONDING KEY
OR PRESS EDIT KEY TO RETURN TO THE MENU

NOTE

If display page that shows a bargraph is pressed, highlighted instructions called "prompts" show in the right corner or across top of video monitor and cursor highlights top bargraph. If a display page without a bargraph is selected, page will flash and monitor returns to menu shown above. Push either another display page key or EDIT key.

b. Push key of display page that shows a bargraph, such as POTABLE WATER TANKS (Figure 8-3) or CHLORINE STATUS (Figure 8-9). Make sure selected display page shows on video monitor.

c. If following prompts show on screen and cursor appears over first bargraph, go to step e.

1 - ADVANCE CURSOR
2 - EDIT THIS ONE
3 - SELECT NEW PAGE
4 - RETURN TO EDIT MENU

d. If screen flashes, indicating display page does not have sensor readouts, either press another display page key or press EDIT key to return to edit menu.

NOTE

Cursor is a bright bar that extends from left side to middle of screen and highlights an item to be edited. Pushing keyboard key 1 (prompt ADVANCE CURSOR) moves cursor one line down. Repeatedly pushing this key or holding it down moves cursor to the last line that can be edited, and then cursor returns to top line.

e. Push keyboard key 1 (ADVANCE CURSOR) and move cursor to desired sensor bargraph.

f. Push keyboard key 2 (EDIT THIS ONE). Make sure video monitor displays desired sensor information with sensor label on top line and prompts in upper right comer. Also make sure that cursor is on the line with "SENSOR ACTIVE."

g. Push keyboard key 2 (EDIT THIS ONE) again. Make sure cursor extends all the way to the right.

h. To activate sensor, push keyboard key "0" and to deactivate sensor, push keyboard key 1.

i. Push ENTER keyboard key. Note that cursor will shorten.

NOTE

EXIT keyboard key provides means to immediately leave edit mode at any time. When EXIT key is pressed, EDIT key goes out and EMS resumes scanning.

j. If editing is complete, push EDIT keyboard key to leave edit mode and return EMS video monitor to normal scanning. If editing is not completed, push keyboard key 3 (prompt SELECT NEW BAR) to return to display page.

k. When display page appears on video monitor, take one of these three actions:
   (1) Push keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to select new sensor,
   (2) Push keyboard key 3 (prompt SELECT NEW PAGE) to select a new page,
   (3) Push keyboard key 4 (prompt RETURN TO EDIT MENU) to return to EDIT MENU.

l. To change reference markers, go to paragraph 8-9.4.2.2

m. If reference markers are not to be changed, and editing is complete, push EXIT keyboard key to leave edit mode. Make sure EDIT key goes out and video monitor starts normal scanning of display pages.

8-9.4.2.2 Using EDIT MENU option 1 to change or set reference markers

a. Press keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to line labeled "REFERENCE MARKER."

b. Press keyboard key 2 (prompt EDIT THIS ONE). Make sure prompt display appears on video monitor and reads as follows:

KEY IN NEW VALUE, THEN PRESS ENTER
RUBOUT - ERASE LAST ENTRY

c. Using keyboard key, enter new position for reference marker.

NOTES

If mistake is made, correct it before pressing ENTER keyboard key by using RUBOUT keyboard key. Pressing RUBOUT key causes EMS to backspace and erase last digit pressed. Further pressing RUBOUT key erases next digit and so on, until all digits are erased.

If mistake is discovered after ENTRY key has been pushed, mistake is treated like a normal setting and changed by following procedures in paragraph 8-9.4.2.3.

d. Correct mistake, if necessary, by using RUBOUT key.

e. Push ENTER keyboard key. Make sure prompt information changes to the following:

1 - ADVANCE CURSOR
2 - EDIT THIS ONE
3 - SELECT NEW BAR

f. Repeat steps a thru e for changing reference marks of additional sensors.

g. When desired reference marks are changed, press EXIT keyboard key to return video monitor to normal scanning and to leave Edit mode, or press "3" keyboard key (SELECT NEW BAR) to return to display page.

h. When display page appears on video monitor screen, take one of these actions:
   (1) Push keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to select a new sensor.
   (2) Push keyboard key 3 (prompt SELECT NEW PAGE) to select a new page.

(3) Push keyboard key 4 (prompt RETURN TO EDIT MENU) to return to EDIT MENU.

8-9.4.2.3 Using EDIT MENU option 2 to activate/deactivate switches

NOTE

Switches are activated/deactivated for the same reason and in a similar manner to activating/deactivating sensors in paragraph 8-9.4.2.1. Deactivating a switch stops main processor from monitoring that particular switch. Deactivation may be necessary when a switch is malfunctioning, is displaying false information on video monitor display page and is activating alarms when no problem exists. When a switch is deactivated, the word DEACTIVATED appears in place of the switch emblem on video monitor display page. After switch is repaired or replaced, switch is reactivated. The word DEACTIVATED disappears and switch emblem again appears on video monitor.

a. Push keyboard key 2 (EDIT MENU option ACTIVATE/DEACTIVATE SWITCHES). Make sure page select prompt in step 8-9.4.2.1a appears on video monitor.

b. Push keyboard key that shows switch data, such as GENERATORS display page (Figure 8-6) or HIGH PRESSURE WATER PUMPS (Figure 8-7) display page.

(1) Make sure display page chosen shows on video monitor.

(2) If highlighted instructions called "prompts," shown below, are displayed on screen and switch closest to top left side of the page is double intensity, go to step c.

1 - ADVANCE CURSOR
2 - EDIT THIS ONE
3 - SELECT NEW PAGE
4 - RETURN TO EDIT MENU

(3) If screen flashes, indicating display page has no switches, either press another display page key or press EDIT key to return to EDIT MENU.

c. Push keyboard key 1 (prompt ADVANCE CURSOR) and move cursor to switch to be activated/deactivated.

d. Push keyboard key 2 (prompt EDIT THIS ONE). Make sure video monitor displays switch information with switch label at top of page and prompts in upper right comer. Make sure cursor is on the line with "SWITCH ACTIVE."

e. Push keyboard key 2 (prompt EDIT THIS ONE) again. Make sure cursor extends all the way to the right.

NOTE

When switch is deactivated, the word DEACTIVATED appears in place of switch emblem. After switch is repaired or replaced, switch is reactivated. The word DEACTIVATED disappears and switch emblem again appears on video monitor.

f. To activate switch, push keyboard key 0, and to deactivate switch, press keyboard key 1.

g. Push ENTER keyboard key. Note that cursor will shorten.

h. Push EDIT keyboard key to leave edit mode and return EMS video monitor to normal scanning or push keyboard key 3 (prompt SELECT NEW SWITCH) to return to display page.

i. When display page appears on video monitor, take one of these three actions.
   (1) Push keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to select new switch.
   (2) Push keyboard key 3 (prompt SELECT NEW PAGE) to select a new display page.
   (3) Push keyboard key 4 (prompt RETURN TO EDIT MENU) to return to EDIT MENU.

8-9.4.2.4 Using EDIT MENU option 3 to activate/deactivate totalizers

NOTE

Totalizers are activated/deactivated for the same reason and in a similar manner to activating/deactivating sensors in paragraph 8-9.4.2. Deactivating a totalizer stops main processor from monitoring that particular switch. Deactivation may be necessary when a totalizer is malfunctioning, is displaying false information on video monitor screen display page and is activating alarms when no problem exists. When a totalizer is deactivated, the word DEACTIVATED appears in place of the totalizer emblem on video monitor. After totalizer has been repaired or replaced, totalizer is reactivated. The word DEACTIVATED disappears and totalizer emblem again appears on video monitor.

a. Push keyboard key 3 (EDIT MENU option ACTIVATE/DEACTIVATE/PRESET TOTALIZERS). Make sure page select prompt in step 8-9.4.2.1 a appears on video monitor.

b. Push POTABLE WATER TANKS keyboard key that shows TOTAL TANKS totalizer data (Figure 8-3).
   (1) Make sure display page chosen is shown on video monitor.
   (2) If highlighted instructions called "prompts" shown below are displayed on the screen and totalizer is double intensity, go to step c.

       1 - ADVANCE CURSOR
       2 - EDIT THIS ONE
       3 - SELECT NEW PAGE
       4 - RETURN TO EDIT MENU

   (3) If screen flashes, indicating display page has no totalizer, either press another display page key or press EDIT key to return to EDIT MENU.

c. Push keyboard key 1 (prompt ADVANCE CURSOR) and move cursor to totalizer to be activated/ deactivated.

d. Push keyboard key 2 (prompt EDIT THIS ONE). Make sure video monitor displays totalizer information with totalizer label at top of page and prompts in upper right comer. Make sure cursor is on the line with "TOTALIZER ACTIVATE."

e. Push keyboard key 2 (prompt EDIT THIS ONE) again. Make sure cursor extends all the way to the right.

NOTE

When totalizer is deactivated, letter "X” replaces numbers to indicate totalizer is no longer counting. After totalizer is repaired or replaced, totalizer is reset to agree with flow meter reading and then is reactivated. Letter "X" is replaced with input figures.

f. To activate totalizer, push keyboard key 0 and to deactivate totalizer, press keyboard key 1.

g. To set number for totalizer to begin counting from zero or number shown on flowmeter, do the following:
   (1) Press keyboard key 1 (ADVANCE CURSOR).
   (2) Press keyboard key 2 (EDIT THIS ONE).
   (3) Press keyboard number keys to set desired number.
   (4) Push ENTER keyboard key to enter numbers. Note that cursor will shorten.

h. Push EDIT keyboard key to leave edit mode and return EMS video monitor to normal scanning or push keyboard key 3 (prompt SELECT NEW TOTALIZER) to return to display page.

i. When display page appears on video monitor, take one of these three actions.
   (1) Push keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to select new totalizer.
   (2) Push keyboard key 3 (prompt SELECT NEW PAGE) to select a new display page.
   (3) Push keyboard key 4 (prompt RETURN TO EDIT MENU) to return to EDIT MENU.

8-9.4.2.5 Using EDIT MENU option 4 to set time and date on EMS clock

NOTE

EMS maintains a 24 hour clock as well as displaying month, day and year at bottom of each video monitor display page. When main power is off, a battery inside main processor keeps clock operating so that next time EMS is turned on, correct time **is shown on display pages.**

a. Push keyboard key 4 (option SET TIME/DATE). Make sure video monitor displays the following and prompts are in upper right comer of screen.

	OLD	NEW*
MONTH	JAN	
DAY	31	
YEAR	1986	
HOUR	16	
MINUTE	52	

*After editing, new information appears on screen.

NOTE

Cursor will be on 0 MONTH.

b. Push keyboard key 1 (prompt ADVANCE CURSOR) to move cursor to item (MONTH, DAY, YEAR, etc.) to be changed.

c. Push keyboard key 2 (prompt EDIT THIS ONE). Make sure cursor extends through old value.

NOTE

By pushing keyboard number keys (as well as "-" and "."), keys act as calculator keys and write numbers on video monitor.

d. Use keyboard keys to enter new values.

e. Push ENTER keyboard key. Note that cursor will shorten.

NOTE

If video monitor shows message "MIN=" or "MAX=," allowable range has been exceeded.

f. If allowable range has been exceeded, repeat steps c and d; otherwise go to step g.

g. Repeat steps b thru f until correct date and time is entered in NEW column.

NOTE

With time and date set, with seconds set to zero, clock starts when EXIT keyboard key is pushed to move video monitor to normal scanning of display pages.

h. Press EXIT keyboard key to leave edit mode and return EMS video monitor to normal scanning or push keyboard key 3 (prompt RETURN TO EDIT MENU).

8-9.4.3 Level 2 editing procedures. Select level 2 editing by entering access combination for level 2 edit obtained from barge master to change display page information. Make sure following EDIT MENU display appears:

EDIT MENU

TO SELECT OPTION, PRESS KEY BELOW NUMBER

1. EDIT BATR PARAMETERS
2. EDIT SWITCH PARAMETERS
3. EDIT TOTALIZERS
4. EDIT ALARM INHIBITS
5. SET TIME/DATE
6. EDIT SCHEDULE LOG

NOTES

- **High and low alarm points are typical data that can be set in level 2.**
- **Video monitor displays many items that pertain to general monitoring system capability and are not part of EMS as used onboard ROWPU barges. Items that are used onboard have data printed under OLD column; those that do not often have "N/A" (not applicable) in that column.**

a. Follow procedure for editing level 2 data as used for level 1 in paragraph 8-9.4.1. First select an option and then follow steps in the prompt shown on video monitor.

NOTE

Time and date can be set either in level 1 or level 2 editing.

b. To leave edit mode at any time, press EXIT keyboard key.

8-9.5 Edit termination. When editing is to be interrupted or is completed, press EXIT key to return EMS to scanning video monitor display pages.

8-9.6 Shutdown procedures

NOTE

Main processor and video monitor are not turned off unless barge is to be out of operation for more than 7 days.

a. For normal shutdown, pull main power switch OFF.
b. Check for damage or corrosion. Repair, dean or paint as necessary.

8-9.7 Operation under extreme conditions. For EMS optimum operating conditions, main processor internal temperature must be maintained between 32 and 131° F. When this temperature reaches 125°F, take the following actions:

a. Make sure all ROWPU space overhead fans are operating and hatches and doors are open.
b. If available, use additional portable fans blowing on the main processor.
c. In extreme cases, cover main processor with damp cloths and have portable fans blowing on main processor.
d. If these methods cannot keep internal temperature below 131° F, turn off EMS during hottest part of the day and visually monitor tank level indicators, gauges, flowmeters, etc., to make sure systems are operating normally since alarm system will be shut down.

CHAPTER 9 CHLORINATION SYSTEM

Section I. General

9-1 General. Chlorination system generates a strong solution of sodium hypochlorite (commonly called chlorine for treating water produced by the ROWPU's. Adding this to the water makes it safe for human consumption.

9-2 Description. The chlorination system produces chlorine in a sodium hypochlorite solution. A metering pump adds this solution, upon demand, to water processed by the ROWPU system just before the water enters the four drinking water storage tanks. The chlorination system's major components for Barge 1 are shown in Figure 9-1 and in Figure 9-2 for Barges 2 and 3. Major components are listed in Table 9-1. A chlorination system general working (block) diagram is in Figure 9-3, and a system flowchart is in Figure 9-4. Equipment specifications, maintenance information, and manufacturer's service manuals are in TM 55-1930-209-14&P-4.

9-3 Capabilities. The system generates and maintains a 5000 to 6000 ppm solution of chlorine and then meters this solution into product water from the ROWPU system to obtain a chlorine concentration of 2 to 5 ppm in the drinking water.

9-4 Special limitations. For normal operation, the chlorination system requires seawater with a 3 to 4 percent salt concentration. If the available seawater has a salt concentration less than this, see paragraph 9-13, to increase concentration.

9-5 Performance characteristics

Production rate	40.5 gph
Holding tank capacity	310 gal
Approximate time to reach concentration	4 hrs

Section II. Description of operation

9-6 General. The chlorination system generates and automatically maintains chlorine in the form of a sodium hypochlorite solution with a strength of 5000 to 6000 ppm expressed as total available chlorine equivalent. This strength is maintained by constantly recirculating the solution from the holding tank through a series of nine electrolytic cells and back to the holding tank for a predetermined period of time. A metering pump draws chlorine from the holding tank and injects it into product water flowing from the ROWPU's. This combination of product and chlorine flows through a mixer just before the water enters the drinking water storage tanks. The mixer evenly distributes the chlorine throughout the product water. A sensor measures the amount of chlorine in the treated water downstream of the mixer and causes the metering pump to inject either more or less chlorine to maintain the amount of chlorine in the drinking water at 2 to 5 ppm. As chlorine is withdrawn from the holding tank and the chlorine solution level drops, a float switch activates the brine pump, which pumps brine solution from the brine tank to the holding tank. In the holding tank, the brine solution is mixed and circulated with the chlorine solution from the electrolytic cells. When the level of chlorine solution in the holding tanks reaches the proper level, the float switch turns the brine pump and circulating pump off. This process of recirculating and replenishing continues as long as the chlorination unit and brine pump are activated and the metering pump withdraws chlorine solution from the holding tank. On/Off operation of the metering pump is controlled by a flow switch located in the ROWPU product water line. When the metering pump motor controller is in the AUTO mode, this flow switch automatically starts the pump when ROWPU product water is flowing and stops the pump when product water stops flowing.

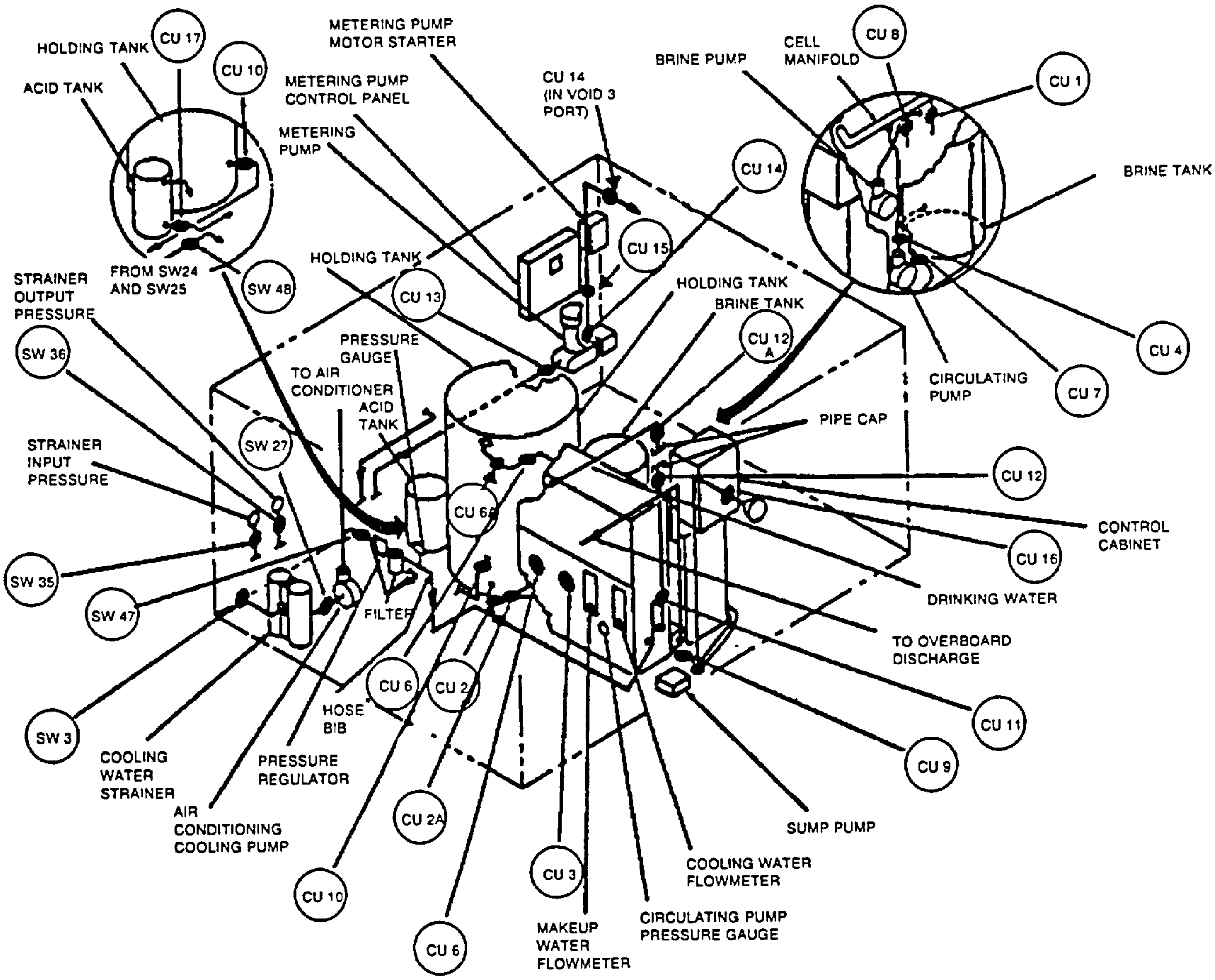


Figure 9-1. Chlorination System Installation (Barge 1)

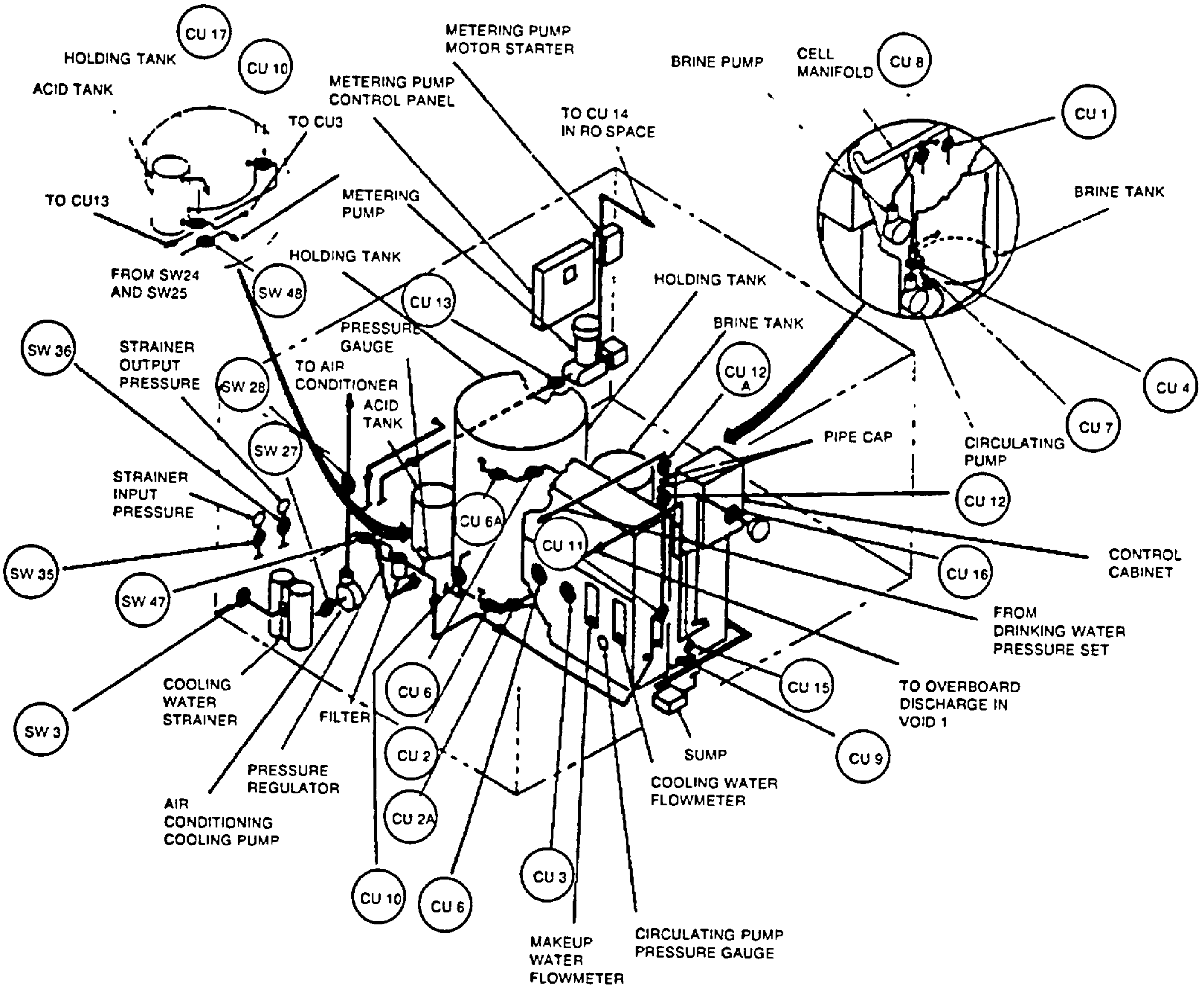


Figure 9-2. Chlorination System Installation (Barges 2 and 3)

Table 9-1. Major Components of Chlorination System

Component	Quantity	Function	Location
Chlorination unit	1	Generates and automatically maintains a hypochlorite solution for treatment of ROWPU product water entering drinking water tanks	Void 2 port
Chlorination unit holding (recycle) tank	1	Holds hypochlorite solution, which Is circulated to the cell assembly by the recirculating pump, and provides chlorine to the metering pump	Void 2 port on chlorination unit skid inboard of brine tank
Chlorination unit brine tank	1	Holds brine solution which is automatically added to the holding tank by the brine pump when needed	Void 2 port on chlorination unit skid outboard of holding tank
Chlorination unit acid tank	1	Holds acid which is used to remove cell assembly scale during scale flushing operation	Void 2 port on chlorination unit skid outboard of holding tank
Chlorination unit circulating pump	1	Recirculates solution from holding tank through cell assembly and back to holding tank	Void 2 port on chlorination unit skid
Chlorination unit brine pump	1	Automatically provides brine solution to the holding tank when needed	Void 2 port on chlorination unit skid
Chlorination unit control cabinet	1	Controls chlorination unit operation	Void 2 port on chlorination unit skid on top of power supply
Drip pan sump tank and pump	1	Discharges drainage from chlorination unit directly overboard	Void 2 port outboard of chlorination unit skid
Metering pump	1	Injects measured amounts of chlorine into ROWPU product water stream	Void 2 port on inboard bulkhead forward
Chlorine sensor	1	Senses amount of chlorine being injected into ROWPU product water stream	Void 3 port in product water overhead piping
Metering pump motor controller	1	Starts and stops metering pump	Void 2 port on inboard bulkhead forward
Metering pump control unit	1	Controls amount of chlorine being injected into ROWPU product water by controlling metering pump operation	Void 2 on inboard bulkhead forward

Table 9-1. Major Components of Chlorination System (continued)

Component	Quantity	Function	Location
Paddle flow switch	1	Automatically starts and stops metering pump when motor controller is in AUTO mode	Void 3 port in product water overhead piping

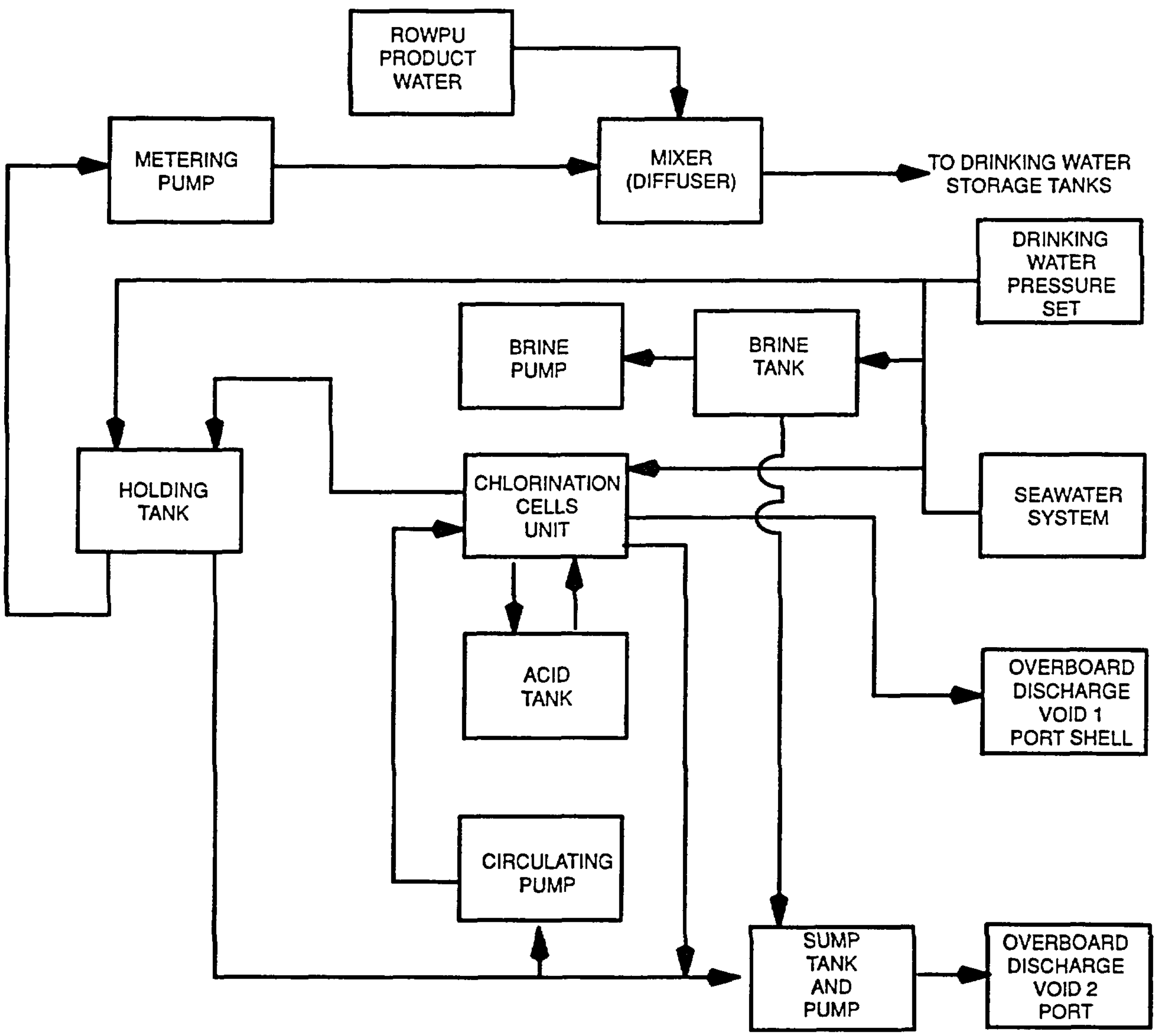


Figure 9-3. Chlorination System General Working (Block) Diagram

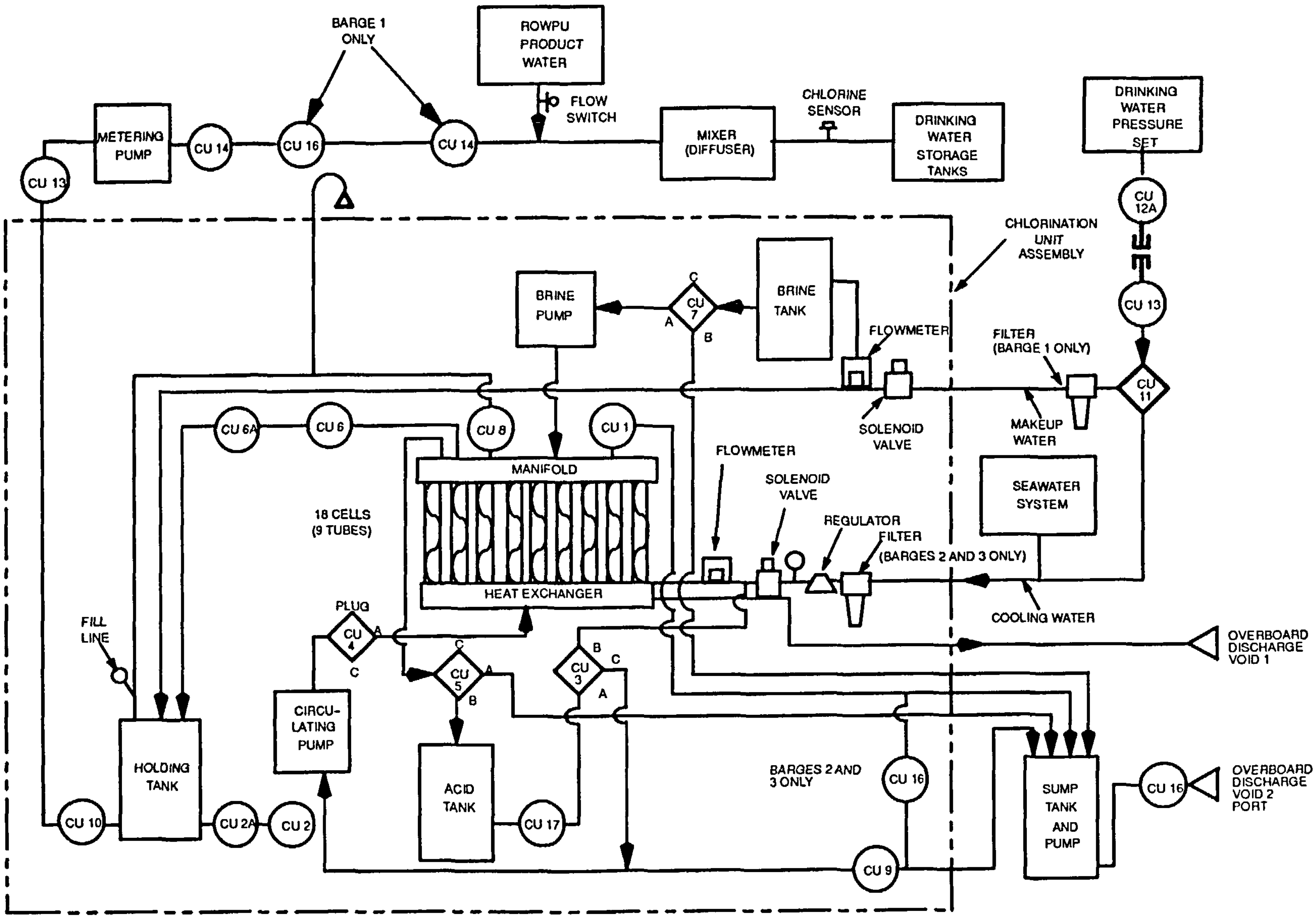


Figure 9-4. Chlorination System Flowchart

9-7 Preparation for operation. Both the holding tank and the brine tank have to be primed before the system can prepare the chlorine solution. Either seawater or fresh water may be used to prime both tanks. If seawater is used, it may be supplied from either the seawater pumps in void 2 starboard or from the cooling pump in void 2 port. Fresh water, if available, is obtained from the drinking water pressure set. Paragraph 9-13 gives details on priming the system. After priming, <u>this system takes about 4 hours to produce a chlorine solution</u> of the proper strength in the holding tank. The system can be placed in operation before this 4-hour period, but the metering pump will inject a larger amount of solution into the product water to raise the chlorine level to the proper concentration. If the system must start injecting chlorine into the product water as soon as the seawater and ROWPU systems are placed in operation, a commercial hypochlorite solution (household bleach) can be added to the holding tank to create a usable solution.

9-8 Non-operating chlorination system. ROWPU barges have only one chlorination system. If this system cannot be operated, arrangements must be made for an onshore water processing facility to add chlorine to the ROWPU barge product water when the water comes ashore. To provide safe onboard drinking water during such a situation, water in the reserve tank must be manually treated with chlorine according to instructions in Chapter 14.

Section III. Operating instructions

9-9 Operating controls and Indicators. Information about the chlorination system operating controls and indicators is in table 9-2. These controls and indicators are shown in Figures 9-5 thru 9-13. Information about chlorination system valves, shown in Figures 9-1 and 9-2, is in Table 9-3.

9-10 Prestart procedures

a. Before performing any chlorination system operation, be sure to check system for damage and perform the following before operation checks.

(1) Wipe components clean, especially flowmeters, indicators, control panels, and electrolytic cells.
(2) Check for leaks, paying special attention to joints, valves, fittings, and piping. Report leaks to shift leader so that corrective action can be taken.
(3) Check for damage, especially to flowmeters, indicators, control panels, and electrolytic cells. Repair as necessary.
(4) Check for loose or missing securements and fasteners. Tighten or replace as necessary.
(5) Check wiring for loose connections and frayed cables. Tighten or replace as necessary.

NOTE

The EMS Indicates amount of chlorine In drinking water and percentage of metering pump stroke action.

b. Make sure EMS is operating. If not operating, start up according to instructions in Chapter 8.

NOTE

Chlorination unit will not operate unless void blower fan 8 Is operating. Fan 8 circuit breaker 8P8 on power panel 2 (amidships on ROWPU space starboard side).

Table 9-2. Operating Controls and Indicators

Component	Figure	Location
Makeup water flowmeter with valve	9-5	Void 2 port on chlorination unit panel
Cooling water flowmeter with valve	9-5	Void 2 port on chlorination unit panel
Heat exchanger pressure gauge	9-5	Void 2 port on chlorination unit panel
Cooling water pressure regulator	9-5	Void 2 port on chlorination unit panel
Cooling water pressure gauge	9-5	Void 2 port on chlorination unit panel
Chlorine metering pump motor controller	9-6 9-8	Void 2 port - center bulkhead
Metering pump function selector	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Metering pump display selector	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Metering pump chlorine range selector	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Metering pump light-emitting diode (LED) display	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Metering pump control	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Metering pump chlorine content (manual)	9-7	Void 2 port - center bulkhead aft on metering pump control unit
Alarm switch	9-9	Void 2 port on chlorination unit control cabinet
Function switch	9-9	Void 2 port on chlorination unit control cabinet
Ammeter	9-9	Void 2 port on chlorination unit control cabinet
Voltmeter	9-9	Void 2 port on chlorination unit control cabinet
Power supply failure light	9-9	Void 2 port on chlorination unit control cabinet
Circulating (recirculating) pump failure light	9-9	Void 2 port on chlorination unit control cabinet
Low salinity light	9-9	Void 2 port on chlorination unit control cabinet
Brine pump switch	9-10	Void 2 port on chlorination unit control cabinet

Table 9-2. Operating Controls and Indicators (Continued)

Component	Figure	Location
EMS keyboard	9-11	ROWPU space- forward bulkhead outboard of workshop door
EMS CHLORINE STATUS display page	9-12	ROWPU space - forward bulkhead outboard of workshop door
EMS SYSTEM STATUS display page	9-13	ROWPU space - forward bulkhead outboard of workshop door

c. Make sure switchboard circuit breakers P5 and P8 are dosed to provide power to panels 1 and 2. Provide power to chlorination unit control cabinet by dosing power panel 1 circuit breaker 9P5. Provide power to metering pump motor controller by dosing power panel 1 circuit breaker 10P5. Provide power to vent fan 8 motor controller by closing power panel 2 circuit breaker 8P8. Start vent fan 8 by pressing START button on motor controller.

NOTE

Seawater can be provided by seawater pumps or cooling water pump.

d. Make sure seawater system is ready for operation. If not operating, start by following procedures in Chapter 11. Seawater can be provided by either seawater pumps or cooling water pump.
e. Make sure seawater filter in line to chlorination system is clear and seawater pressure regulator is set to 10 psi.
f. When using drinking water, connect drinking water line to chlorination unit by connecting hose between valves CU12 and CU12A. Make sure drinking water system holding tanks contain water and pressure set is ready for operation. If not operating, start drinking water system by following procedures in Chapter 14.
g. Make sure ROWPU system is operational and can be started when chlorine solution is strong enough to provide necessary chlorine to the product water. if not operational, follow maintenance procedures in Chapter 13.
h. Check oil level on chlorination unit circulating pump (void 2 port) to make sure oil is up to the mark. Add oil if necessary.

WARNING

In an emergency, follow emergency procedures posted on bulkheads and vacate void 2 port.

9-11 Operating procedures. Chlorination system operating procedures are provided as follows:

a. Normal operations - paragraph 9-12.
b. Priming brine tank and holding tank - paragraph 9-13.
c. Chlorine generation and recirculation - paragraph 9-14.
d. Chlorination unit descaling - paragraph 9-15.
e. Initial flushing with seawater - paragraph 9-15.1.
f. Flushing with acid - paragraph 9-15.2.

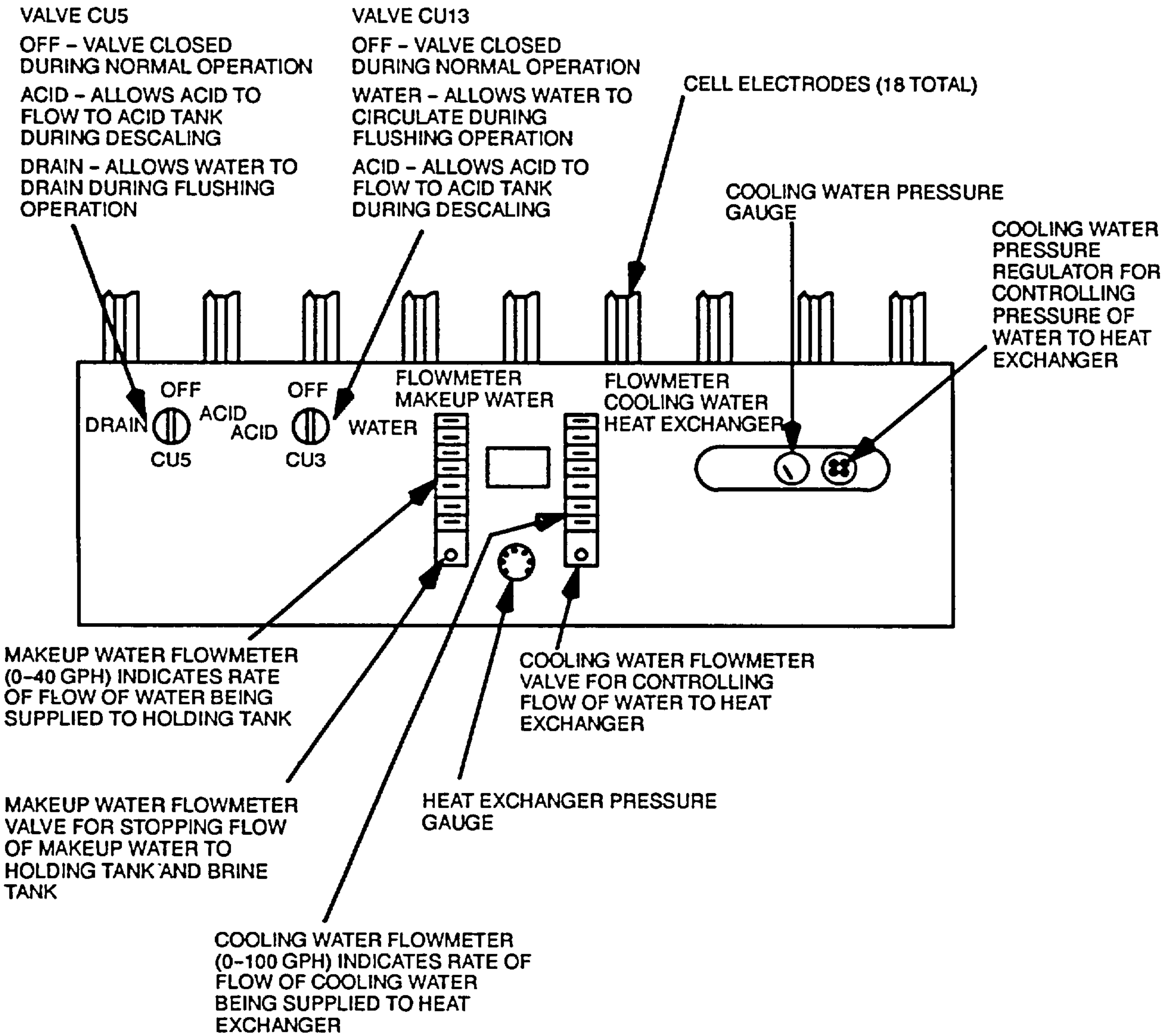


Figure 9-5. Chlorination Unit Controls and Indicators

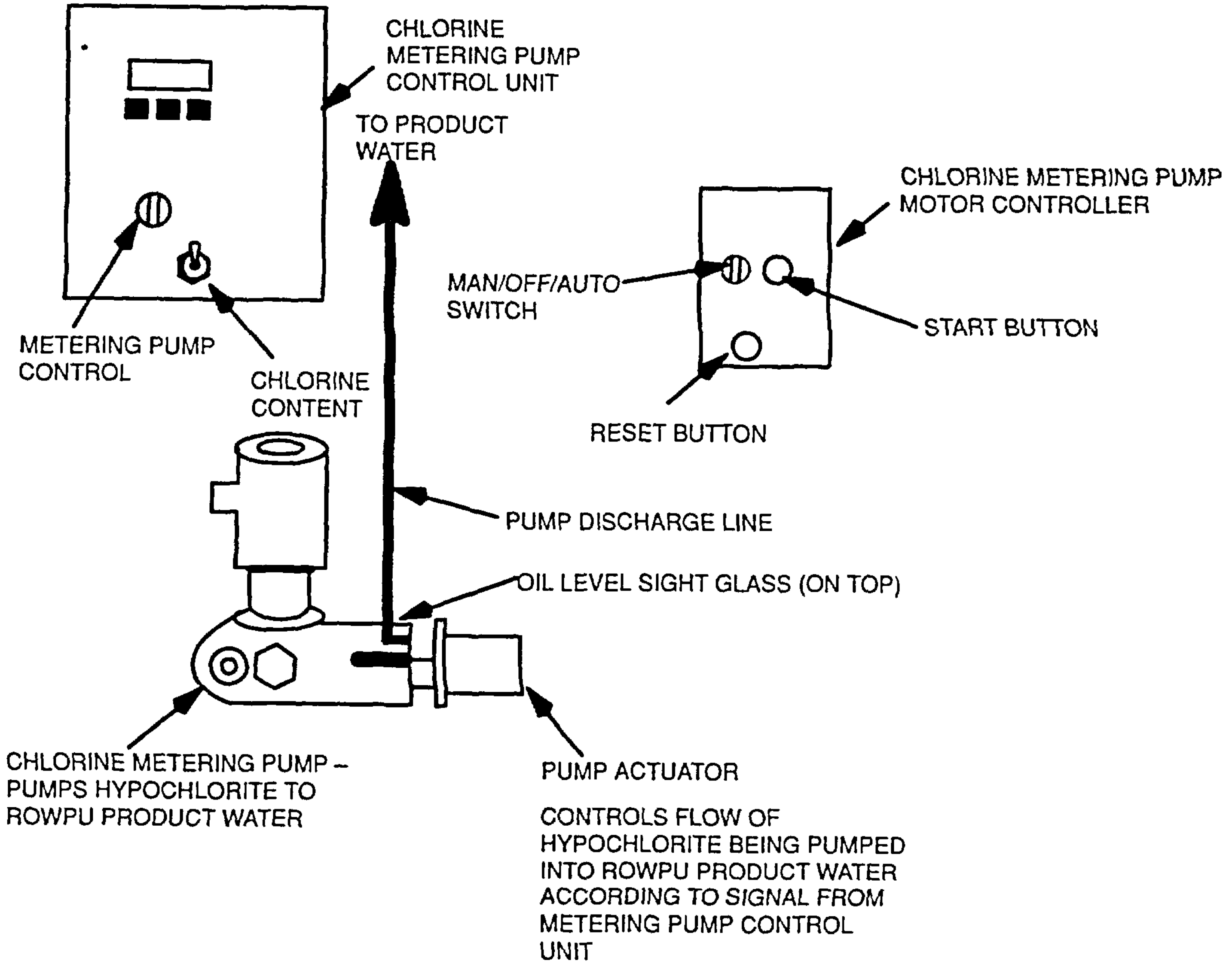


Figure 9-6. Chlorine Metering Pump Controls

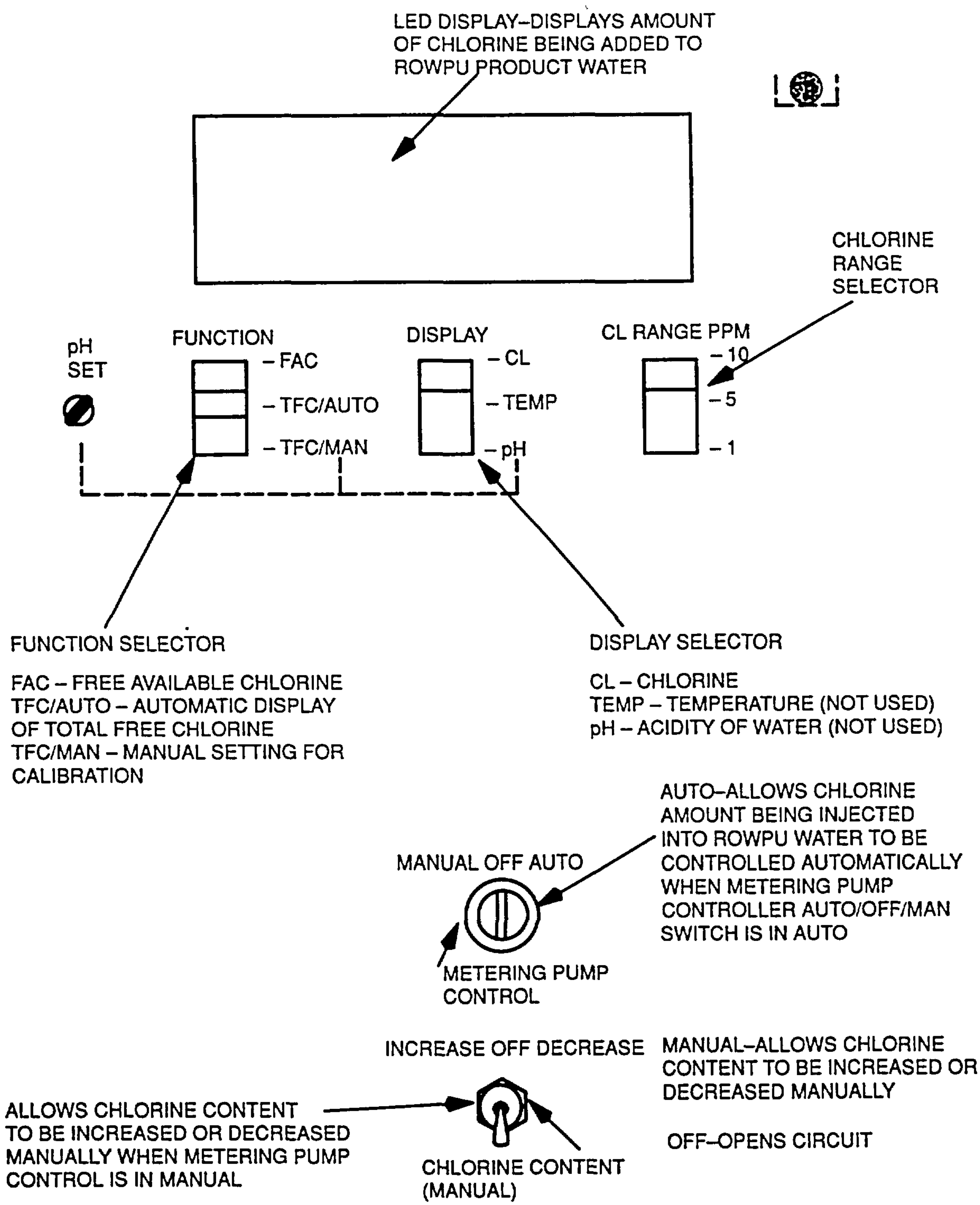
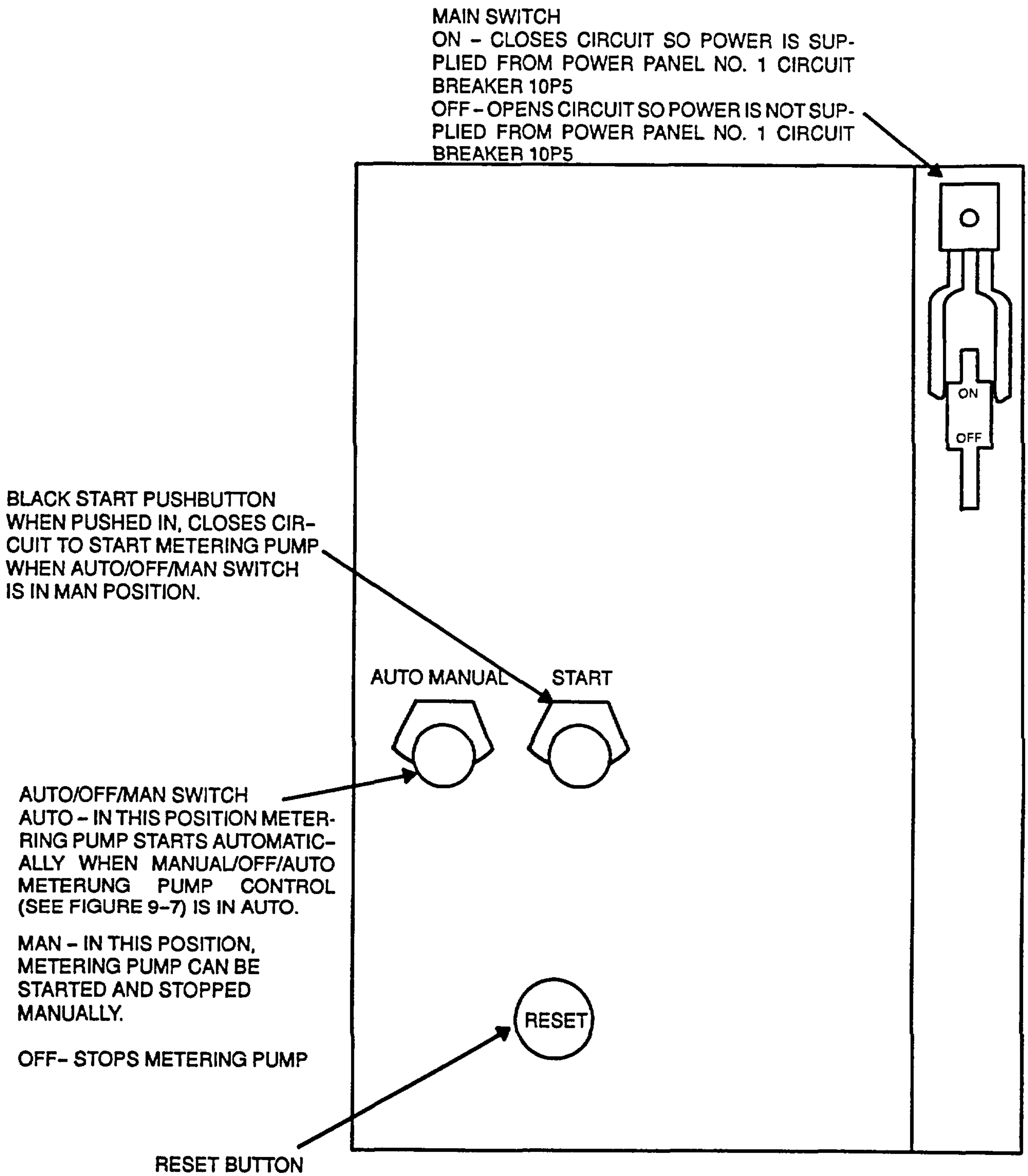


Figure 9-7. Chlorine Metering Pump Control Unit Controls and Indicators



LOCATED IN VOID 2 PORT ON INBOARD BULKHEAD FORWARD

Figure 9-8. Chlorine Metering Pump Motor Controller

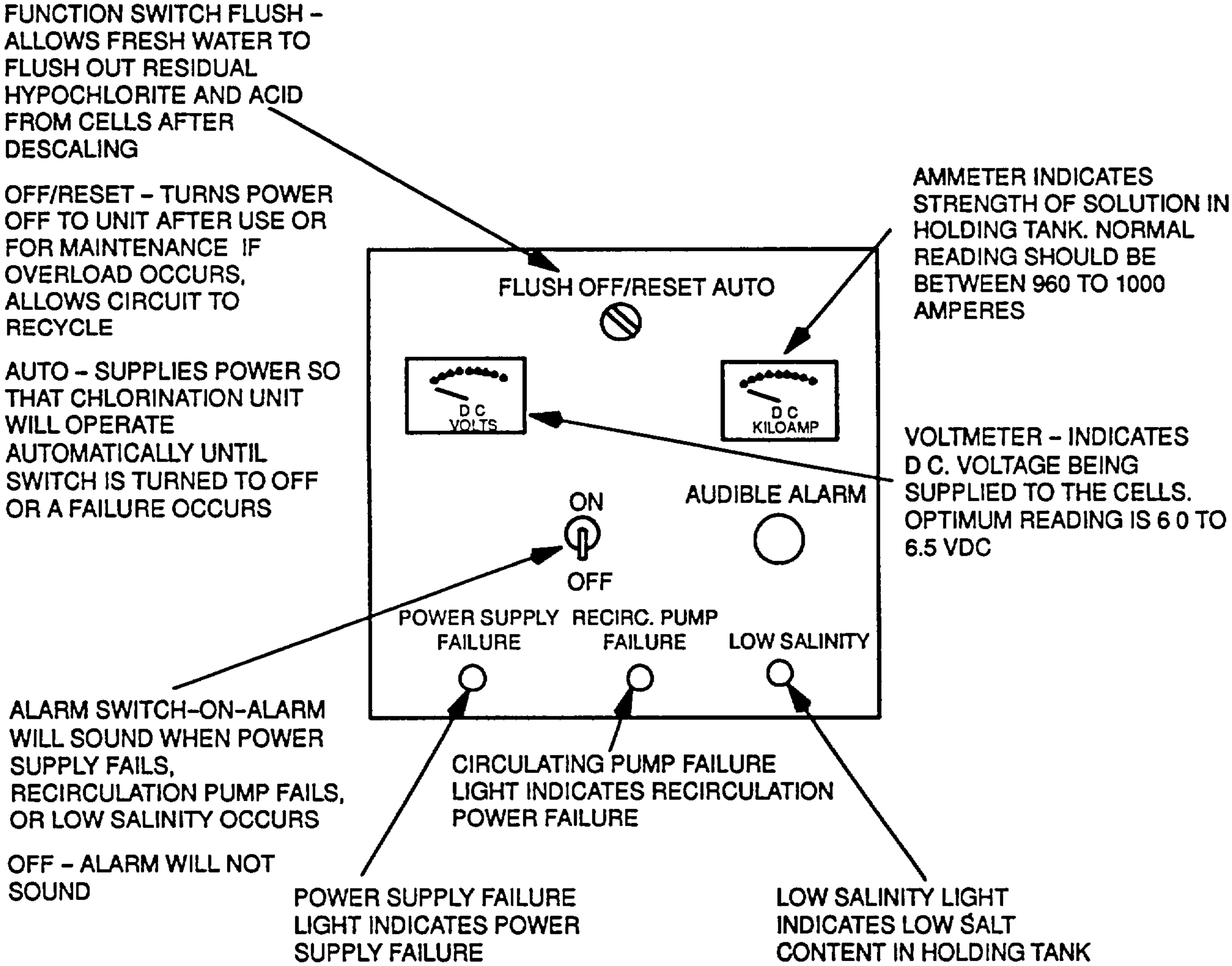


Figure 9-9. Chlorination Unit Control Cabinet Controls and Indicators

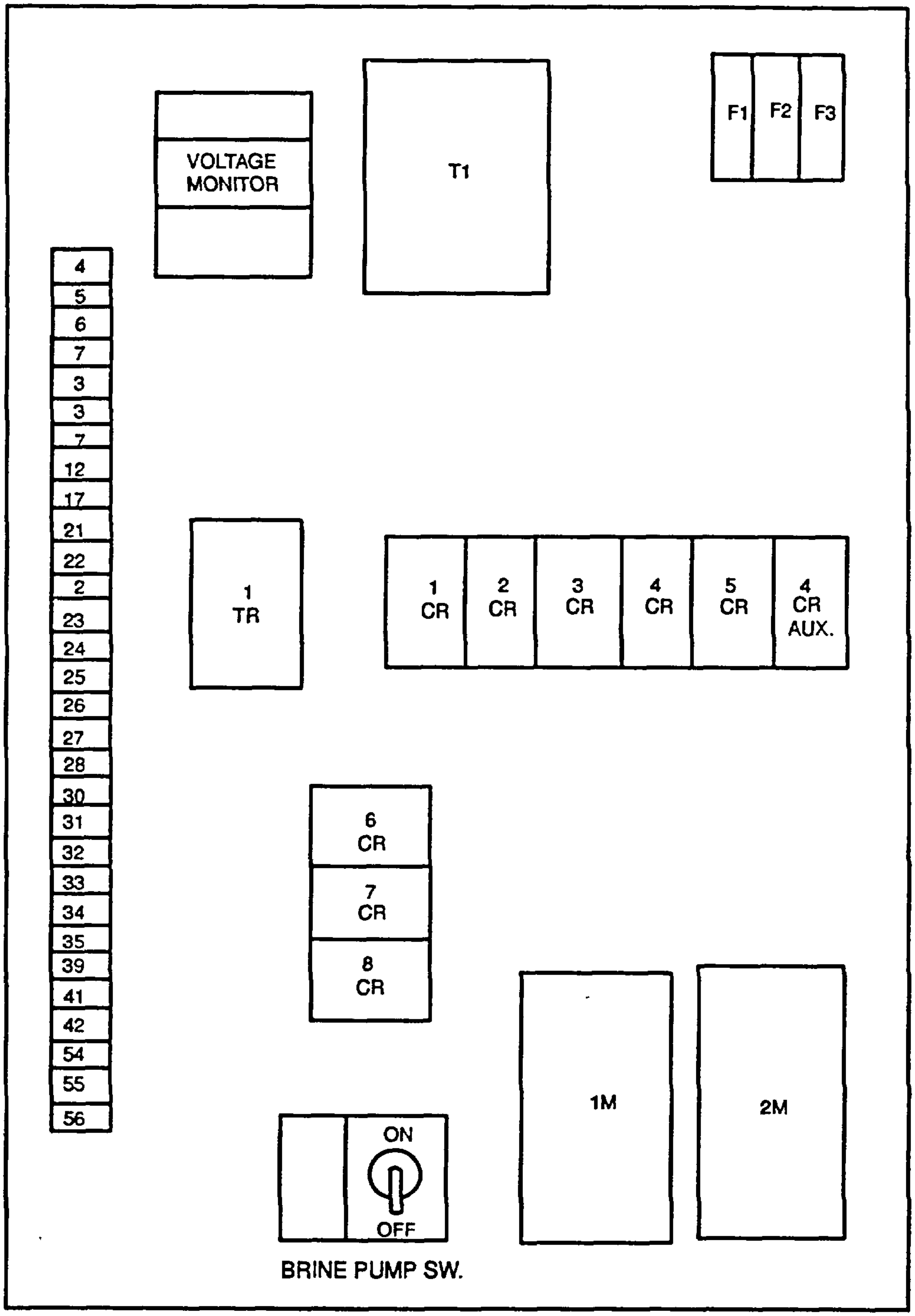


Figure 9-10. Interior of Chlorination Control Unit Cabinet

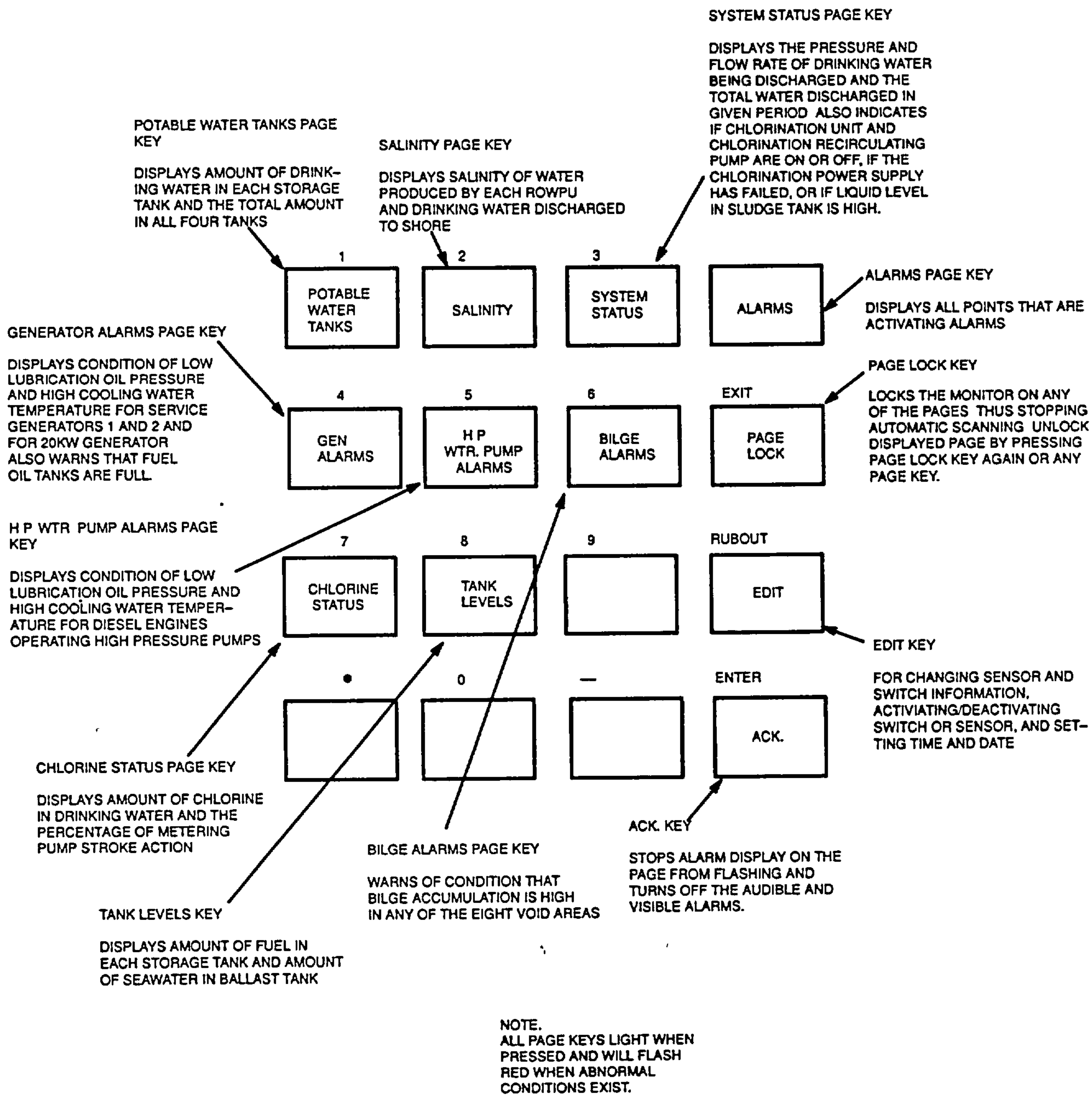


Figure 9-11. EMS Keyboard

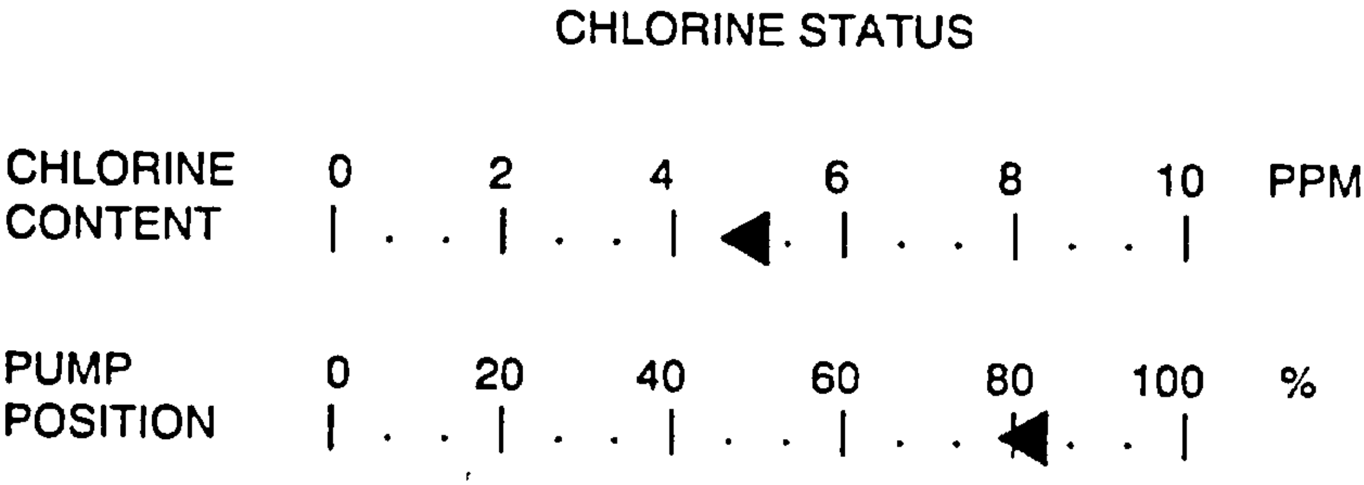


Figure 9-12. EMS Chlorine Status Display Page

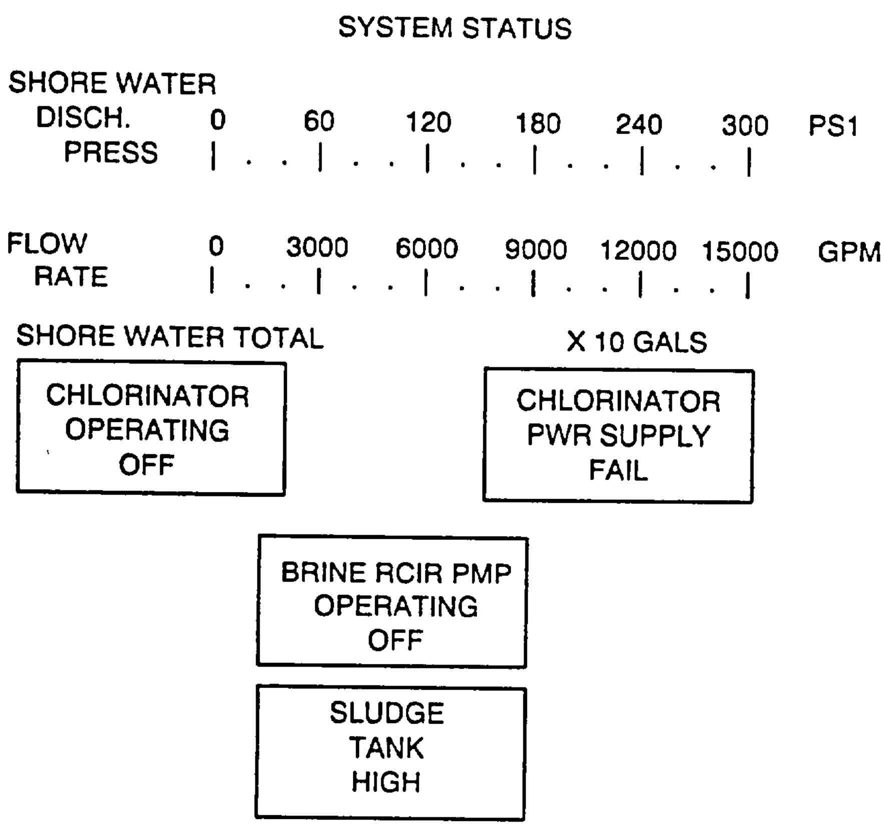


Figure 9-13. EMS Status Display Page

Table 9-3. Chlorination System Valves

Type	Figures 9-1 & 9-2 Callout	Location	Label Identification and Valve Function
2-way	CU1*	In chlorination unit manifold drain line	CHLORINATION PRESSURE RELIEF (PRESET): Allows relief drainage from manifold to sump in case of pressure build-up in chlorination unit cells
2-way	CU2*	In recirculating (circulating) pump suction line from holding tank (recycle tank)	CHLORINATION SYSTEM HOLDING TANK OUTPUT TO RECIRCULATING PUMP: Allows flow from holding tank to recirculating pump during normal operation
2-way	CU2A* (Barges 2 and 3 only)	In circulating (recirculating) pump suction line near valve CU2	CHLORINATION CELL INPUT: Allows flow from valve CU2 to recirculating pump during normal operation
3-way	CU3*	In acid tank outlet line	CHLORINATION DESCALING OPERATION FLOW CONTROL: In WATER position, allows flush water to flow to recirculating pump to flush out both residual hypochlorite (before flushing with acid), and acid (during scale flushing operation). In ACID position, allows acid to flow from acid tank to recirculating pump during scale flushing operation. Closed (OFF) during normal operation
3-way	CU4*	In recirculating pump discharge line	CHLORINATION RECIRCULATING PUMP OUTPUT CONTROL: Allows recirculating pump discharge to flow to heat exchangers and cells during normal operation and, when 50% open, during scale flushing operation
3-way	CU5*	In acid tank inlet line	CHLORINATION DESCALING OPERATION FLOW CONTROL: In ACID position, allows acid to flow back to acid tank during scale removal operation In DRAIN position, allows flush water to drain overboard during scale flushing operation. Closed (OFF) during normal operation
2-way	CU6*	In holding tank cell input line	CHLORINATION SYSTEM HOLDING TANK CELL OUTPUT: Allows cell output to flow to holding tank during normal operation
2-way	CU6A* (Barges 2 and 3 only)	In holding tank cell output line	CHLORINATION HOLDING TANK INPUT: Allows cell output to flow from valve CU6 to holding tank
3-way	CU7*	In brine tank outlet line	CHLORINATION BRINE FLOW CONTROL: Allows brine to flow from brine tank to brine pump and allows draining of brine tank

Table 9-3. Chlorination System Valves (Continued)

Type	Callout	Location	Label Identification and Valve Function
2-way	CU8*	In chlorination unit manifold vent line	CHLORINATION AIR VENT: Allows venting of chlorination unit during normal operation and descaling and flushing
2-way	CU9*	In chlorination unit drain line to sump	CHLORINATION DRAIN: Allows draining to sump from chlorination unit, circulating pump, acid tank, and holding tank
2-way	CU10*	In chlorination unit holding tank supply line to metering pump	CHLORINATION HOLDING TANK CHLORINE FLOW. Allows chlorinated water to flow to metering pump from holding tank and isolates tank
3-way	CU11*	In makeup water line on discharge side of pressure set	CHLORINATION INPUT WATER CONTROL: Allows either seawater from cooling pump or drinking water from pressure set to flow to holding tank
2-way	CU12	In drinking water line from pressure set in void 2 port near valve CU11	CHLORINATION DRINKING WATER INPUT: Isolates drinking water supply from chlorination system until hose is connected between valves CU12 and CU12A
2-way	CU12A	In drinking water line from pressure set in void 2 port above valve CU12	CHLORINATION DRINKING WATER INPUT: Allows drinking water to flow from pressure set to chlorination unit when hose is connected between valves CU12 and CU12A
2-way	CU13	In chlorination unit holding tank supply line to metering pump	CHLORINATION SYSTEM METERING PUMP INPUT: Allows chlorinated water to flow to metering pump from holding tank and isolates metering pump
2-way ball	CU14 (There are two valves CU14 on Barge 1)	In metering pump discharge line between pump and mixer	CHLORINATION SYSTEM METERING PUMP OUTPUT: Allows measured amounts of chlorinated water to flow into ROWPU product waterstream
2-way	CU15* (Barge 1)	In metering pump discharge line between two valves labeled CU14	CHLORINATION SYSTEM CHLORINE FLOW TO DRINKING WATER. Allows chlorinated water to flow from metering pump to mixer
2-way	CU15* (Barges 2 and 3 only)	In line connected to valve CU1 to cell drain line and circulating pump drain line	CHLORINATION DRAIN CONTROL: Allows drain of chlorine from valve CU1 to sump tank

Table 9-3. Chlorination System Valves (Continued)

Type	Callout	Location	Label Identification and Valve Function
2-way globe	CU16	Void 2 port overboard discharge	CHLORINATION SUMP TO OVERBOARD: Allows sump tank to discharge overboard
2-way ball	CU17	In the discharge line from acid tank	CHLORINATION ACID TANK DRAIN: Allows drain of acid tank to sump

* Indicates valve is part of chlorination unit

9-12 Normal chlorination system operation

a. Perform prestart procedures in paragraph 9-10.
b. Make sure brine tank and holding tank are primed and holding tank is producing enough chlorine. If not, prime tanks according to paragraph 9-13 and start generating and recirculating chlorine according to paragraph 9-14.
c. Check sight on metering pump to ensure oil level is up to mark Add oil if necessary.
d. Turn alarm ON/OFF switch on control cabinet (Figure 9-9) ON.
e. Turn brine pump ON/OFF switch inside control cabinet (Figure 9-10) ON.

NOTE

There are two valves CU14 on Barge 1. Ensure that both are opened.

f. Position barge Chlorination Unit (CU) valves as indicated below:

o = open x = closed A - position A B = position B C = position C

CU VALVE NO	2	2A	3	4	5	6	6A	7	8	9	10	13	14	15	16
POSITION	o	o	C	A	C	o	o	A	x	x	o	o	o	x	o

g. For makeup water using seawater system or drinking water system, position chlorination unit valves CU11, CU12, and CU1 2A as indicated below:

o = open x = closed A= position A B = position B

MAKEUP WATER USED: CU Valves:	11	12*	12A*
SEAWATER	A	x	x
DRINKING WATER	B	o	o

* Connect hose between valves CU12 and CU12A before opening valves.

h. Adjust chlorination unit cooling water flowmeter and pressure regulator (Figure 9-5) to 80 gph at 10 psi.

NOTE

A semiannual adjustment should be made using higher flow rate in summer and lower flow rate in winter. Local climatic conditions should determine final flow rate.

i. Set chlorination unit makeup water flowmeter (Figure 9-5) to 36 gph.

j. Turn function switch on control cabinet (Figure 9-9) to AUTO.

NOTE

When metering pump motor control MANUAL/OFF/AUTO switch is in AUTO, paddle flow switch In ROWPU product water line automatically starts and stops metering pump. This action controls amount of chlorine the pump Injects into the product water. When product water starts flowing, pump starts and when product water stops flowing, metering pump stops.

k. Turn chlorine metering pump motor controller AUTO/OFF/MAN switch (Figure 9-6) to AUTO.

NOTE

Chlorination unit operates best when temperature of solution in holding tank is between 75 and 95°F. Increasing cooling water flow decreases temperature; decreasing flow Increases temperature.

l. Turn metering pump control MANUAL/OFF/AUTO switch (Figure 9-7) to AUTO.
m. Chlorination system is now operating in conjunction with the seawater system, ROWPU system, and drinking water system to provide correct amount of chlorine solution to ROWPU product water.
n. While chlorination system is operating, monitor the following for normal indications:

(1) Chlorination unit panel (Figure 9-5)

(a) Makeup water flowmeter - 36 gph
(b) Cooling water flowmeter - 80 gph
(c) Cooling water pressure gauge - 20-40 psi
(d) Heat exchanger pressure gauge - 30-60 psi
(e) When reading not normal, troubleshoot as necessary.

(2) Metering pump control unit (Figure 9-7)

(a) Chlorine status on LED display.

(3) Chlorination unit control cabinet (Figure 9-9)

(a) Ammeter reading is between 950 to 1000 amperes (amps) (0.95-1.0 kilo amps)
(b) Voltmeter reading is between 6.0 to 6.5 Vdc
(c) Alarm When alarm sounds, turn ON/OFF switch to OFF. Check if one of the following goes out and troubleshoot as necessary:

(1) Power supply failure light
(2) Circulation (recirculation) pump failure light
(3) Low salinity light.

(4) EMS

(a) CHLORINE STATUS display page (Figure 9-12)

(1) Chlorine content
(2) Pump position

(b) SYSTEM STATUS display page (Figure 9-13) - check the following:

(1) CHLORINATOR OPERATING OFF is normal
(2) CHLORINATOR PWR SUPPLY FAIL is normal
(3) BRINE RCIR PMP OPERATING OFF is normal.

o. If these indicators are not as listed in step n, take corrective action.
p. If EMS alarms indicate abnormal conditions, acknowledge alarms according to instructions below and take corrective action.

NOTE

If abnormal condition occurs, EMS activates horn and strobe light in ROWPU space. In addition, EMS keyboard alarm sounds and EMS video monitor automatically switches to ALARM page which shows abnormal condition in flashing double intensity. The affected keyboard key, CHLORINE STATUS or SYSTEM STATUS, flashes red.

(1) Press red flashing key on keyboard to change ALARMS display page back to CHLORINE STATUS or SYSTEMS STATUS display pages.
(2) Press ACK key on keyboard to stop alarms, to automatically change red flashing key to white, and to change flashing display on video monitor screen display page to double intensity.

NOTE

Display stays double intensity until abnormal condition causing alarm is corrected.

q. During operation, perform following during operation checks:

(1) Check for leaks, paying special attention to joints, valves, fittings, and piping. Report leaks to shift leader for corrective action.
(2) Check for loose of missing securements and fasteners. Tighten or replace as necessary.
(3) Check wiring for loose connections. Tighten as necessary. Be alert to unusual noises or overheating that might indicate a pending malfunction.
(4) Make sure all components operate normally.

9-13 Brine tank and holding tank priming

NOTE

If brine tank and/or holding tank are empty, tanks must be primed according to these Instructions. Valves are located in void 2 port and 2 starboard.

a. Perform prestart procedure in paragraph 9-10.
b. Turn function switch on control cabinet (Figure 9-9) to OFF/RESET. This opens level sensors in holding tank and solenoid valves which stops flow of water to brine tank c. Turn alarm ON/OFF switch on control cabinet (Figure 9-9) to OFF.
d. Turn brine pump ON/OFF switch inside control cabinet (Figure 9-10) to OFF.
e. Close chlorination valves CU2 and CU10 to isolate holding tank.
f. When priming tanks with water from seawater system cooling pump:

   (1) Make sure cooling pump is operating. Hf not operating, open valves SW3, SW27, SW35, and SW36 to provide seawater from seawater strainer 3 to strainer pressure gauges and cooling pump. Start pump by pressing START button on pump motor controller.
   (2) Open seawater valve SW47 to allow seawater flow to chlorination unit.
   (3) Close seawater valve SW48 to stop seawater flow from seawater pump.
   (4) Attach hose to hose bib on seawater to chlorination system line in void 2 port.
   (5) Go to step i to prime brine tank or to step j to prime holding tank

g. When priming tanks with water from seawater system pump(s) 1 and/or 2:

   (1) Open seawater valve(s) SW24 and/or SW25 in void 2 starboard to provide seawater from seawater pump(s).
   (2) Open seawater valve SW48 to allow seawater flow to chlorination unit.
   (3) Close seawater valve SW47 to prevent seawater flow from cooling pump.
   (4) Attach hose to hose bib on seawater to chlorination system line in void 2 port.
   (5) Go to step i to prime brine tank or to step j to prime holding tank h. When priming tanks with water from drinking water system pressure set:

   (1) Open drinking water system valve DW17 in void 3 port to allow drinking water to flow to hose bib in void 2 port.
   (2) Attach hose to hose bib on drinking water to chlorination system line in void 2 port.
   (3) Go to step i to prime brine tank or to step j to prime holding tank

i. Prime brine tank as follows:

   (1) Remove lid from brine tank and turn chlorination valve CU7 to position C (dose) to isolate brine tank
   (2) Using hose previously attached to bib, fill brine tank half full of water.
   (3) Add salt to brine tank and stir manually until no more salt will dissolve in water (about 500 pounds).
   (4) Replace lid on brine tank

j. Prime brine tank as follows:

(1) Open cap on Y-connection on top of holding tank and using hose previously attached to bib, fill to low level mark (90 gallons).
(2) Use manual salinity tester (Total Dissolved Solids Tester) according to TM 5-6630-215-12 to test seawater salt concentration. if test indicates seawater is about a 4 percent brine solution (40 per 1000 ppm), no additional salt is needed in the holding tank However, if tests indicate additional salt is necessary, refer to chart below for amount of salt to add to holding tank

Salt concentration of seawater per 1000 ppm:	1	10	20	30	40
Salt required in Ibs:	28	20	15	7	0

(3) If necessary, add proper amount of salt to agree with salt concentration as determined by salinity tester. Then replace cap on Y-connection of holding tank
(4) Generate and circulate chlorine according to paragraph 9-14.

9-14 Chlorine generation and recirculation

a. Make sure holding tank has been primed according to paragraph 9-13.
b. Position CU valves as indicated below.

o = open x = closed A = position A B = position B C = position C

CU VALVE NO	2	2A	3	4	5	6	6A	7	8	9	10
POSITION	o	o	C	A	C	o	o	C	x	x	x

c. Close chlorination unit makeup water and cooling water flowmeter valves (Figure 9-5). Make sure brine pump switch inside control cabinet (Figure 9-10) is OFF.
d. Turn alarm switch on control cabinet (Figure 9-9) to OFF.
e. Turn function switch on control cabinet (Figure 9-9) to AUTO.

NOTE

Chlorination system now makes chlorine solution of a proper concentration in approximately 4 hours. When DC ammeter (Figure 9-9) is reading 950 to 1000 amps (0.95 to 1.0 kilo amps), holding tank solution is at proper level of concentration. Add salt or water to holding tank as necessary.

f. For an alternate method of producing chlorine solution to eliminate initial build-up time, add 10 gallons of commercial hypochlorite solution (Clorox or other liquid chlorine bleach) to holding tank as follows:

(1) Open cap on Y-connection on top of holding tank.
(2) Add 1 gallon of commercial hypochlorite solution (bleach) for every 9 gallons of water in holding tank.
(3) Close cap on Y-connection of holding tank (4) Turn function switch on control cabinet (Figure 9-9) to OFF/RESET to stop recirculation of holding tank solution.

9-15 Chlorination unit descaling. Perform this procedure when an excess of white mineral scale shows on the chlorination unit cells (anodes), when there is a decrease in flow rate to holding tank as shown on makeup flowmeter (Figure 9-5), or when there is an absence of solution at top of the cells. When any of these conditions are observed, excessive scale build-up or low flow is occurring Flush and descale unit. Flushing procedure uses water from seawater system to flush chlorination unit. Holding tank continues to supply chlorine to product water during descaling and flushing operations.

NOTE

If EMS alarms are activated during descaling procedure, acknowledge alarms according to paragraph 9-12, step p.

9-15.1 Initial flushing with seawater

a. Make sure seawater system is operating and providing seawater to chlorination system through seawater valve SW47 or SW48.
b. Turn alarm ON/OFF switch on control cabinet (Figure 9-9) to OFF.
c. Turn function switch on control cabinet (Figure 9-9) to OFF/RESET.
d. Position chlorination unit valves as indicated below:

o = open x = closed A = position A B = position B C = position C

CU VALVE NO	2	2A	3	5	6	6A	8	9	12	16
POSITION	x	x	B	A	x	x	x	x	x	o

e. Position valve CU4 halfway between positions A and C to reduce flow through system.
f. Turn brine pump ON/OFF switch inside control cabinet (Figure 9-10) to OFF.
g. Turn cooling water flowmeter OFF by dosing valve at bottom of flowmeter (Figure 9-5).
h. Turn makeup water flowmeter OFF by dosing valve at bottom of flowmeter (Figure 9-5).
i. Turn function switch on control cabinet (Figure 9-9) to FLUSH.
j. Allow seawater to flow through chlorination unit for about 5 minutes, then turn function switch on control cabinet to OFF/RESET.
k. Open chlorination valve CU9 to allow chlorination unit to drain. If sump appears to be overfilling, partially close valve CU9 to reduce drain flow to sump.
l. After chlorination unit has drained, close valves CU8 and CU9 and turn valve CU5 to position C (OFF).
m. Flush unit with acid according to paragraph 9-15.2

9-15.2 Flushing with acid

9-15.2.1 Acid tank preparation

WARNING

Wear rubber gloves, safety goggles or faceshield, and chemical dust mask when working with acid crystals and acid solution.

a. Remove lid to acid tank and fill with about 25 gallons of drinking water from fill hose attached to bib in void 2 port above holding tank

WARNING

Always add acid to water. Do not add water to acid. If any acid crystals or solution splash on skin, flush skin with water immediately. Immediately flush eyes at eyewash station if acid crystals or solution splash in eyes.

b. Add two cans (14 Ibs) of sulphamic acid to water in acid tank

9-15.2.2 Acid flush

a. Turn valve CU3 to position A, ACID.
b. Turn valve CU5 to position B, ACID.
c. Open valve CU17. Make sure valve CU16 is open.
d. Turn function switch on control cabinet (Figure 9-9) to FLUSH.
e. Descale until all visible signs of scale are gone from anodes (cells), approximately 5 minutes, then turn function switch to OFF/RESET.

NOTE

Sump tank pump automatically empties sump tank. Level switch in sump tank starts and stops sump pump.

f. Turn valve CU5 to position A, DRAIN, to allow solution to drain to sump tank.
g. Remove lid to acid tank to observe level of solution in tank
h. Turn function switch on control cabinet (Figure 9-9) to FLUSH. Acid tank is now being emptied by circulating pump.
i. When acid tank is empty, turn function switch to OFF/RESET.
j. Close valve CU17.
k. Replace lid on acid tank.

NOTE

After descaling with acid, flush chlorination unit with seawater before returning to normal operation.

l. Turn valve CU3 to position B, WATER, to allow seawater to flush out acid.
m. Turn valve CU5 to position A, DRAIN, to allow flushing seawater to drain to sump tank
n. Turn function switch to FLUSH.
o. After flushing to remove acid for about 5 minutes, turn function switch on control cabinet (Figure 9-9) to OFF/RESET.
p. Return chlorination system to normal operation (paragraph 9-12).

9-16 Shutdown procedure

NOTE

Shutdown procedure is for normal operation and short downtime. For extended shutdown times, see TM 55-1930-209-14&P-4.

a. Turn metering pump control MANUAL/OFF/AUTO switch to OFF.
b. Stop metering pump by turning MAN/OFF/AUTO switch on metering pump motor controller (Figure 9-6) to OFF.

NOTE

Chlorination unit continues to produce and store chlorine solution for later use. If chlorination unit Is to be shut down completely, perform steps c and d.

c. Close valves CU2, CU6, and CU10.
d. Turn function switch on control cabinet (Figure 9-9) to OFF/RESET.
e. After shutdown, perform following after operation checks:

   (1) Wipe components clean, especially flowmeters, indicators, control panels, and electrolytic cells.
   (2) Check for leaks, paying special attention to all joints, valves, fittings, and piping Report leaks to shift leader so corrective action can be taken.
   (3) Check for damage, especially to pressure gauges, flowmeters, indicators, and control panels. Repair as necessary.
   (4) Check for loose or missing securements and fasteners. Tighten or replace as necessary.
   (5) Check wiring for loose connections and frayed cables. Tighten or replace as necessary.

9-17 Emergency shutdown

9-17.1 General. The barge has two emergency shutdown modes (Chapter 3). One mode shuts down individual systems such as the ventilation system or a diesel high pressure pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Seven red system shutdown buttons are located on the ROWPU space starboard bulkhead just aft of the personnel door. These system shutdown buttons (Figure 3-16) control shore power, ventilation systems, ROWPU1 diesel HP pump, ROWPU2 diesel HP pump, SAG, SSG2, and SSG1.

Six red total shutdown buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of row of system shutdown buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

9-17.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.
b. When emergency situation is corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button pops out and again is in the ready position.
c. When emergency button is reset, restart chlorination system according to Section III, paragraph 9-10.

Section IV. Operation under extreme conditions

9-18 Operation under extreme conditions. Operation of chlorination system in extreme cold creates a special problem with lubricants. Other problems occur during operation in extreme heat. These conditions are discussed below. Additional information can be found in manufacturers' service manuals/instructions listed in TM 55-1930-209-14&P-4.

9-18.1 Operation in extreme cold. Cold weather lubricants must be used. When not operating, flush chlorination unit with clean, fresh water and drain to prevent damage due to freezing or severe abrasion to the circulating pump impeller due to salt precipitation.

9-18.2 Operation In extreme heat

9-18.2.1 Lubricants. Hot weather lubricants must be used.

9-18.2.2 Motors. Electric motors may have a tendency to run hot, causing internal protective devices to stop motors. When this happens, allow motor to cool and it will automatically restart when it reaches a safe operating temperature.

CHAPTER 10 WORKBOAT AND BOW CRANE

Section I. General

10-1 General. This workboat provides water transportation for crewmembers and visitors, small cargo items, transporting the messenger line for shore discharge hose, and similar work-related tasks associated with operating the water purification barge.

10-2 Description

10-2.1 Workboat (Figures 10-1 and 10-2) is a 23-foot, reinforced aluminum-hulled, triple-V-bottomed craft with a forward cabin for six passengers plus the operator and a flush after-deck for small cargo and messenger line reel unit. Closed cell flotation foam fills the forward compartment, under the cabin floor, and small compartments on both sides of the engine compartment. Workboat has two push knees on the bow, an aluminum tubular protective frame around the outboard drive, and two bow and two stern mooring bitts. It has a diving ladder that fits into sockets on either port or starboard just aft of cabin and forward of aft guard rail. Lifesaving equipment includes eight life vests stowed under cabin benchseats and a ring life buoy with floating marker light and line.

10-2.2 Power is supplied by a six cylinder inline turbocharged diesel engine, inboard/outboard configuration, driving a single propeller. Engine rpms and engagement are controlled by one lever at the operator's station. Steering is by hydraulically operated controls at the operator's station Complete instrumentation, including a 4-inch compass and engine hour meter, is included at the operator's station. Workboat has two automatic bilge pumps, and a 50-gallon diesel fuel tank in the engine compartment.

10-2.3 Workboat, when not in daily use, is stowed in Its cradle on deckhouse top. It is held in place by three strap winches on each side. These straps are hooked into three eyes on each side of boat just under the rubber bumper. The boat is launched from storage using a three-point suspension harness attached to specially constructed points on the hull and lifted overboard by a hydraulic bow crane and lowered into the water. The boat is lifted from the water and stored on the cradle In the same manner.

10-2.4 Major components are the following.

a. Hull, aluminum, 23 ft, MonArk 2308-C
b. Switch, ON/OFF master, Perko 9601

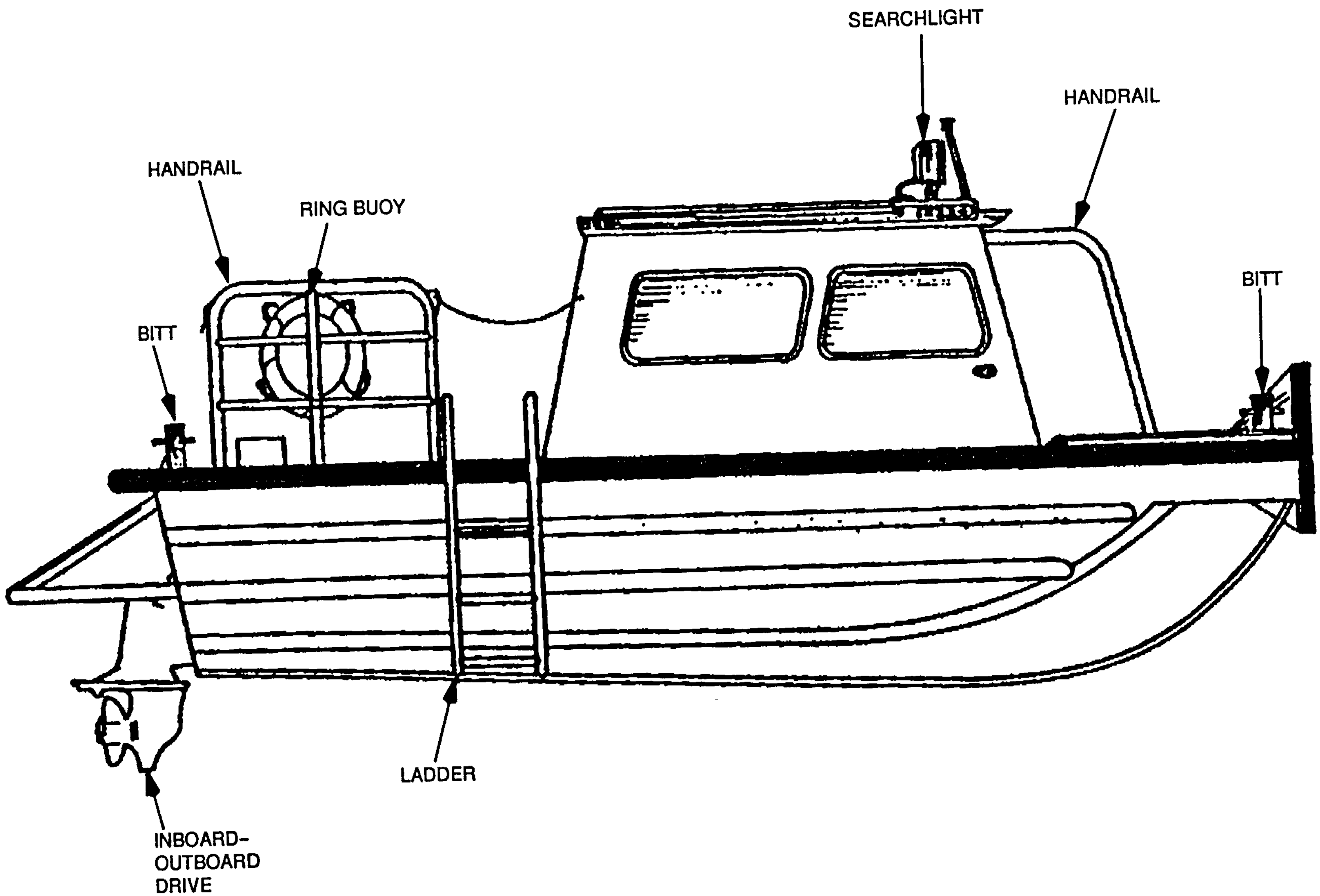


Figure 10-1. Workboat Profile

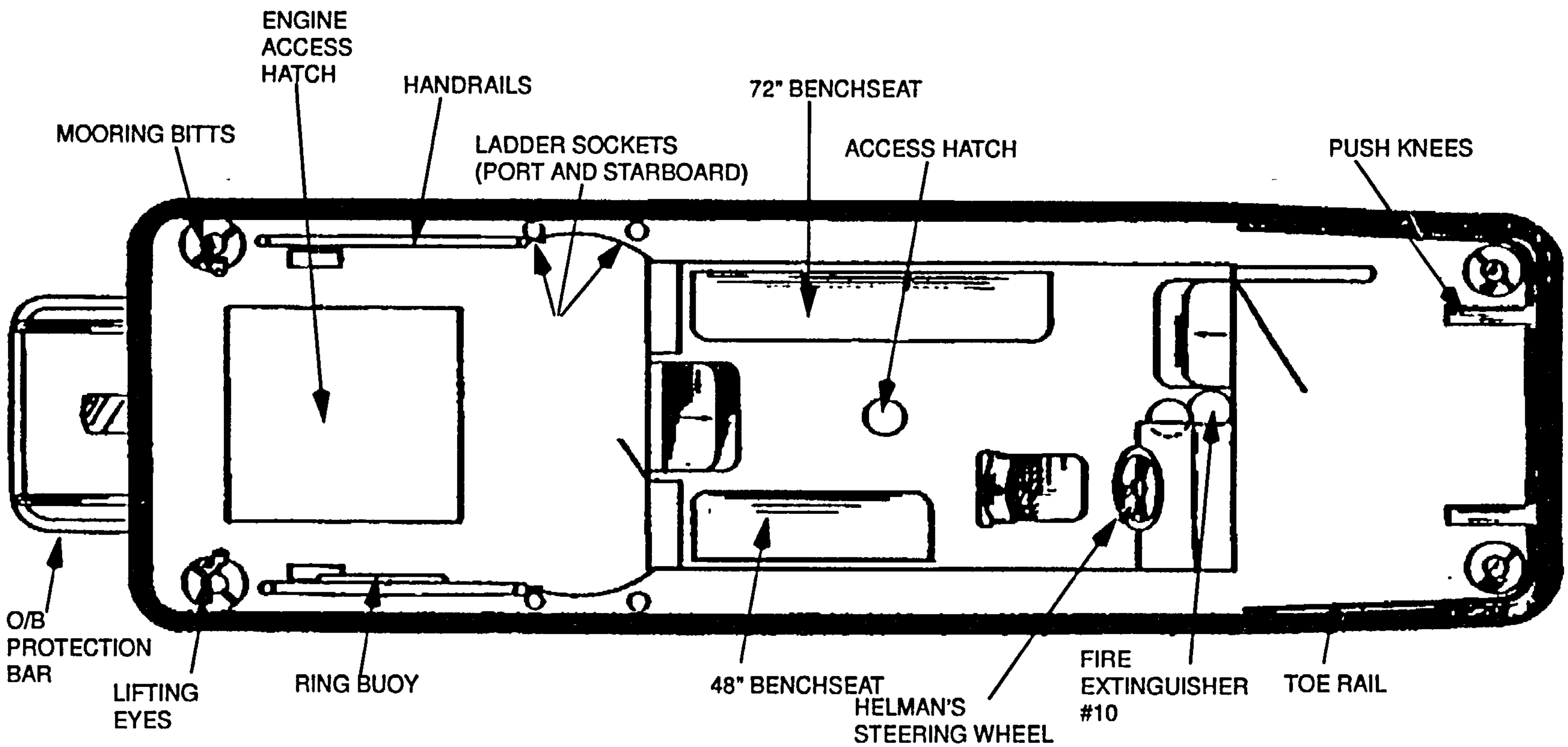


Figure 10-2. Location of Workboat Components

c. Radio, VHF/FM commercial marine band
d. Depthfinder, digital, Aqua Probe model 550
e. Switch, panel, Perko 517
f. Switch, 3-position, Perko 366
g. Panel, fuse, Perko 647-6
h. Bar, ground, Perko 627-6
i. Panel, engine, Volvo Penta
j. Meter, engine hour
k. Compass, 4-in., HB 70 Ritchie
l. Gauge, fuel, Tempo w/fuel sender
m. Helm, Teleflex Seastar HH5201
n. Controls, Morse D67978
o. Cables, control, Morse
p. Pump, trim, Volvo Penta
q. Horn, Pollack, 41-201 w/switch
r. Wiper, American Bosch WWF12C1
s. Light, dome, Perko 300-2
t. Light, white 360-degree, Aqua Signal 33513-003
u. Light, sides, Aqua Signal 33511-102/33510-102 (2)
v. Engine, Volvo Penta AQAD-40
w. Box, battery (2)
x. Battery, 12-volt, Delco (2)
y. Switch, selector, Perko 8501
z. Tank, fuel, 50-gal, MonArk
aa. Vent, tank, 1/2-in. coupling, MonArk
ab. Fill, deck, diesel, Perko 1328
ac. Fitting, through hull, Rule
ad. Filter, fuel, Racor 500 MA
ae. Valve, shutoff, Tempo 300SOV
af. Pump, stripping, TAT 350
ag. Pump, bilge, Rule 2000 (2)
ah. Switch, bilge, Rule 41-A (2)
ai. Switch, float, Mayfair 601 (2)

10-2.5 Special components mounted on workboat

a. Reel, aluminum, w/mount*

b. Line, messenger, 3000 ft, 5/8 In kevlar, 8000 lb test pull*

* Reel w/mount is attached to a sliding base that is bolted on rear workboat deck over engine compartment and holds messenger line. Sliding base is on outside of engine compartment and allows reel to be moved forward against workboat cabin for easier access to engine compartment. It can be moved to the rear to allow use of aft door from cabin and for dispensing messenger line from shore to barge. Reel and mount are locally fabricated. Messenger line, in conjunction with AMCON shore winch pulls shore discharge hose from barge to shore.

10-2.6 Equipment specifications, maintenance information, and manufacturer's service manuals are contained in TM 55-1930-209-14&P-17.

10-3 Capabilities. This boat has a rated load capacity of 4000 pounds, or six passengers, operator and 2600 pounds. The messenger reel and line, when mounted, weigh 670 pounds, and workboat's load capacity must be reduced by this amount. A full fuel tank of 50 gallons of diesel fuel provides about 3 hours of operations. Depending on the propeller fitted, speed, load, sea conditions and amount of maneuvering, this fuel should provide a one-way range of about 70 miles.

10-4 Special limitations. Although the aluminum hull is reinforced, it is neither designed nor constructed to be run ashore. When running in shallow water, the outboard drive should be raised to full "beach" position to reduce possibility of damage to the outboard drive. In this position, the outboard drive produces less thrust.

10-5 Performance characteristics. According to factory tests, with only operator onboard and using a 3-bladed, 16-inch propeller with 21 inch pitch, boat has a top speed of 30 mph at a maximum attainable rpm of 3150. Boats are now equipped with 3-bladed, 16-inch propellers with 19-inch pitch, and factory performance data is not available for this combination. These boats, at full rpm, have a turning radius of about 90 feet.

Section II. Operating instructions

10-6 Controls and Indicators. Operator controls and indicators are at operator's station in workboat cabin on forward starboard side (Figure 10-3). Workboats have same controls and indicators, but the locations of dash-mounted items vary among different boats. Following sections provide general location and operating instructions for controls and indicators in the workboat cabin.

10-6.1 Searchlight. Searchlight controls protrude from cabin ceiling above and forward of wheel.

a. Direct light by rotating handle around vertical shaft. Light is directly attached to shaft.
b. Raise lightbeam by pulling down on handle.
c. Lower lightbeam by pushing up on handle.
d. Switch is on operator's electrical control panel.

10-6.2 Operator's electrical control panel. Mounted on the dash, this panel has ON/OFF switches for searchlight, windshield wipers, cabin dome light, engine room light, and running lights. Switches are on left side of panel, labels are in the middle, and fuse containers are on right side.

10-6.3 Windshield wiper. Windshield wiper motor is mounted above windshield, and ON/OFF switch is located on the electrical control panel.

10-6.4 Boat horn. Horn is mounted on top of cabin, and horn button is located on the operator's dashboard. Push to blow horn.

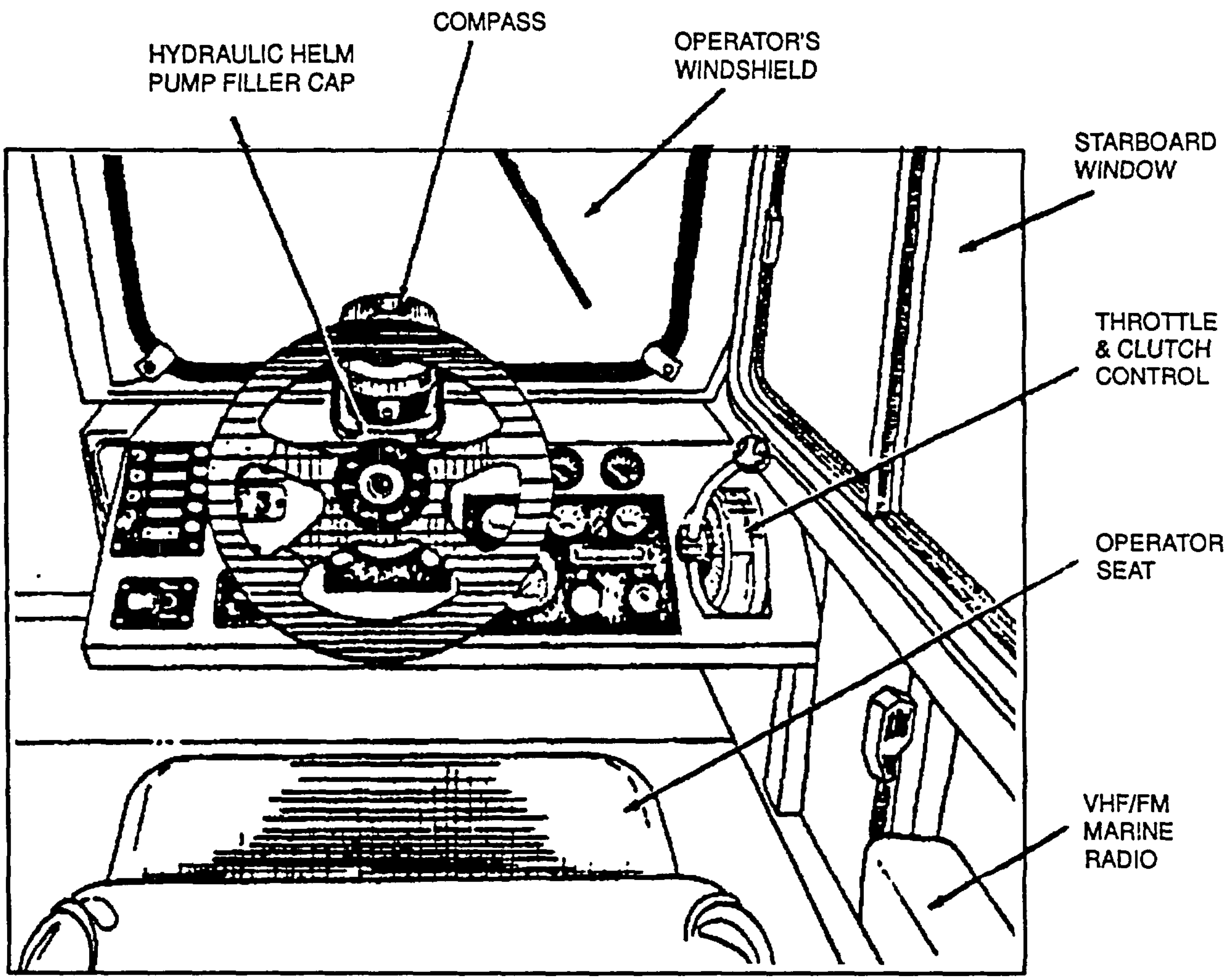


Figure 10-3. Workboat Operator Controls and Indicators

10-6.5 Bilge pump switches and indicators. Controls for two bilge pumps are on operator's dash. Each pump has a fuse container, a light Indicating when pumps are working and a three-way pump switch that operates. MAN (manual on) to the right, OFF in the middle, and AUTO to the left. The three-way switch Is spring loaded to OFF and must be held to the right to keep pumps working The switch stays In the AUTO position until turned back to OFF. Normal position is AUTO. Bilge switches bypass master switch so when all electricals are turned off, except battery select switch in engine compartment, bilge pumps work when automatic float switches activate them. Red warning light glows whenever bilge pumps are operating.

10-6.6 Outboard drive controls. Two panels on operator's dash indicate and control status of outboard drive. Red warning light on panel comes on when outboard drive is in TILT range. A series of small green lights indicates position of outboard drive A toggle switch and a pushbutton control the outboard position.

a. Push black rubber-covered toggle switch UP to move outboard drive up.
b. Push that same switch DOWN to move outboard drive down.
c. Push in on black rubber covered button and then push up on black toggle switch to move outboard drive to TILT position. Red position light will come on.

10-6.7 Magnetic compass. A four inch, fully gimballed, lighted compass with built-in magnetic compensators Is mounted in top center of dashboard. An internal compass light comes on when cabin dome light is turned on. Magnetic deviation set in compass should be verified when boat is moved more than 100 miles east or west of previous location.

10-6.8 Steering pump filler. Filler for hydraulic steering is on top of wheel housing behind wheel. See TM 55-1930-209-14&P-17, for servicing.

10-6.9 Engine hourmeter. Mounted on the dashboard, the hourmeter records and indicates hours of engine operation. This data Is used as basis for workboat maintenance program.

10-6.10 Fuel gauge. Mounted on operator's dashboard, the fuel gauge is electrically powered and is turned on when master switch is turned on. The gauge indicates E for empty on left, F for full on right, and 1/4, 1/2, and 3/4th markings In between. Gauge does not have a warning light for low fuel condition.

10-6.11 Volvo engine instrument panel. This panel, on operator's dashboard, displays a coolant temperature gauge, oil pressure gauge, voltmeter, tachometer, instrument warning light cluster, alarm buzzer test button, instrument light, and light switch.

a. Temperature gauge, in upper left corner of engine instrument panel, shows closed circuit coolant temperature. Normal coolant temperature should be between 165 and 195°F. When coolant temperature exceeds 195°F, left light in warning light cluster shows red and portrays international sign of a thermometer. Instrument panel alarm buzzer also sounds.
b. Oil pressure gauge is in center of three gauges across top of engine instrument panel. Gauge markings indicate from 0 on the left to 120 psi on the right, with Intermediate marks for 30, 60, 80, and 100 psi. Lower arc of numbers is for metric measurement of oil pressure. Normal operating temperature for a warm engine should be between 30 and 100 psi When oil pressure drops too low, second light from left on warning light cluster shows red with the international sign of an oil can. Instrument panel alarm buzzer also sounds.
c. Voltmeter gauge is in right corner of engine instrument panel and indicates amount of charging from alternator into battery or batteries selected with battery selector switch on aft edge of engine compartment. When alternator ceases to provide a charge to the batteries, third light from the left in instrument warning light cluster glows red and shows a battery.
d. Tachometer is in lower left corner of engine instrument panel and indicates engine rpm in 100's Tachometer indicates up to 5000 rpm and does not show a redline. Warmup Idle speed is normally between 900-1200 rpm. Normal idle speed is about 600 rpm Normal operating range, depending on load, sea conditions, and propeller, is between 1000 and 3800 rpm.

e. Instrument warning light cluster is right of tachometer and below oil pressure and voltmeter gauges. II shows four warnings. From left to right, these are: coolant temperature (shown with a thermometer), oil pressure (shown with an oil can), battery charging, (a battery), and glowplugs engaged (large, C-shaped arrow with wave in the middle).

f. Engine alarm buzzer test button is below instrument warning light cluster. Push button to test buzzer. Buzzer should sound. Alarm buzzer is below buzzer test button.

g. Instrument light switch Is also below instrument warning light cluster. Push to turn on instrument lights. Push to turn off instrument lights.

10-6.12 Master switch. Master switch Is on port side of operator's dashboard facing the passageway from the front entrance to the cabin. It has two positions, ON and OFF. Bilge pumps are not connected through the master switch and must be turned off with bilge pump controls on the dashboard.

10-6.13 Ignition/electrical switch. This switch requires a key to operate. Switch has five positions:

a. O - Turns off all electrical circuits associated with engine

b. R - Stops engine

c. 1 - Turns on engine instruments

d. 2 - Turns on engine glow plugs

e. 3 - Turns starter and starts engine

10-6.14 Throttle and shift controls. These are combined in one lever to right of operator's control panel. When lever is vertical to its pedestal, controls are In neutral and engine is idling. Pushing lever forward shifts drive to forward, and continued movement forward increases throttle. Pulling lever back shifts drive to reverse, and continued movement back increases throttle. To disengage throttle from shifting, place lever in neutral, push In and hold button at bottom of lever push lever slightly forward and then release button. Lever now becomes throttle control and drive mechanism stays In neutral. This Is normally done when engine is started so warmup idle speed can be set on throttle.

10-6.15 Marine band VHF/FM radio. This is mounted below window frame on starboard side of operator's position. Figure 10-4 shows controls and indicators for this radio.

10-6.16 Depthfinder controls and indicators. These are mounted aft of VHF/FM radio on starboard side of operator's position and shown in Figure 10-5.

10-6.17 Engine maintenance controls and indicators. These are shown In Figure 10-6.

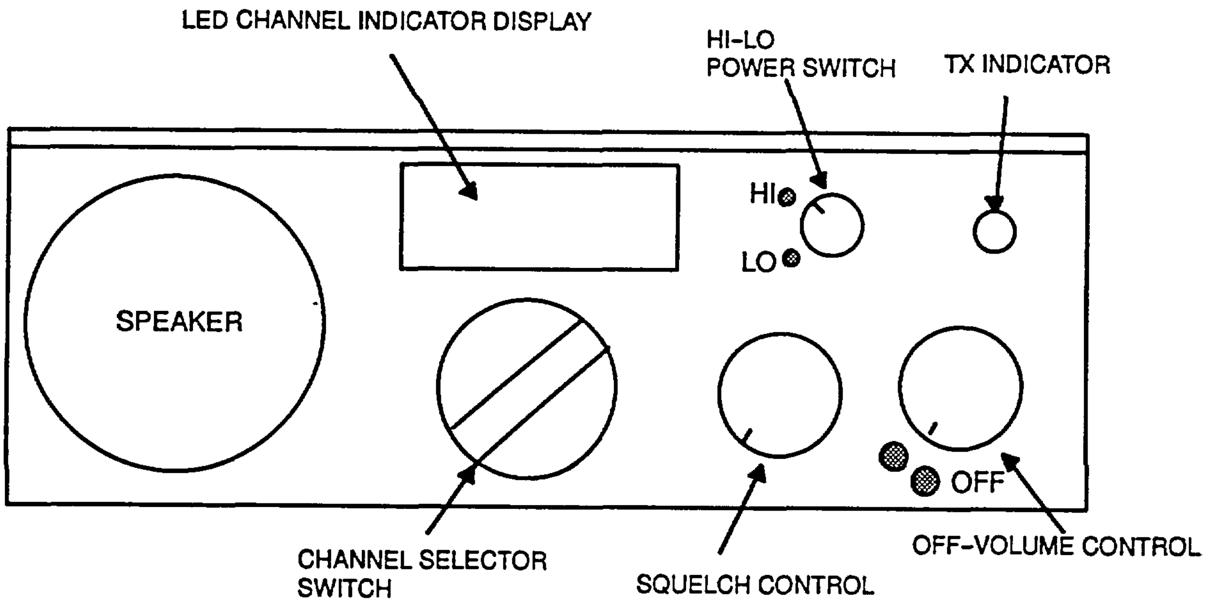


Figure 10-4. VHF/FM Marine Radio Control Panel

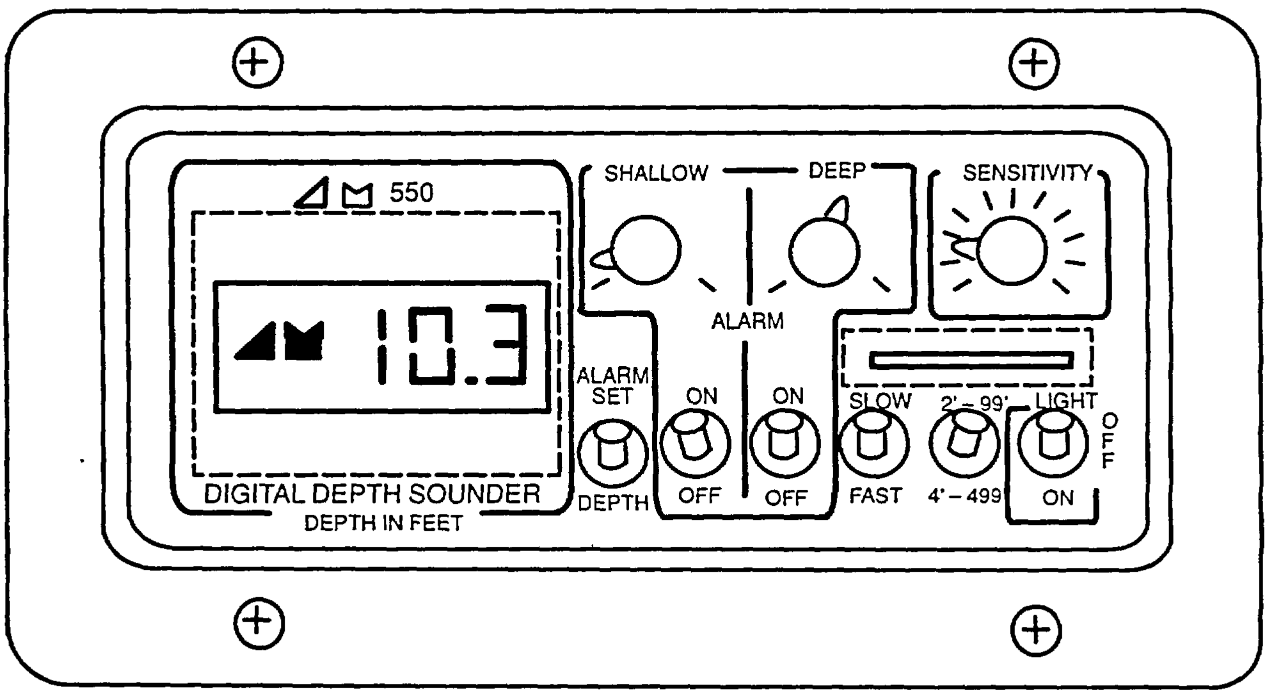


Figure 10-5. Depthfinder Controls and Indicators

10-7 Prestart procedures

NOTE

These procedures start with the workboat in the water and secured to side of the barge with four lines using the small workboat cleats on the forward two-thirds of the barge on either side. This is the area with the vertical fenders. Procedures for launching from and returning the boat to its storage cradle on the deckhouse top are provided in paragraph 10-13.

a. Make an overall visual check of workboat's condition. Check boat's hull and installed equipment, such as running lights and searchlight, and also make sure it is properly secured with lines and bumpers.
b. Open cabin and make sure master switch is OFF (Figure 10-3). Obtain engine hatch tool from under operator's seat.
c. If necessary, move messenger line reel unit (Figure 10-7) as far forward as possible. Pull pins on sliding tracks on each side of unit, shove unit forward against the stops, and replace pins.
d. Using engine hatch tool, rotate lock nuts on each corner one half turn and slowly open engine compartment (aft deck closure). Escaping air may indicate that water is entering engine compartment and forcing air out.
e. Check engine compartment to make sure there are no diesel fuel, water, oil, or hydraulic fluid leaks. Tighten filters and fittings or take other corrective action as necessary.
f. Check oil level. Dipstick is on top of engine between branches of intake manifold (Figure 10-6). Oil level should be between top and bottom of rough hatchmark area of the stick Fill with oil, when necessary, through the oil filler cap on top of the engine. Use diesel lubricating oil CD (MIL-L-2104), SAE 20W30, above 50°F and oil CD, SAE 10W, below 50°F.
g. Check coolant level in heat exchanger by opening cap at front of engine. If necessary, fill to upper edge of splash plate on thermostat housing. Coolant must be either a 50-50 mixture of fresh, clean water and corrosion-protective antifreeze or fresh, clean water with a corrosion-protective additive. If coolant level is very low, check again after engine has started and is idling. If necessary, add additional coolant to bring it to upper edge of splash plate.
h. At rear of engine compartment, make sure battery selector switch is set to ALL position.
i. Close engine hatch, turn closure nuts on each comer one-half turn clockwise, and return engine hatch tool to storage under operator's seat cushion.

10-8 Starting procedures

a. At operator's station, make sure all electrical circuits are OFF except bilge pumps, which should be in AUTO (Figure 10-3).
b. Turn master switch ON.
c. Insert key into ignition switch and turn clockwise from OFF to position 1. This turns on engine electrical accessories.
d. Lower outboard drive, if in the TILT range. Small red light on outboard drive panels is on if outboard drive is in TILT range.

CAUTION

Engine must NOT be started with outboard drive In TILT range. When engine is in TILT UP position, water pickup point on outboard drive Is out of water and engine cannot receive seawater to cool closed coolant system.

e. Release engine speed control from shift control by placing shift control lever in neutral position, and, while holding in on button at bottom of lever, moving lever forward (Figure 10-3).
f. Check fuel gauge on instrument panel If refueling is necessary, make sure radio and other electrical accessories are off.

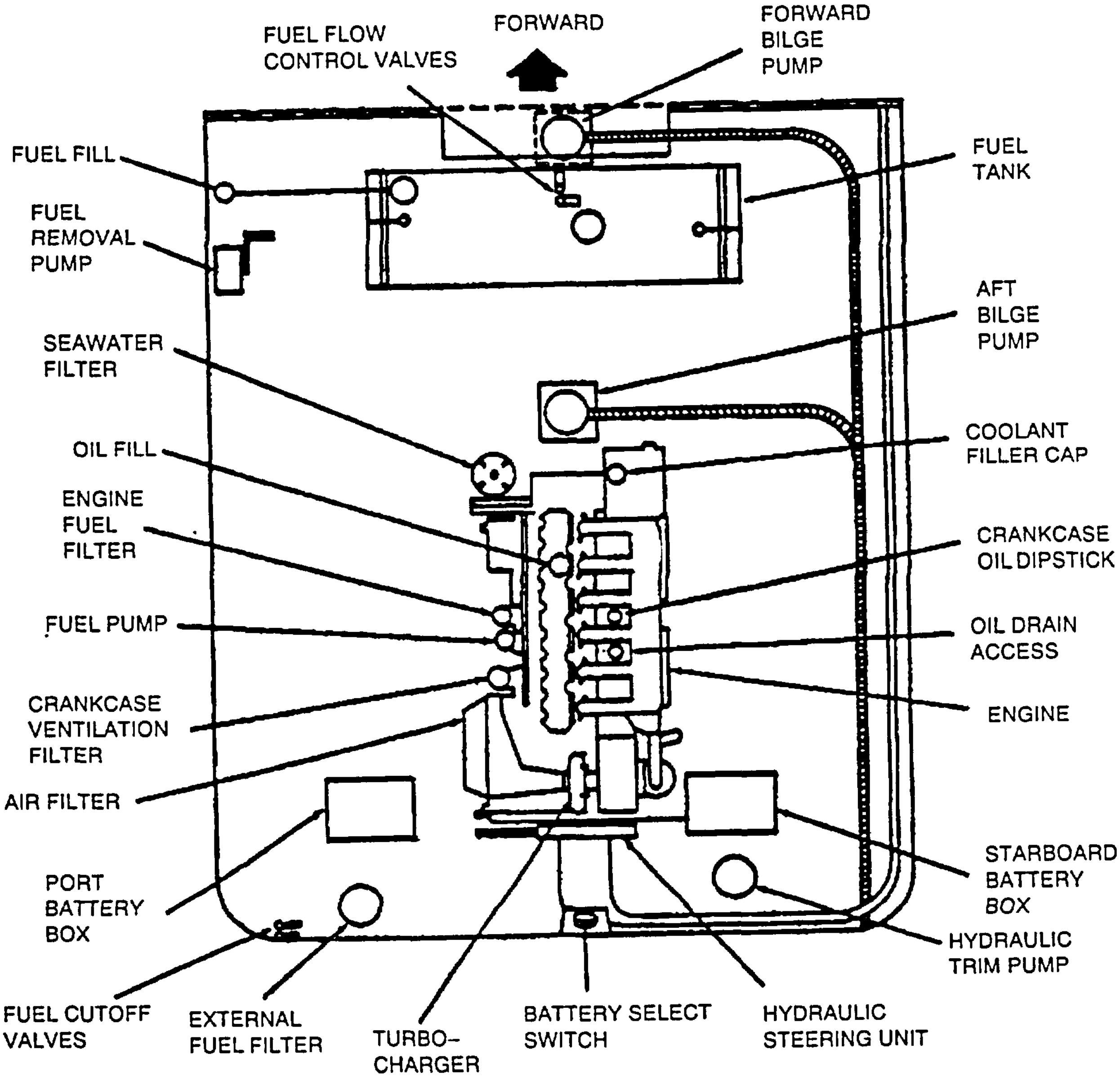
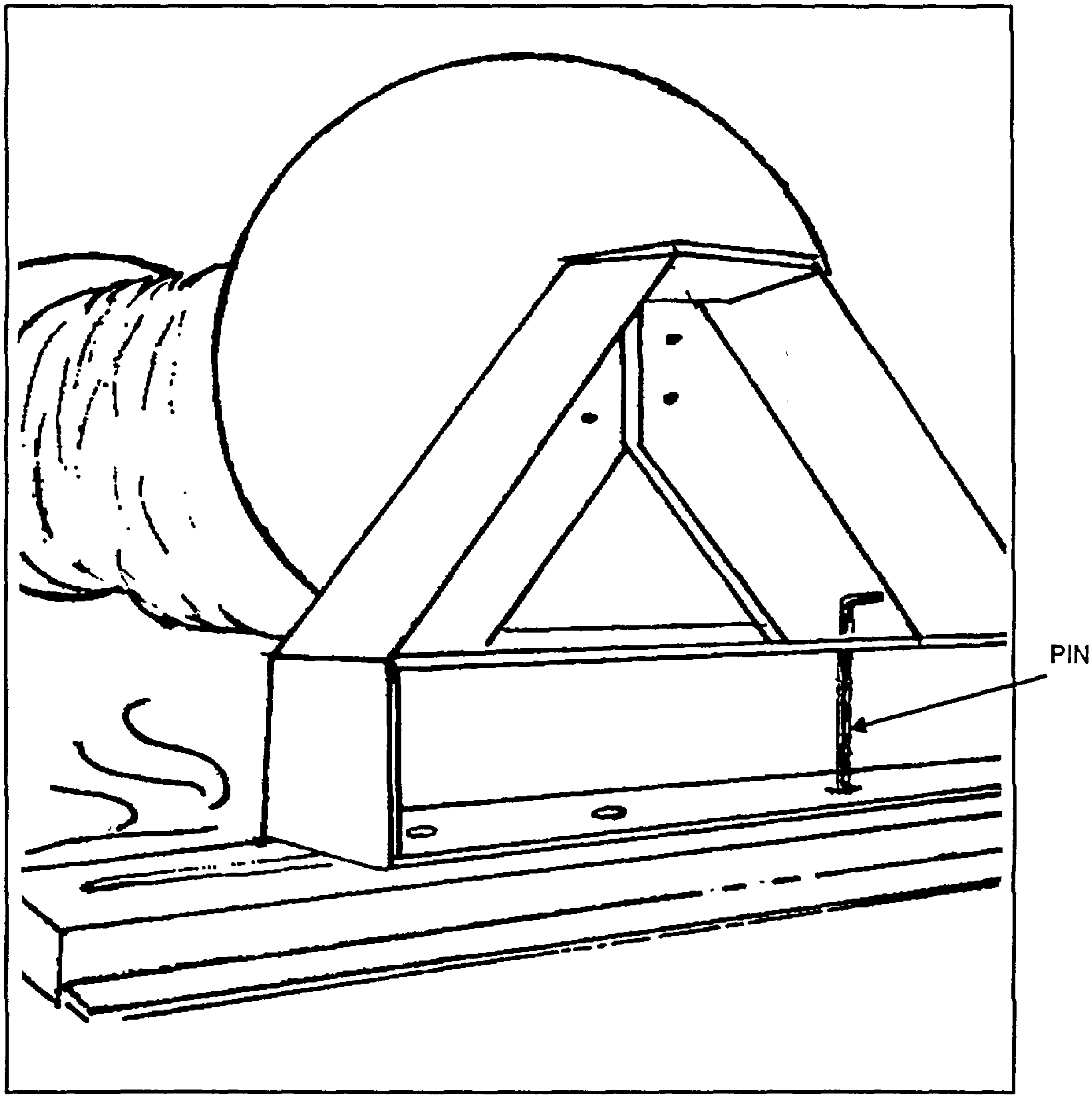


Figure 10-6. Engine Maintenance Controls and Indicators



MOUNTED AFT OF WORKBOAT CABIN ABOVE ENGINE COMPARTMENT, UNIT SLIDES AFT FOR EASIER ACCESS TO CABIN AND FORWARD FOR ACCESS TO ENGINE COMPARTMENT. UNIT IS HELD IN PLACE BY TWO PINS ON EACH SIDE (ONLY ONE PIN SHOWN)

Figure 10-7. Messenger Line Reel Unit

WARNING

During fueling operations, neither open flame nor smoking is permitted within 10 feet of fueling operations. Only minimum number of persons necessary to conduct fueling are permitted in area.

g. Make sure engine compartment hatch is secured in place.
h. Attach grounding wire from barge to workboat, making sure damp has a good contact on metallic part of workboat.
i. Using Perko special key or large screwdriver, open fuel filler cap on port side aft of cabin.
j. While monitoring fuel gauge on instrument panel at operator's station, fill workboat fuel tank from barge fueling station. Do NOT fill workboat fuel tank full. Leave room for expansion of cool fuel coming from voids storage tank into warmer workboat fuel tank k. Close workboat fuel filler cap.
l. Remove grounding wire from workboat and reattach to fueling station.
m. Clean any fuel oil spills immediately.
n. Turn ignition switch to position 2, activating diesel engine glow plugs. If engine is cold, hold in this position for 30 seconds. An automatic cold starting device is built into fuel injection pump. This warmup of glow plugs is not necessary on a warm engine.

WARNING

Operator and passengers onboard workboat must wear ear protectors whenever engine rpm exceeds 1500 rpm.

Make sure all passengers are wearing life vests and ear protectors and have been briefed on emergency procedures to include location of lifesaving equipment.

o. After warming glow plugs, turn starter switch OFF and then to position 3 for starting.
p. When engine starts, release starter switch, and it will return to position 1: master switch - all electrical accessories on. Check instruments. OCl pressure gauge and voltmeter readings should be normal.

CAUTION

If Instrument readings are not normal or engine alarm buzzer is sounding, stop engine immediately by turning starter switch to R (between OFF and position 1). Troubleshoot engine, locate fault and repair or replace as necessary.

q. Run engine at high idle (900-1200 rpm) until gauges reach normal operating ranges. Check that cooling water is being discharged overboard.
r. Reduce engine speed to normal idle (600 rpm) and check that engine is running smoothly.
s. Pull shift control lever to neutral position. This will engage shifting mechanism with engine speed control.
t. While still tied to the barge, move control lever to forward at idle. Check that boat starts moving forward. Go immediately to neutral and then do the same in reverse.
u. With shift control lever in neutral, turn wheel strongly to starboard and then to port. Have observer check that outboard drive moves in response to wheel movements.
v. If these checks indicate power and control, and engine instruments are indicating normal conditions, start loading passengers and/or cargo. If workboat does NOT respond to these checks, troubleshoot and correct before loading passengers or cargo.

10-9 Operating procedures

10-9.1 Radio operations. VHF/FM commercial marine radio (Figure 10-4) operates in the 156.250-162.550 MHz frequency range, develops up to 25 watts of radio frequency (RF) power, receives 50 channels for operational and environmental announcements, and transmits on 46 channels. The workboat commercial marine radio is identical to the marine radio installed on the barge and described in Chapter 5 of this TM. When workboat is deployed in U.S. coastal waters and marine radio is not being used for two-way communications, monitor channel 16. The following operational procedures (Chapter 5) should be observed.

a. When using the radios for two-way communications, observe secure transmission procedures as specified in unit Communication Electronics Operation Instructions.

b. Perform the following to turn on the marine radio:

   (1) Verify that antenna lead and power lead are properly attached to radio set.
   (2) On marine radio power supply, set power switch to ON.
   (3) On marine radio (Figure 5-5), turn VOLUME control clockwise to mid-position on dial.

c. Perform the following to receive from a remote radio station:

   (1) On marine radio, turn CHANNEL selector switch to the desired channel in accordance with Table 5-2 in Chapter 5 of this TM. In most instances, channel 16 is used to establish initial contact and for DISTRESS and SAFETY communications. Once contact is made on channel 16, the appropriate working channel is selected and set.

NOTE

Selection of channel 15 or channel 17 automatically reduces radio output power to 1 watt, In compliance with US FCC regulations.

   (2) Select/set the desired HI/LO power setting.
   (3) Turn SQUELCH control clockwise until background noise just disappears. Do not adjust control beyond this point or the marine radio receiver sensitivity will be reduced.
   (4) When message is received, adjust VOLUME control to obtain desired listening level.

d. Perform the following to transmit to a remote radio station.

NOTE

Do not transmit on frequencies assigned to other radio sets. Refer to Table 5-2, Chapter 5, for a general listing of channel assignments and the purpose for which these channels are to be used.

   (1) Turn HI-LO POWER selector switch to desired setting.

NOTE

HI-LO POWER selector switch should Initially be set In LO position (1 watt RF output power) for near stations (1-2 miles). Use HI position (25 watt RF output power) when contact cannot be made using low power (LO position) or for distant stations (over 2 miles).

   (2) Turn CHANNEL selector switch to obtain desired channel, normally channel 16, to establish initial contact. (Channels 16 and 22 are always monitored by the USCG.)

NOTE

Refer to Table 5-2, Chapter 5, to select the proper channel to be used as a working channel after initial contact Before transmitting on the working channel, make sure channel selected is not in use.

(3) Hold microphone about 1 inch from the mouth, press and hold PUSH-TO-TALK button on microphone, and speak into it slowly and distinctly.

(4) When message is complete, release PUSH-TO-TALK button so acknowledgement and incoming messages can be received. Marine radios cannot receive incoming messages while transmitting. Wait until incoming message is completed before pressing PUSH-TO-TALK button again to transmit.

10-9.2 Depthfinder operations. This Aqua Probe model 550 digital depthfinder operates like a computer that is programmed to filter and interpret return signals. It displays only the depth of the strongest, shallowest echo. It does not display all return signals.

a. Make sure power cable and transducer cable are firmly installed in bottom of depthfinder unit.
b. Make sure LIGHT/OFF/ON switch (Figure 10-5) is in center OFF position.
c. All other switches must be in down position.
d. Set SENSITIVITY and SHALLOW alarm knobs to minimum settings by rotating fully counterclockwise.
e. Turn power on by turning switch to ON during daylight and to LIGHT during darkness. Liquid crystal display will come on. (If SENSITIVITY switch is set on minimum, it will show a logo and display "No Echo" in lower left comer.) If boat is over a very hard packed sandy or rock bottom in shallow water, it may receive enough return signal even at minimum settings to provide a depth reading.
f. To set SENSITIVITY control, slowly rotate control clockwise to the point where the water depth starts to be displayed. "No echo" indication will disappear and water depth will be displayed. This is sensitivity threshold.
g. Continue to rotate control clockwise until display shows two more gradations above threshold.
h. Select depthfinding range by pushing 2'-99'/4'-499' switch up to shallow range (2 ft to 99 ft).
i. Make sure update rate on SLOW/FAST switch is set to FAST.
j. Make sure DEEP ON/OFF switch is in OFF (down) position.
k Turn SHALLOW ON/OFF switch to ON by moving toggle switch up.
I. Turn ALARM SET/DEPTH switch to ALARM SET by moving toggle switch up.
m. Adjust SHALLOW knob slowly until liquid crystal display shows 06.0 feet (depth of outboard when boat is loaded plus safety factor). Shallow alarm may be set to alert operator to any desired depth within range selected for finder to measure.

CAUTION

In using shallow alarm system and setting depth for alarm to sound, remember that depthfinder's transducer Is mounted on the stern. Although It sends and receives signals In a cone shape with transducer at the top of the cone, alarm system Is NOT foolproof at predicting water depth in FRONT of the boat This Is especially true when the boat Is moving fast

NOTE

For additional Information on depthfinder operations, read pages 9 thru 14 of the Aqua Probe Owner's Handbook In Appendix B TM 55-1930-209-14 &P-17.

n. Move ALARM SET/DEPTH switch to down position and display will again indicate depth beneath the boat.
o. Set deep alarm by turning off shallow alarm and following these procedures for setting deep alarm. Then, with deep alarm on, again turn shallow alarm on. Now both shallow and deep alarms are operating.

10-9.3 Workboat operations

a. Cast off from barge, ensuring that mooring lines are secured and not creating a safety hazard on deck or in the water.
b. At idle speed, maneuver away from barge.
c. For long distance or long periods of operation, cruising maximum speed is about 200 rpm below maximum attainable rpm. Set throttle for maximum power and allow boat to reach its maximum rpm. Then, reduce rpms - to 200 below the maximum rpm.

CAUTIONS

Never shift to reverse when boat Is planing.

If accidentally running In very shallow water, shift engine to neutral and raise outboard drive to full TILT position to preclude damage to drive. Power cannot be applied to drive while in TILT position.

NOTES

Depending on load and sea conditions, normal cruising should range between approx. 2600 rpm (where boat may fall off plane) and a maximum cruise of approx. 3300 rpm. These parameters, based on use of a 16 Inch dia meter propeller with 19 inch pitch, may change when a different propeller Is fitted.

Reverse can be engaged while in TRIM or BEACH range of the trim plane gauge.

d. Monitor engine instruments for proper readings. Coolant temperature should be 165 to 195°F. Make sure cooling water is flowing overboard.
e. Adjust outboard drive by using power trim switch to maintain best running conditions. This will show on the trim gauge within the TRIM range.
f. When running in shallow water or water of unknown depth, adjust outboard drive into BEACH range. Reduce engine speed to very low or idle speed, push IN button on trim control on dashboard, and push toggle switch UP to adjust drive as indicated on trim gauge. This must be done ONLY when engine is at low speed or idle. Once in BEACH range, engage either forward or reverse and increase speed. With this setting, propeller will not develop as much thrust.

10-10 Emergency procedures

10-10.1 General. The two most dangerous situations for small boats are to have a fire onboard or accidentally run aground under power. This assumes that good judgment and knowledge of weather and sea conditions would preclude being capsized or swamped in heavy seas.

10-10.2 Fire prevention. The best firefighting technique on the workboat is to prevent a fire from starting. This requires strict compliance with preventive measures such as:

a. Keep engine compartment clean and free of debris, rags, oil, and fuel spills.
b. Keep bilges dean and pumped out.
c. Clean any fuel oil or lubricating oil spills immediately.
d. No smoking in cabin.
e. Keep fuel lines and filters tight to preclude seepage and leaks.

10-10.3 Firefighting techniques

a. Send a distress signal via radio, flares, or horn.
b. Make sure all persons onboard are wearing their lifevests.
c. Since wind created by boat's movement may fan the fire or blow away firefighting chemicals, bring boat to a standstill if sea conditions permit.
d. Smother engine fires by leaving engine hatch tightly closed. Use firefighting chemicals through air intakes on each side or smother fire by dosing air intakes. Use blankets, tarps, cushions, etc., to completely dose air intakes.

NOTE

Portable, dry powder fire extinguisher onboard (10 pound capacity) is effective against fires Involving fuel oil, electrical wiring and equipment, and plastics.

e. Carry extinguisher to upwind side of fire, if possible. Pull safety pin, aim nozzle at base of fire, preferably on upwind side, and pull trigger. If chemical is to be effective, it must not be blown away by the wind.

f. After extinguishing fire, examine onboard electrical and mechanical systems for possible damage. If towing is necessary, tow according to paragraph 10-11.2.

10-10.4 Running aground prevention. Before maneuvering or operating in an area, study charts and know depths and possible underwater obstacles. In unknown waters, use depthfinder and proceed at idle speed with forward lookouts. If possible, leave outboard trim switch in TRIM range so reverse can be engaged to stop and prevent grounding or striking underwater obstacles.

10-10.5 Recovery procedures when aground

a. Send a distress signal via radio, flares, or horn.
b. Make sure all persons onboard are wearing lifevests.
c. Check for possible persons overboard. Begin rescue operations.
d. Check for possible personal injury due to sudden stop. Render first aid if necessary. If radio contact is available, notify rescuing effort of personal injuries.
e. Check hull around outboard drive for cracks, splits, bent metal, and leaks. Check both outside of hull and inside engine compartment.
f. If possible, raise outboard drive and examine casing for cracks, and bent or broken metal. Check propeller for bent or broken blades. If possible, lower outboard drive and check if operational.
g. Check other portions of hull for damage and leaks.
h. Make sure bilge pumps are ON.
i. If hull does not leak and engine/outboard drive operates, attempt to back off grounding. If this is possible, check for leaks as boat comes dear of grounding.

WARNING

Workboat has flotation foam in forward compartment, under cabin floor, and on outside of engine compartment However, this has not been tested and may not be sufficient to prevent boat from sinking.

j. Plug and control leaks in the hull. Use cushions, blankets, jackets, or other material to plug holes or cracks.

10-11 Operations under unusual conditions

10-11.1 General. Several unusual conditions may occur in small craft operations. Towing another boat or being towed by another boat are most common.

10-11.2 Being towed by another boat

a. Discuss towing procedures with operator of the towing boat and establish a communications system, preferably two-way voice radio, between boats.
b. If possible, make a towing bridle by using heavy line at least 30 feet long. Fashion a loop in the middle and fasten each end to one of the forward bitts. Attach bridle to bitts so that it can be quickly and easily disconnected. Secure towing line to loop in middle of this emergency towing bridle.

CAUTION

Make sure towing bridle and line do not become entangled In propeller of towing boat

c. If possible, raise outboard drive to maximum UP position during towing.
d. Before towing starts, prepare a sea anchor to use as a brake to control forward movement of towed boat.

WARNING

Keep decks clear in case towing line breaks. Such lines are extremely dangerous if they break under tow.

CAUTION

Tow at very low speed.

e. Do not allow towing boat to tow workboat to dock or to barge. Terminate tow away from dock or barge. Final maneuvering should be done with handlines and/or pushing and nudging boat into position.

10-11.3 Towing another boat

a. Discuss towing procedures with operator of towed boat and establish a communications system, preferably two-way voice radio, between boats.
b. Make a towing bridle by using heavy line at least 30 feet long. Make a loop in the middle and fasten each end to one of the stem bitts. Attach bridle to bitts so that it can be quickly and easily disconnected. Secure towing line to loop in middle of this emergency towing bridle.

CAUTION

Make sure towing bridle and line do not become entangled in propeller of towing boat

c. Make sure towed boat does not overrun towing boat. Prevent this by using a sea anchor on towed boat or using a tow-line sufficiently long to allow water friction to stop towed boat before it overruns the towing boat.

WARNING

Keep decks clear in case towing line breaks. Such lines are extremely dangerous If they break under tow.

CAUTION

Tow at a very low speed.

d. Do not try to tow disabled boat to dock Cast off with plenty of maneuvering room. Work disabled boat to dock with handlines or nudging with workboat pushknees.

10-12 Shutdown procedures

a. Come along starboard side of barge. Keep workboat drive in neutral and idle the engine.

CAUTION

If workboat Is tied to other than barge and In shallow water where depth may vary due to tides, tilt outboard drive to fill UP position.

b. Secure workboat to barge with sufficient bumpers and four lines; i.e., bow, stem, and two springlines.
c. Unload passengers and cargo.
d. Turn off radio by turning OFF/VOLUME control counterclockwise until it dicks OFF. Turn radio off before turning off master switch.
e. When engine has been idling for at least 2 minutes, stop engine by turning ignition switch to R.
f. Make sure engine compartment hatch is secured in place.
g. Attach grounding wire from barge to workboat, making sure clamp has a good contact on a metallic part of the workboat

WARNING

During fueling operations, neither open flame nor smoking is permitted within 10 feet of fueling operation. Only minimum number of persons necessary to conduct fueling are permitted In area.

h. Using special Perko wrench or large screwdriver, open fuel filler cap in deck on port side aft of cabin.
i. While monitoring fuel gauge on operator's dashboard, fill workboat fuel tank from barge fueling station. Do NOT fill workboat fuel tank completely full. Leave room for expansion of cool fuel coming from voids storage tanks into warmer workboat fuel tank.
j. Secure fueling station hose and equipment.
k. Close workboat fuel filler cap.
l. Remove grounding wire from workboat and reattach to fueling station.
m. Make every effort to prevent fuel oil spills and dean any spills immediately.

CAUTION

Never turn master switch off until engine has stopped.

n. Turn master switch OFF.
o. If necessary, move messenger line reel unit as far forward as possible. Pull pins on sliding tracks on each side of unit, shove unit forward, and replace pins.
p. Use engine hatch tool (stored under operator's seat) to turn closure nuts on each comer one-half turn and slowly open engine compartment (aft deck closure). Escaping air may indicate that water is entering the engine compartment and forcing the air out.
q. Check compartment to make sure there is no leakage of fuel oil, lubricating oil, hydraulic fluid, or water. Tighten filters and fittings or take other corrective action as necessary.
r. Check oil level. Dipstick is on top of engine between branches of intake manifold (Figure 10-6). Oil level should be between marks on the stick. Fill with oil, when necessary, through oil filler cap on top of the engine. Use diesel lubricating oil CD (MIL-L-2104), SAE 20W30, above 50°F and oil CD, SAE 10W, below 50°F.
s. Do NOT attempt to check coolant levels at this time.

t. Close engine hatch and secure by turning closure nuts on each comer one-half turn and return engine hatch tool to storage under operator's seat cushion.

u. Before leaving boat, make sure bilge pump switch is in AUTO and all loose items have been stowed or secured.

10-13 Deployment and recovery

10-13.1 General. During storage and movement of the barge, workboat is normally carried in a specially constructed cradle on forward section of deckhouse top and covered with a tarpaulin. The workboat is secured in the cradle by three tiedown straps on each side of the cradle. These straps hook into three eyelets on each side of the workboat and are pulled tight with a crank and ratchet set on the side of the cradle. For long overseas movement, these tiedown straps may be supplemented with four steel turnbuckles, one on each comer of the workboat. These are attached to eyelets welded to the deckhouse top and into special fittings on the workboat forward knees and the stem bitts.

10-13.2 Bow crane. A hydraulic crane mounted on the bow weatherdeck moves the workboat in and out of the water. When not in daily use, place it in its traveling configuration as shown in Figure 10-8. Operation, maintenance and use of the bow crane is described in TM 55-1930-209-14&P-13. The bow crane, when being used to move the workboat, has several operating restrictions:

WARNINGS

- **Never use the crane for moving the workboat when the barge is rolling 50 or more.**
- **Always use the shortest possible boom reach that will provide a safe clearance of all obstacles.**
- **Never use a boom extension of more than 35 feet 7 Inches for moving the workboat.**

10-13.3 Operating controls. The bow crane movement controls are on the forward side of the deckhouse top and the hydraulic power system controls are in void 1. Crane movement controls consist of five control levers (Figures 10-9 and 10-10), control valve system, hoses, and associated connecting hardware. The control valve system is factory sealed and is especially designed for use in a marine environment. It has a built-in pressure relief valve, which prevents damage to the crane from overloading; a suction valve, which ensures a continuous flow of hydraulic fluid; and a constant flow valve, which regulates and maintains the required system hydraulic pressure.

10-13.4 Prestart procedures

a. Check barge maintenance log on bow crane and its hydraulic system. Make sure there are no discrepancies that would prohibit operating the bow crane.

b. Make sure switchboard circuit breaker P16 is ON.

CAUTION

Due to high pressure In hydraulic system, crane can NOT be operated with any visible leaks. These must be repaired prior to use. Leaks In flexible hose, hardpiping, or Joints must be corrected. Do not confuse seepage around hydraulic packing on actuator arms with leaks. A small amount of such seepage is acceptable.

c. In void 1, visually inspect hydraulic pump and motor and hard piping of crane hydraulic system for leaks or damage. Do not use system until such leaks have been repaired.

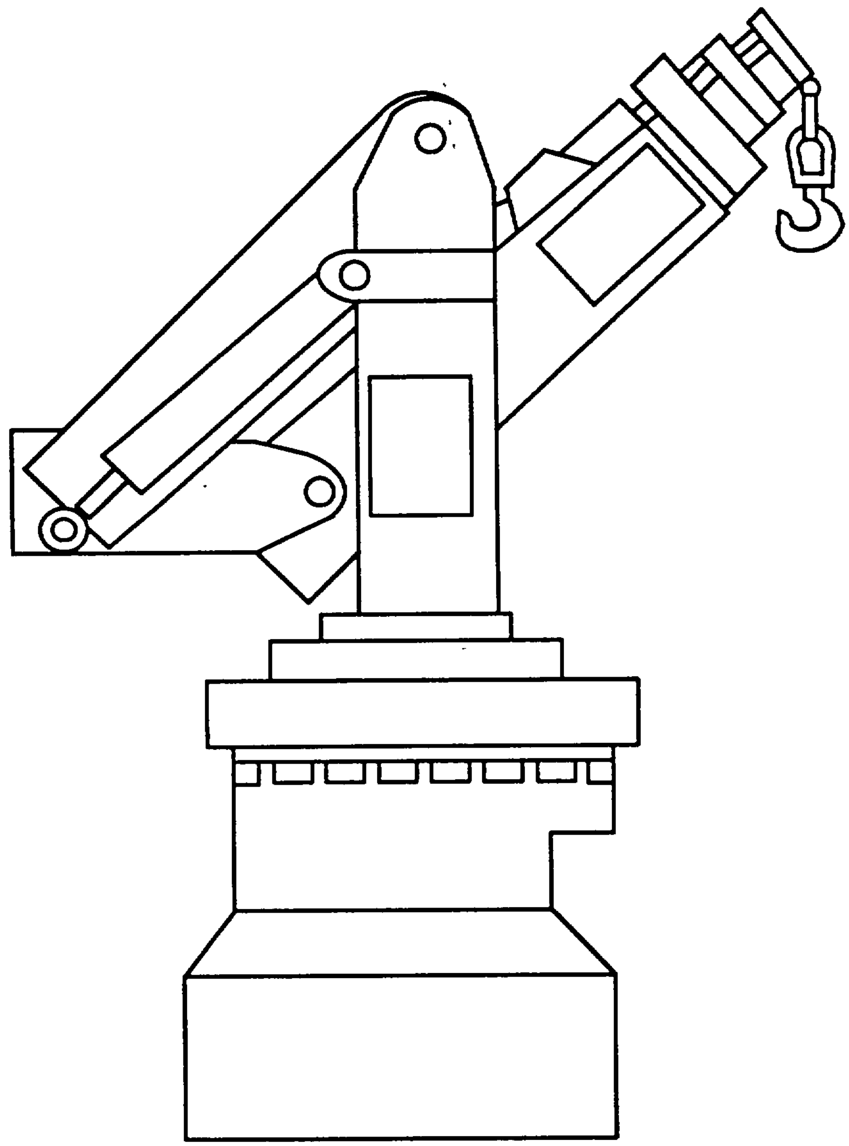


Figure 10-8. Bow Crane In Traveling (Stowed) Configuration

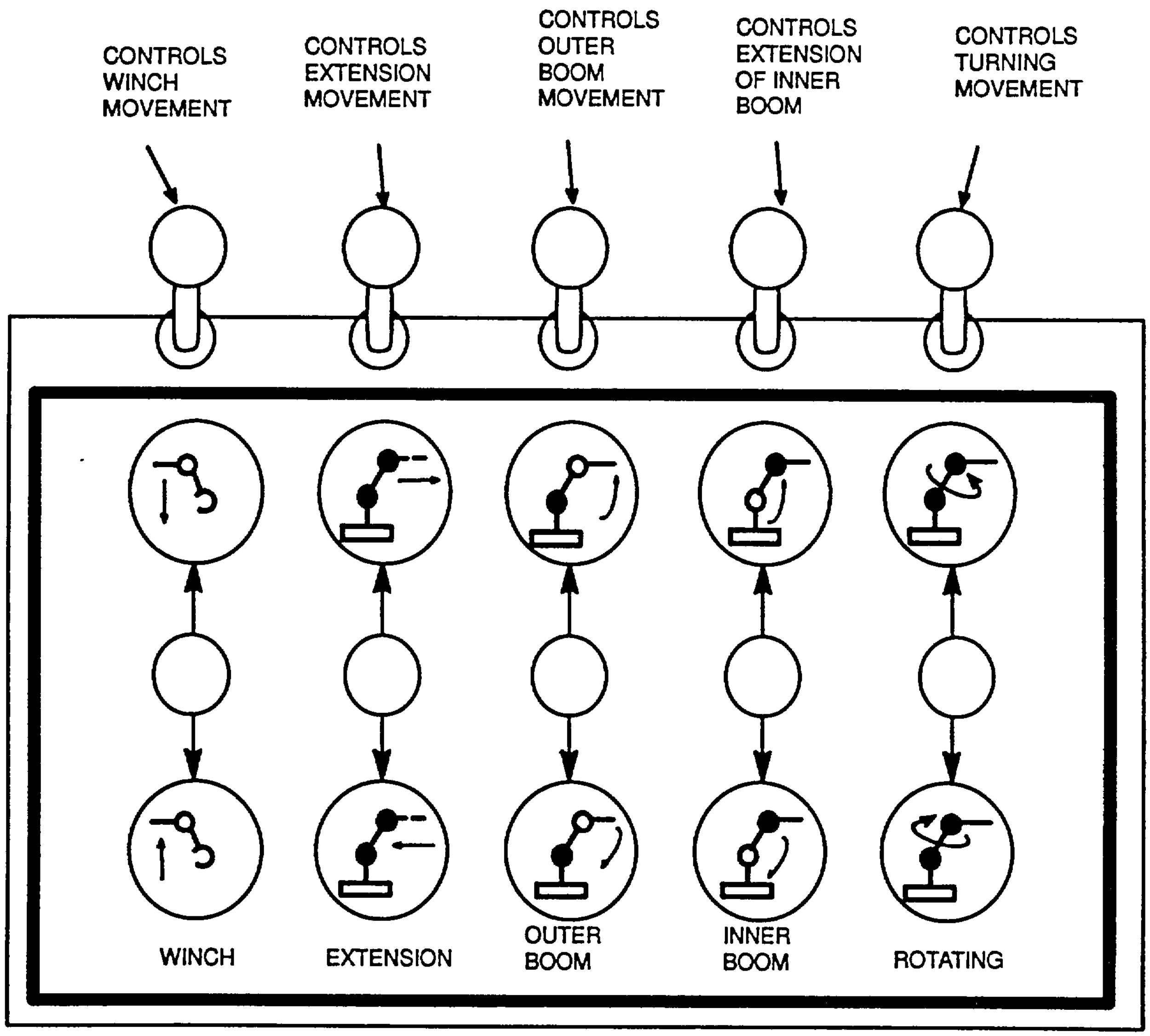


Figure 10-9. Bow Crane Control Panel (Barge 1)

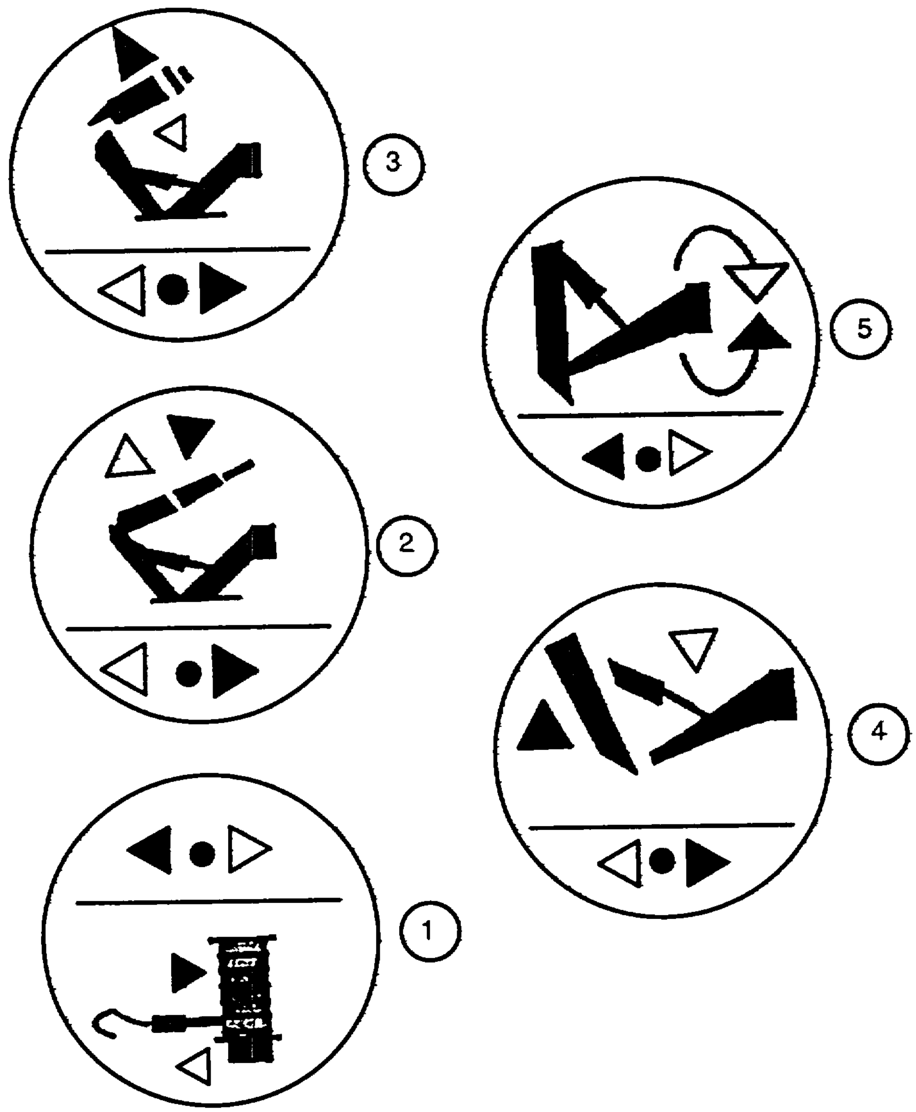


Figure 10-10. Bow Crane Control Panel (Barges 2 and 3)

d. Remove filler cap on hydraulic tank and make sure level is within 1 inch of bottom of filler neck. If below this level, add hydraulic fluid before using crane. Be sure this cap is screwed on tight before starting hydraulic pump.
e. In void 1, push up on top switch on hydraulic pump controller (aft bulkhead) and set side switch to AUTO position.
f. On forward weatherdeck, visually check exposed hardpiping and flexible hydraulic lines for cracks or leaks. Check crane base to ensure it is secure and make sure forward weatherdeck is dear of any material that might obstruct bow crane movement.
g. On deckhouse top, inside watertight control box, make sure anti-two block system is activated.
h. Inside watertight control box, push START button on START/STOP panel. High pitched whine of hydraulic pump will indicate crane is ready for use.
i. Using crane control sticks, deploy crane from traveling position. Extend all booms to their maximum length and slew crane around in at least one complete circle. During these movements, check for any change in pitch of the hydraulic pump noise and any jerky, sticking, or uneven movement of any part of the crane. If such symptoms are noted, check crane carefully before using. See TM 55-1930-209-14 & P-13 for details on crane maintenance.

10-13.5 Procedures for deploying workboat

WARNING

Crewmembers, crane, and workboat must never touch VHF/FM antenna mounted outboard of starboard railing. Antenna may contain high voltage that will seriously Injure personnel.

a. Move crane to position hook over center of workboat in its cradle on deckhouse top.
b. On workboat, make sure two seawater drain plugs on bottom of hull are installed with properly fitting gaskets and are tight.
c. Take boat lifting harness from storage in cabin and attach to three lifting points on workboat; two eyes on bottom of stem mooring bitts and one eye under cabin floor. Open aft cabin top hatch to allow front lifting harness to reach crane hook without damaging cabin top.
d. Place lifting harness ring in crane winch hook and use crane winch to take up slack in harness.

CAUTION

Non-Commissioned-Officer-in-Charge (NCOIC) must supervise crane operator and crewmembers on control lines to control boat movement. Crane operator cannot see all portions of workboat when it is being moved. To control crane movement, NCOIC uses hand signals (Figure 10-11) or walkie-talkies to give directions to crane operator.

e. Attach at least two control lines to boat to prevent swinging, twisting, and yawing when crane lifts boat from cradle.

f. Check crane winch hook and harness alignment to make sure it will lift boat vertically.

g. When ready, release tension on three tiedown straps (Figure 10-12) on each side of cradle and station crewmembers on control lines. Using crane winch, lift boat about 6 inches vertically from cradle.

h. If all is under control, unhook three tie-down straps on each side of cradle.

i. Lift boat vertically to dear all items on deckhouse top and slew crane in a counterclockwise direction to move boat over starboard side. Keep control lines tight (Figure 10-13).

j. Keep control lines tight to control boat during movement.

WARNING

In moving workboat with crane, workboat and crane must never pass over crane operator or other crewmembers.

k. Slowly lower boat into water, keeping harness taut to maintain control of boat until tielines secure the workboat to the barge.
l. When boat is secure, lower crane winch hook. Remove lifting harness ring from hook and from three eyes on workboat. Stow harness under port passenger seat in workboat cabin. Free control lines and stow with lifting harness.

10-13.6 Bow crane shutdown procedures

CAUTION

To avoid damage to bow crane and its hydraulic control system, crane must always be returned to Its folded position for storage and travel.

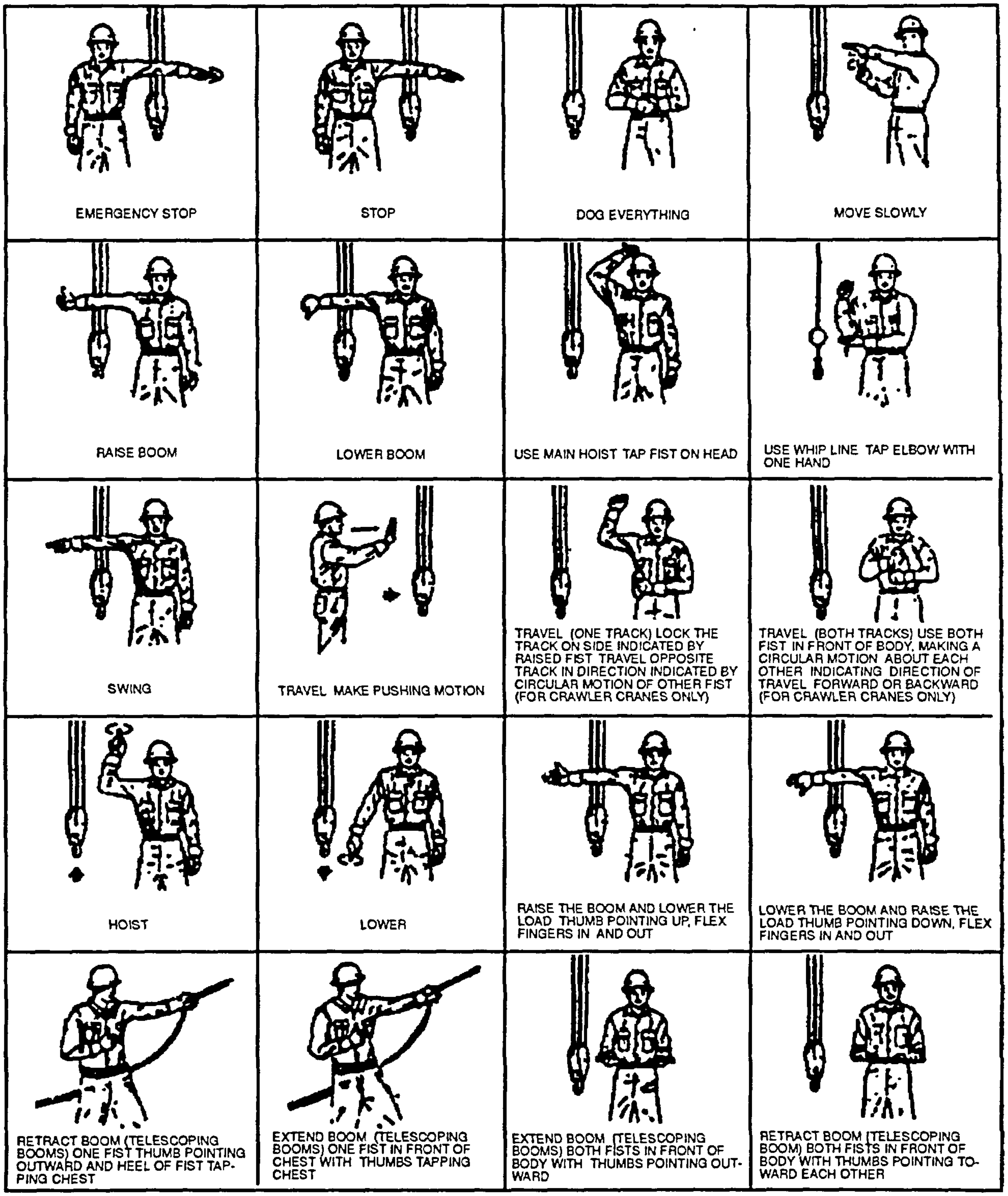
a. Draw back extension boom to its innermost position.
b. Fold outer boom in position under inner boom.
c. Swing lower boom into pedestal tunnel and pull up until pulley wheel touches pedestal.
d. In watertight control box, press STOP button on START/STOP panel. Close and secure box.
e. In void 1, on hydraulic pump controller, turn side switch OFF and pull top switch down.

NOTE

If bow crane must be left In unfolded position, apply a light coat of grease or hydraulic fluid to all exposed chromium-plated parts of crane hydraulic cylinder system. This coating must then be wiped clean before using the crane. If crane must be left In this position, it must be exercised daily.

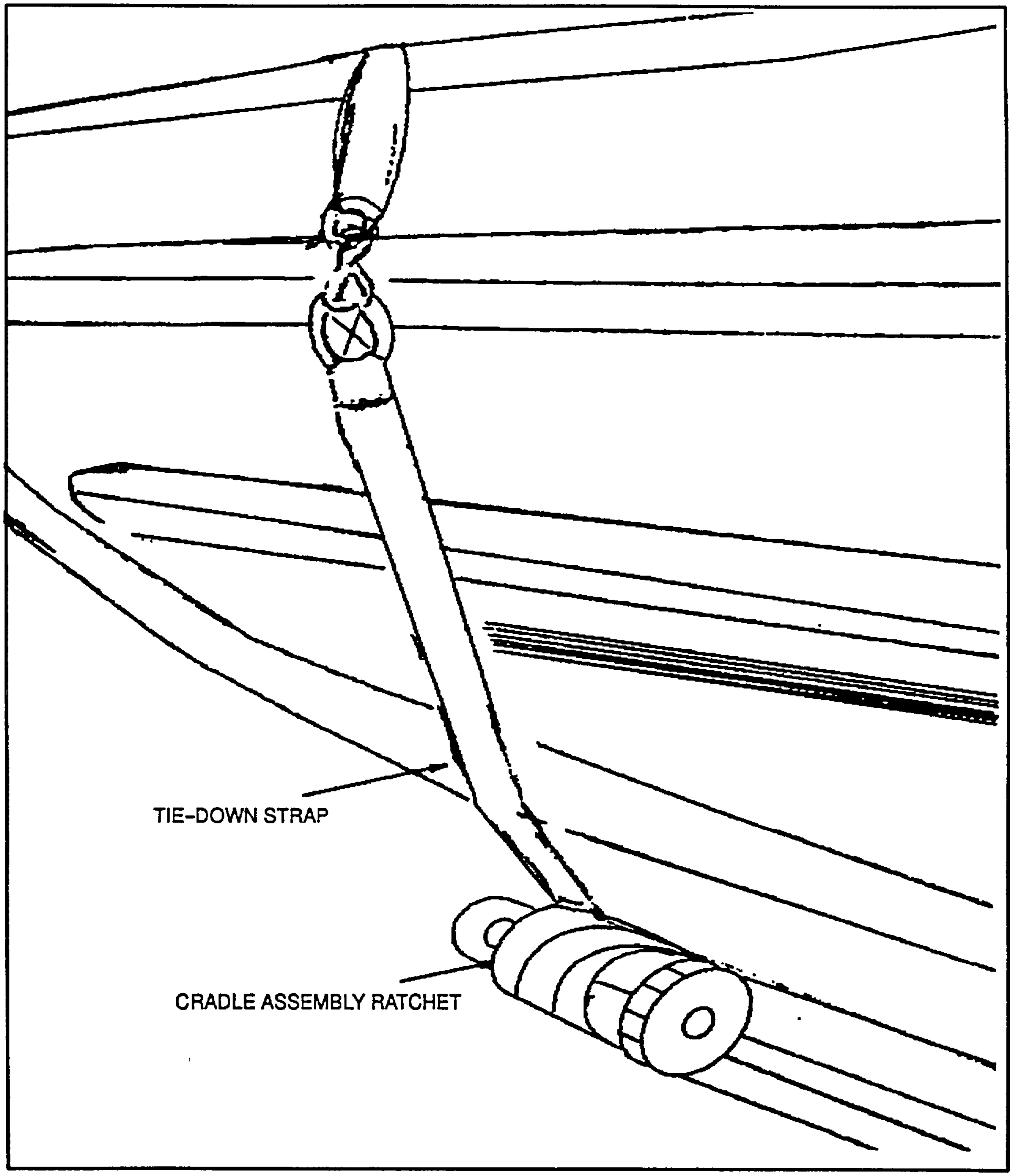
10-13.7 Workboat recovery procedures

a. Recovery of workboat is essentially the reverse of deployment procedures provided above.
b. Prior to starting recovery, perform all after operation checks and inspections on the workboat as discussed in paragraph 10-12 and complete any scheduled maintenance services as discussed in TM 55-1930-209-14&P-17.
c. Raise outboard drive to full UP (TILT) position.
d. Fold radio antenna, spotlight, and anchor light mast down flat with cabin top.
e. When boat is in its cradle and the three tiedown straps on each side have been fastened to boat and pulled tight, remove two seawater drain plugs and store them under operator's seat in the cabin.
f. Remove marine radio and depthfinder and store in barge dayroom. Turn spotlight face down toward cabin roof. Store diving ladder and life ring buoy with rope and light in cabin. Secure cabin.



NOTE: USE ARMY STANDARD HAND SIGNALS TO DIRECT CRANE OPERATOR IN MOVEMENT OF CRANE AND WORKBOAT.

Figure 10-11. Standard Military Hand Signals for Controlling Cranes



THREE TIE-DOWN STRAPS ON EACH SIDE OF WORKBOAT CRADLE ATTACH TO THREE EYES ON EACH SIDE OF WORKBOAT. AFTER ATTACHING TO WORKBOAT, TIGHTEN RATCHET WITH A TURNING BAR.

Figure 10-12. Workboat Cradle Tie-Down with Ratchet

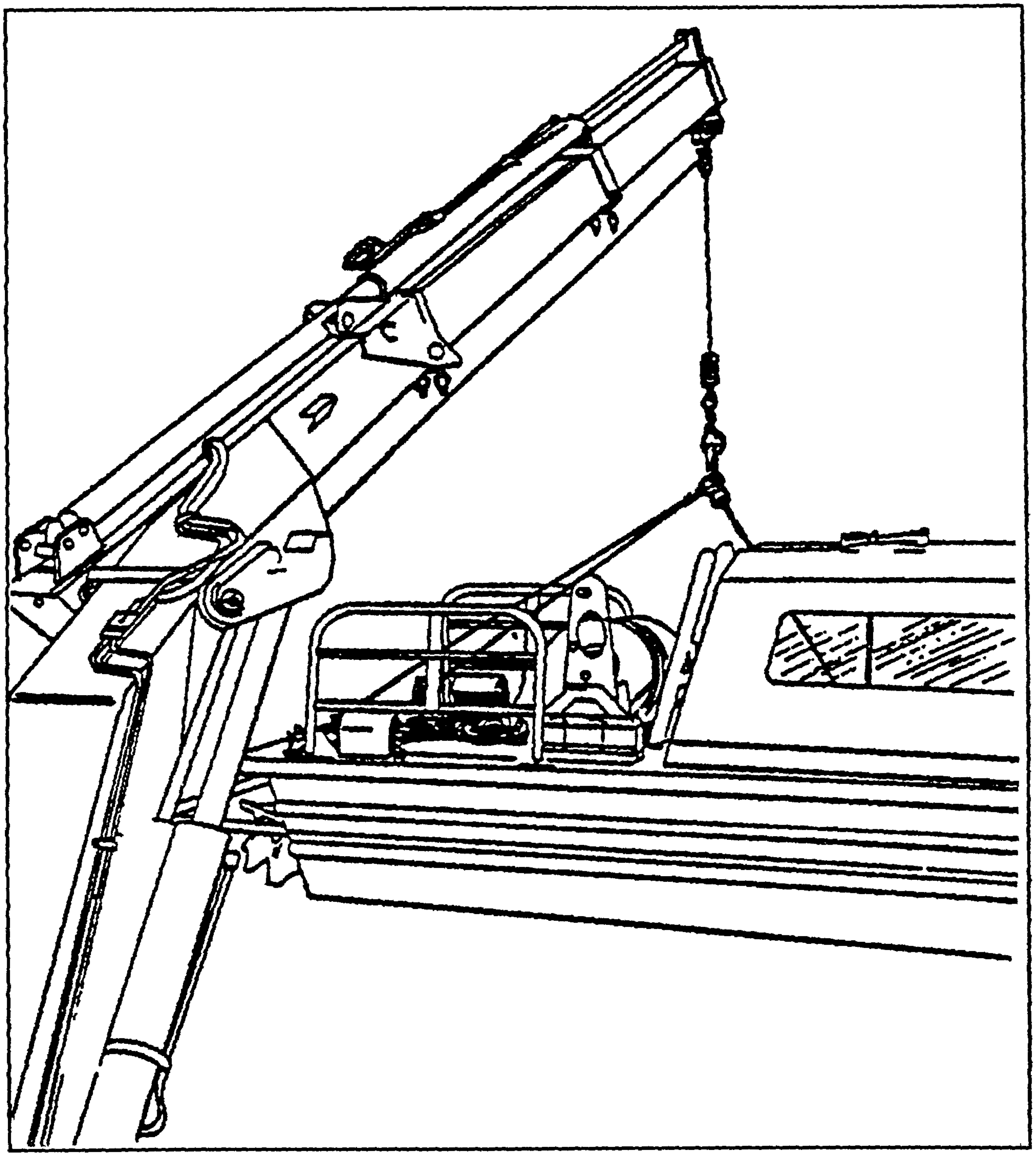


Figure 10-13. Bow Crane Lifts Workboat with Three-Point Suspension Harness

10-14 Operations under extreme conditions

10-14.1 Operations In extreme heat. This boat has been designed with oversize engine compartment vents to provide sufficient airflow for operations in tropical conditions. In temperatures above 50°F, use diesel lubricating oil CD (MIL-L-2104), SAE 20W30, for engine and outboard drive. Other lubricating requirements do not change with changes in temperature or season.

10-14.2 Operations in high humidity conditions. High temperatures and high humidity combine to produce large amounts of condensation. Since diesel engines must have fuel free of water, precautions must be taken to prevent condensation creating water in the fuel system.

a. Refuel often and keep fuel tank as dose to full as possible. However, allow space for fuel expansion due to heat.
b. Do not allow boat to remain idle with a partially filled tank as this provides area for water condensation in the tank.
c. When operating continuously in these conditions, change fuel filters every 100 hours instead of the normal 200 hour interval.

10-14.3 Operations In extreme cold. It is not contemplated that barge and workboat will be deployed to locations with ambient temperatures below freezing. However, in temperatures below 50°F, follow these procedures:

a. Use diesel lubricating oil CD (MIL-L-2104), SAE 10W, for engine and outboard drive.
b. Make longer use of glow plug warmup prior to starting engine.
c. Take longer time to warm up engine before using power.

CHAPTER 11 SEAWATER SYSTEM

Section I. General

11-1 General. Seawater system supplies seawater to the ROWPU's for processing, to the air conditioning unit for cooling, to the ballast tank for barge trimming, to the chlorination unit for priming and cooling, and to the diesel generators for cooling.

11-2 Description

11-2.1 ROWPU and ballast seawater supply. This installation (Figure 11-1) consists of a forward seachest, two seawater strainers with pressure gauges, two seawater filters, two seawater pumps, ballast tank and associated piping, valves, and electrical circuitry. This arrangement supplies seawater to the ROWPU's for processing, to the ballast system for trimming, and to the chlorination unit. Information about major components is listed in Table 11-1. A block diagram is shown in Figure 11-2 Equipment specifications maintenance information and manufacturer's service manuals are contained In TM 55-1930-209-14&P-2.

11-2.2 Air conditioner cooling seawater and chlorination unit supply. This installation (Figure 11-3) consists of a seawater strainer with gauges, seawater filter, pressure regulator with gauge, cooling pump and associated piping, valves, and electrical circuitry. When seawater pumps are not operating, this arrangement can supply seawater to the air conditioning unit for cooling and to the chlorination unit for cooling and producing chlorine. Information about major components is listed in Table 11-2. A block diagram is shown in Figure 11-4.

11-2.3 Diesel engine generator seawater cooling. This installation (Figure 11-5) consists of an aft seachest, a seawater strainer, temperature gauges (on each generator set), associated piping, valves, and electrical circuitry. This arrangement supplies cooling seawater to diesel engine generator sets. Information about major components is in Table 11-3 Block diagrams are shown in Figures 11-6 and 11-7.

11-3 Seawater supply. The three seawater supply sources are: a forward seachest in void 2 starboard, a shell penetration in void 2 starboard, and an aft seachest in void 4 port. Seachest in void 2 starboard supplies sufficient seawater to ROWPU's for processing when barge is anchored in 15 or more feet of water. When anchored in 15 feet of water but not less than 10 feet, starboard shell intake can supply sufficient seawater to ROWPU's for processing. At all times, when barge is anchored or pierside, seachest in void 2 starboard can be used to supply seawater to the air conditioner and to the chlorination unit. The seachest In void 4 port also can be used to supply seawater for cooling the diesel generators whether the barge is anchored or pierside.

11-4 Special limitations. Seawater system should not be operated in rough sea conditions exceeding Sea State 3. ROWPU feedwater must be kept free of chlorine, detergents, oil, and other contaminants. Water must be deep enough to ensure sand and other foreign matter are not taken into the system with the seawater.

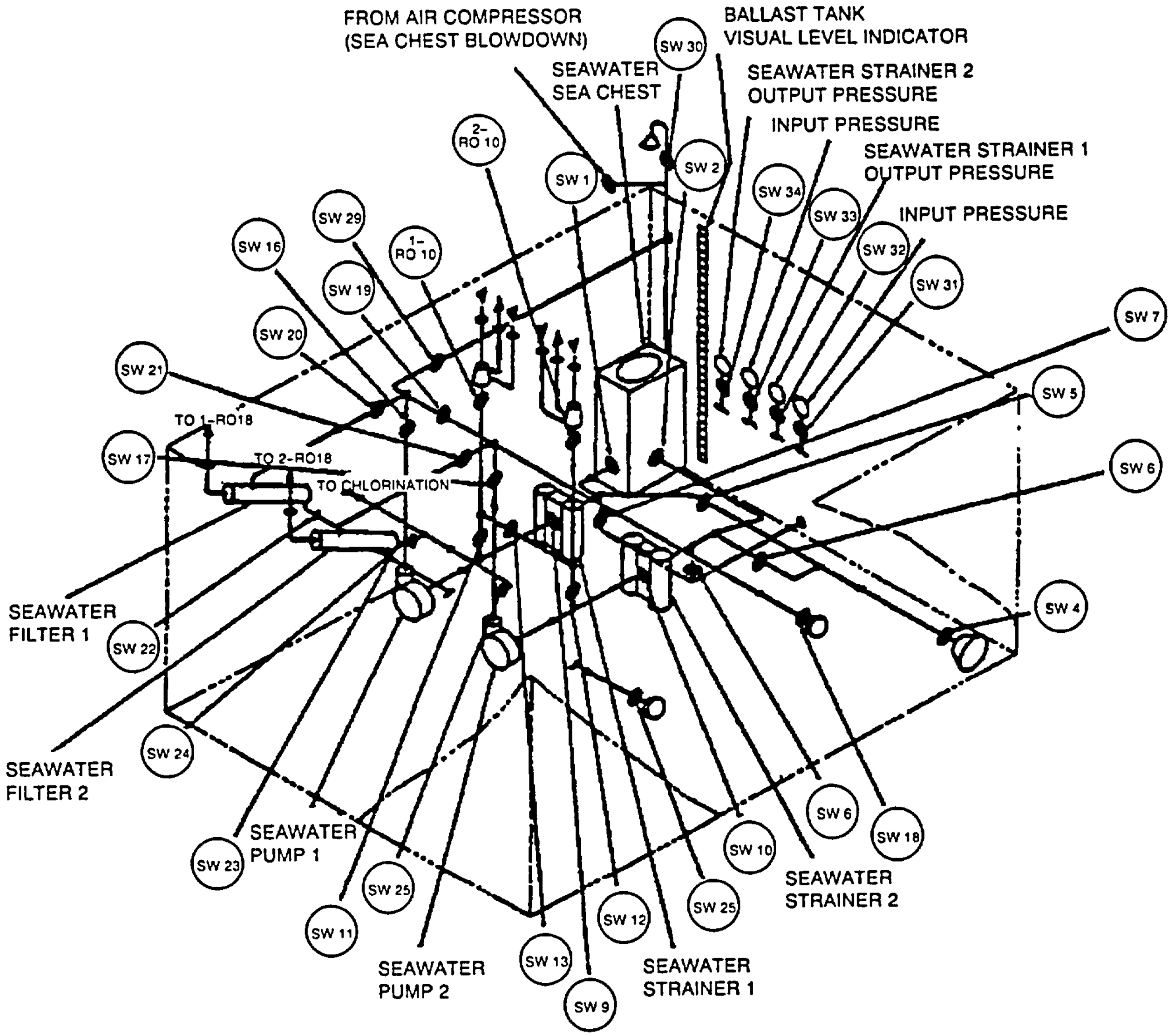


Figure 11-1. ROWPU and Ballast Seawater Supply

Table 11-1. Major Components of ROWPU and Ballast Seawater Supply

Component	Function	Location
Seachest	Supplies seawater for ROWPU processing, chlorination unit cooling and heating, and air conditioning unit cooling	Void 2 starboard
Seawater strainers 1 and 2	Remove foreign matter from seawater before water enters seawater pumps	Void 2 starboard
Seawater pumps 1 and 2	Draw seawater from seachest or shell penetration for processing in ROWPU's	Void 2 starboard
Seawater filters 1 and 2	Filter additional foreign matter from seawater before water enters ROWPU media filters	Void 2 starboard
Ballast tank barge	Stores seawater for trimming	Void 1
Ballast tank liquid level Indicator	Indicates seawater level in ballast tank	Void 2 starboard on forward bulkhead
Seawater pump OFF/ ON/START switches	For operation of seawater pumps	ROWPU space on ROWPU 1 and 2 control stations
Seawater pump local control switches	Provide local operation of seawater pumps	Void 2 starboard on centerline bulkhead near pumps
Strainer 1 inlet pressure gauge	Indicates pressure in strainer 1 input line	Void 2 starboard
Strainer 1 outlet pressure gauge	Indicates pressure in strainer 1 output line	Void 2 starboard
Strainer 2 inlet pressure gauge	Indicates pressure in strainer 2 input line	Void 2 starboard
Strainer 2 outlet pressure gauge	Indicates pressure in strainer 2 output line	Void 2 starboard

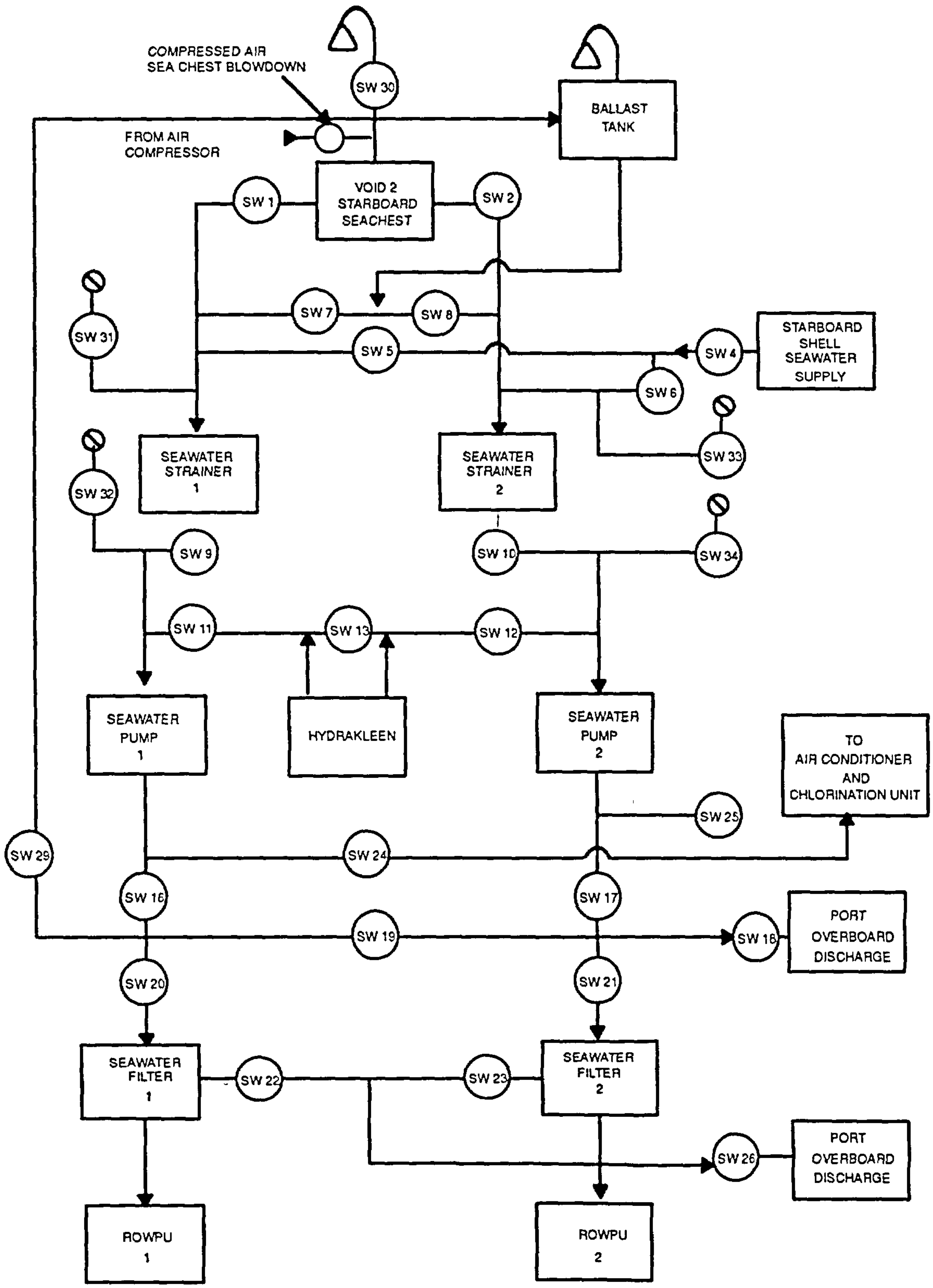


Figure 11-2. ROWPU and Ballast Seawater Supply Block Diagram

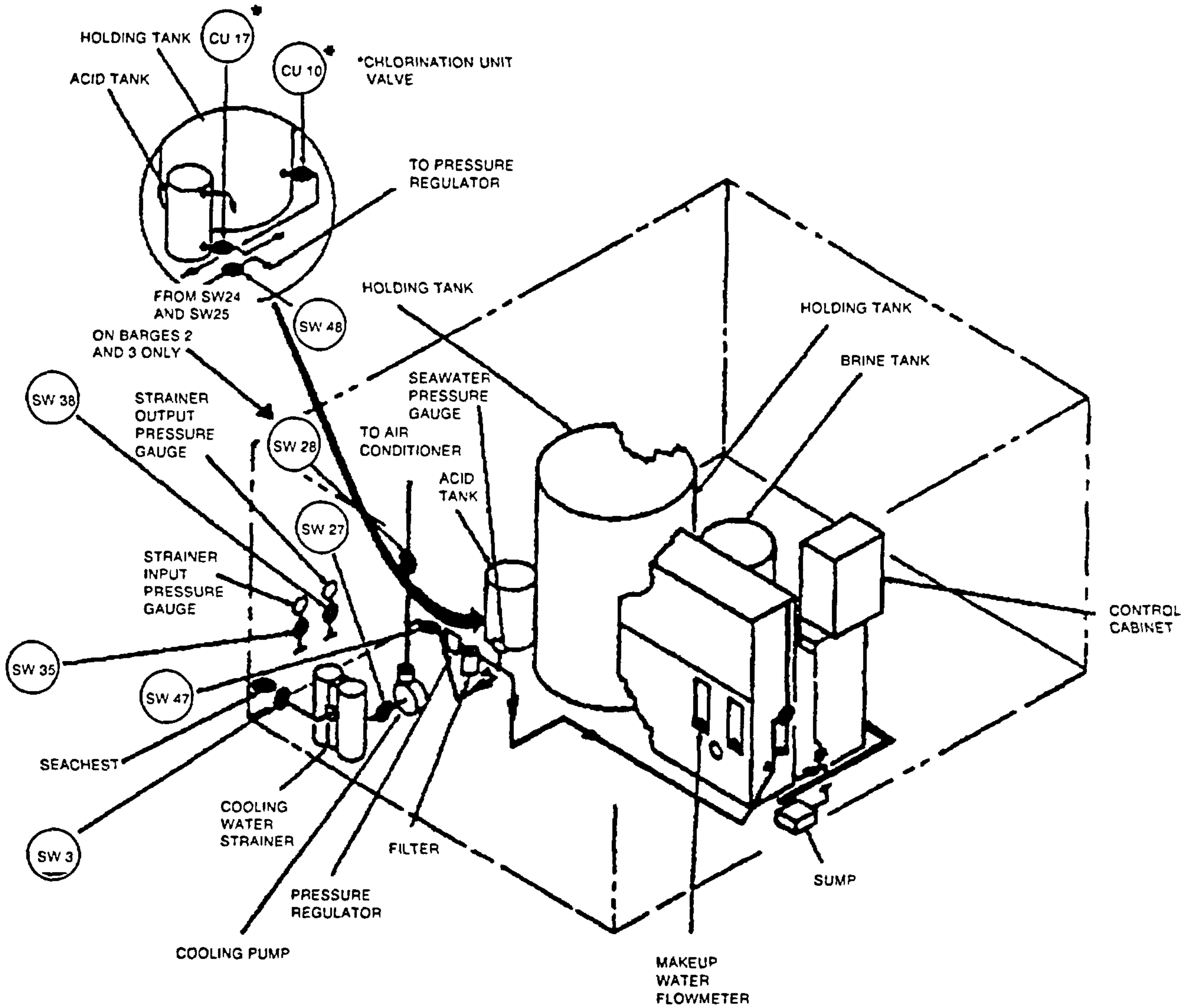


Figure 11-3. Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply

Table 11-2. Major Components of Air Conditioner Cooling Seawater and Chlorination Unit Seawater Supply

Component	Function	Location
Seawater strainer 3	Removes foreign matter from seawater before water enters air conditioning cooling pump	Void 2 port
Cooling pump	Draws seawater from seachest for cooling air conditioner and/or chlorination system	Void 2 port
Cooling pump motor controller	Allows manual operation of cooling pump	Void 2 port centerline bulkhead
Seawater pressure regulator	Controls pressure to chlorination unit	Void 2 port in seawater line
Seawater pressure gauge	Indicates seawater pressure to chlorination unit	Void 2 port in seawater line
Seawater filter 3	Filters seawater to chlorination unit	Void 2 port in seawater line
Strainer 3 inlet pressure gauge	Indicates pressure In strainer 3 input line	Void 2 port
Strainer 3 outlet pressure gauge	Indicates pressure in strainer 3 output line	Void 2 port

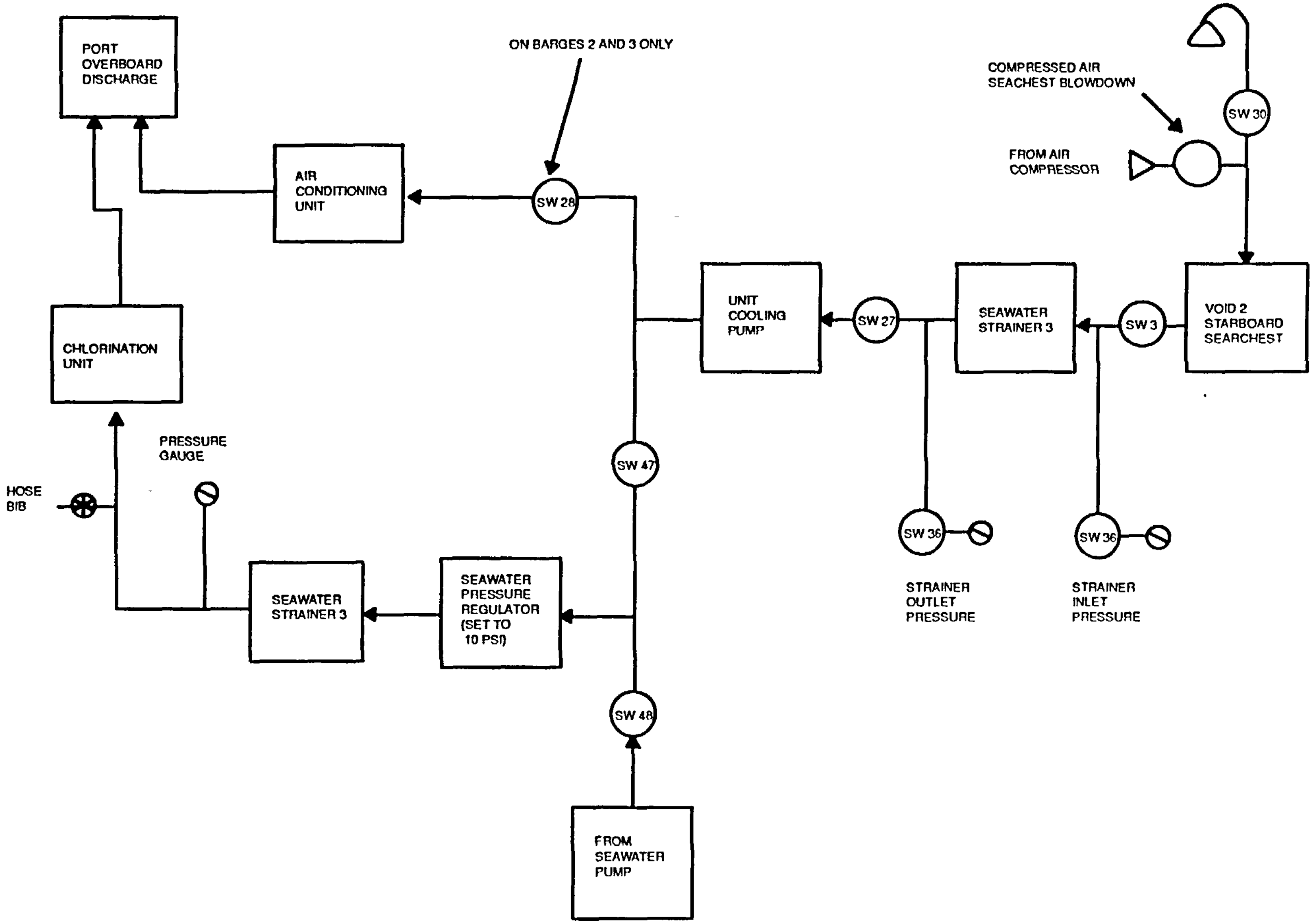


Figure 11-4. Air Conditioner and Chlorination Seawater Cooling Block Diagram

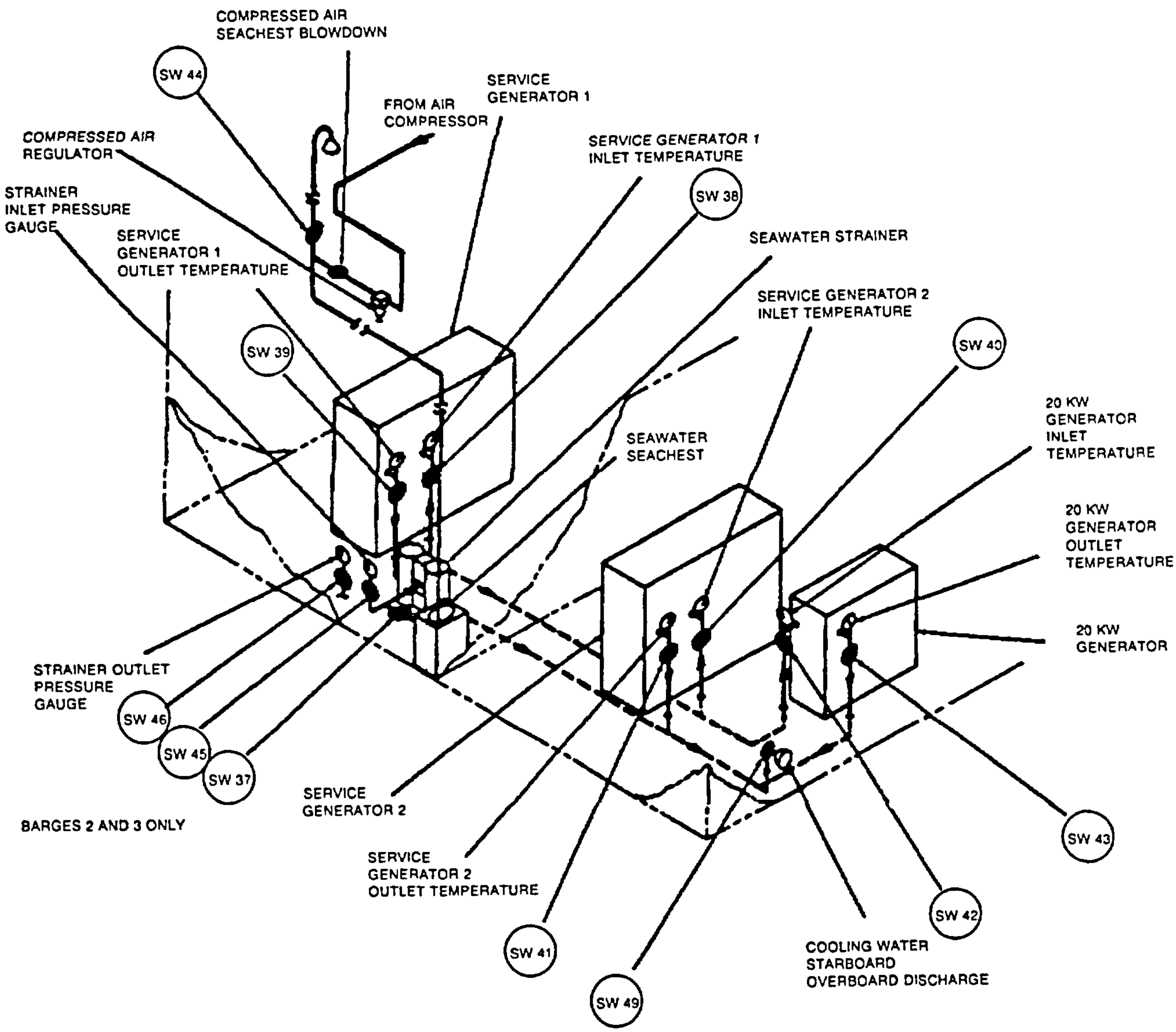


Figure 11-5. Diesel Engine Generator Cooling Seawater

Table 11-3. Major Components of Diesel Engine Generator Cooling Seawater

Component	Function	Location
Seachest	Supplies seawater for generator unit cooling	Void 4 port
Generator cooling strainer	Removes foreign matter from seawater before water enters generator cooling pump	Void 4 port
Cooling strainer inlet pressure gauge (Barges 2 and 3 only)	Indicates pressure in strainer input line	Void 4 port
Cooling strainer outlet pressure gauge (Barges 2 and 3 only)	Indicates pressure in strainer output line	Void 4 port
Inlet temperature gauge	Indicates temperature of cooling water entering each generator set	1 in void 4 port and 2 in void 4 starboard (one on each generator set)
Outlet temperature gauge	Indicates temperature of cooling water leaving each generator set	1 in void 4 port and 2 in void 4 starboard (one on each generator set except for the auxiliary generator on Barge 1)

Section II. Description of operation

11-5 ROWPU seawater supply. When barge is deployed in deep water (15 feet or more), seawater is obtained from the void 2 starboard seachest. When barge is deployed in shallow water (less than 15 but more than 10 feet), seawater is taken in through the void 2 starboard shell penetration. The seawater pumps draw the seawater through a strainer to remove foreign matter, and discharge the water through a seawater filter where additional foreign matter is removed. This filtered water then flows to the ROWPU's for processing.

11-6 Ballast seawater supply. Ballast seawater is used for altering the trim of the barge before discharging drinking water to shore or before towing. When barge is to be trimmed, seawater is drawn from void 2 starboard seachest or void 2 starboard shell penetration by seawater pump(s) and discharged into the ballast tank until desired trim is established. When ballast tank is to be drained, seawater is drawn from the tank by seawater pump(s) and discharged directly overboard through the overboard discharge in void 2 starboard.

11-7 Air conditioning unit seawater supply. When air conditioning unit is operating, a cooling pump draws seawater, through a strainer, from void 2 starboard seachest. Seawater is then discharged to air conditioning unit to cool the unit. After circulating through unit, the heated seawater is discharged directly overboard through overboard discharge in void 1 port.

11-8 Chlorination unit seawater supply. When ROWPU's are operating, seawater pumps supply strained seawater to the chlorination unit. When ROWPU's are not operating, strained seawater is supplied by the cooling pump. This seawater is used for priming the chlorination unit, for producing sodium hypochlorite, and for cooling. After circulating through the unit, the heated seawater is discharged directly overboard through the overboard discharge in void 1 port.

11-9 Diesel generators seawater supply. When any of the three diesel generators in voids 4 port and starboard operate, cooling seawater is obtained from seachest in void 4 port. Seawater is drawn by a generator internal cooling pump through the generator cooling strainer before entering the pump. After circulating through the generators, the heated seawater is discharged directly through the overboard discharge in void 4 starboard.

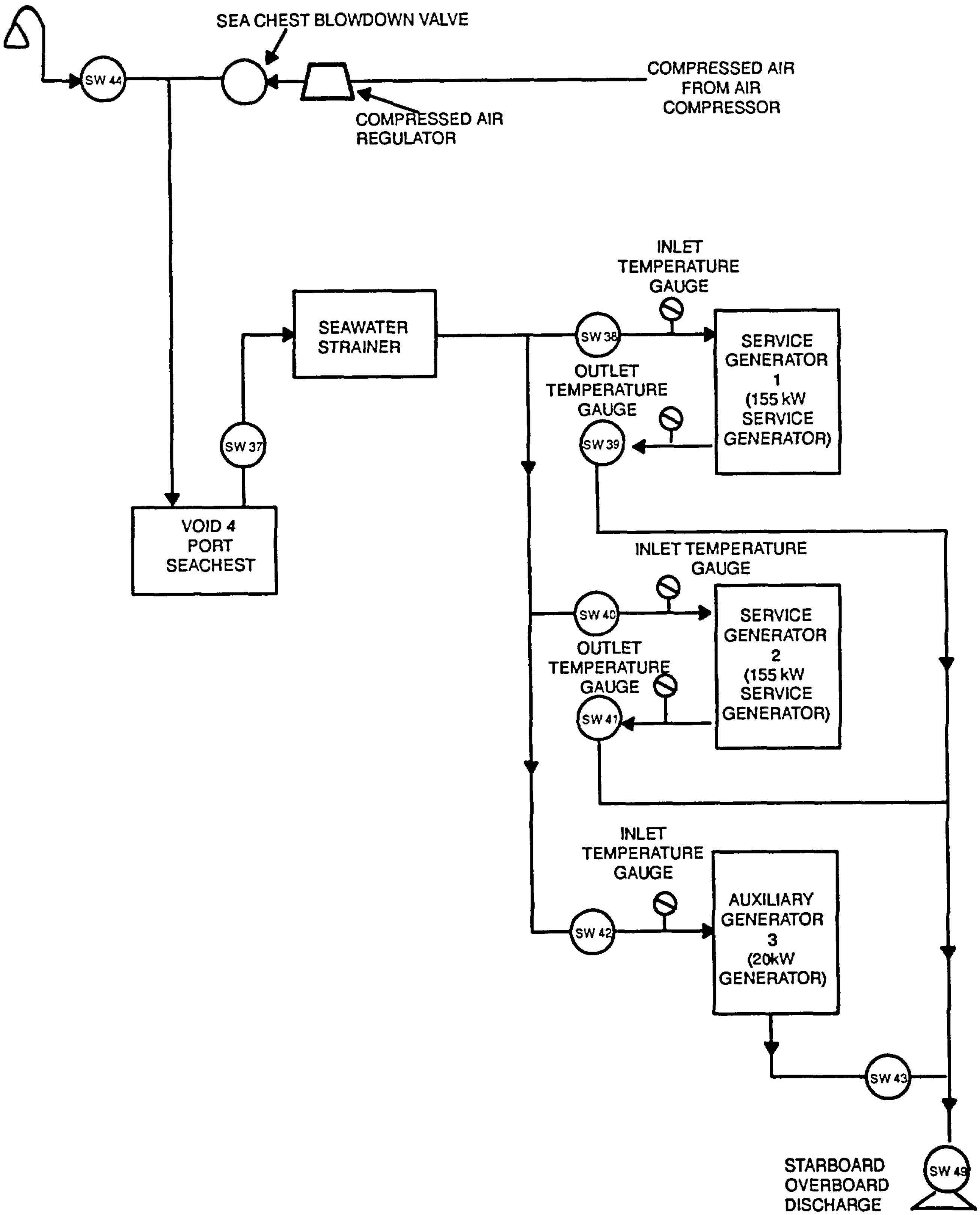


Figure 11-6. Diesel Engine Generator Cooling Seawater Block Diagram (Barge 1)

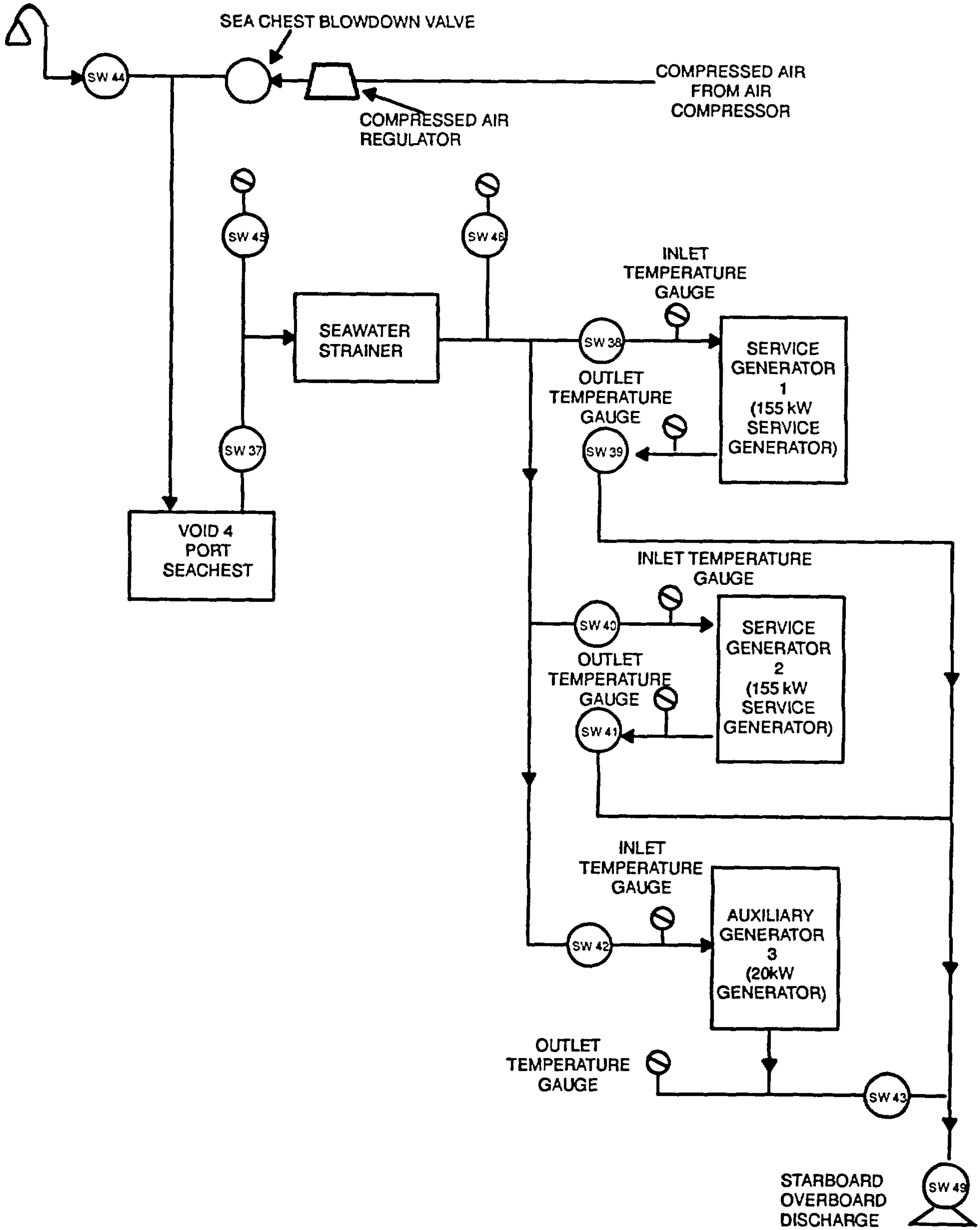


Figure 11-7. Diesel Engine Generator Cooling Seawater Block Diagram (Barges 2 and 3)

Section III. Operating instructions

11-10 Operating controls and Indicators. Operating controls and indicators are listed in Table 11-4 and shown in Figures 11-8 thru 11-10. Information on ROWPU and ballast seawater supply valves is in Table 11-5. Location of valves is shown in Figure 11-11. Information on air conditioning and chlorination cooling flow valves is in Table 11-5. Location of these valves is shown in Figure 11-3. Information on generator cooling flow valves is in Table 11-5. Location of these valves is shown in Figure 11-5.

11-11 Prestart procedures

a. Wipe components clean, especially gauges and control panels.
b. Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report leaks to shift leader so corrective action can be taken.
c. Check for damage especially to pressure gauges, filters, and control panels.
d. Check for loose or missing securements and fasteners. Tighten or replace as necessary.
e. Check wiring for loose connections and frayed cables. Secure as necessary. Repair or replace damaged cables.
f. Check if seawater strainer baskets are dean and properly installed.
g. Provide power to ROWPU 1 and 2 control stations by dosing (ON) switchboard circuit breakers P6 and P7.
h. Provide power to cooling pump controller by dosing (ON) power panel 1 circuit breaker 1 P5.

11-12 Normal and alternate operating procedures

WARNING

Do not open seachest valves SW1, SW2, or SW3 unless valve SW30 is open to vent seachest to the atmosphere.

CAUTION

Seawater being supplied to ROWPU's must not be contaminated with oil, detergents, chlorine, or other foreign matter. Contaminated seawater could damage ROWPU membranes.

Water below barge seachests must be deep enough to make sure sand and other foreign matter are not sucked Into the system with the seawater.

NOTE

Deep water Is defined as water 15 feet deep or more. Shallow water is defined as water less than 15 feet deep.

a. Supplying seawater to ROWPU's is covered in paragraphs 11-12.1 and 11-12.2.
b. Supplying seawater to chlorination and air conditioning units is covered in paragraphs 11-12.3 and 11-12.4.
c. Supplying seawater for filling and draining ballast tank is covered in paragraphs 11-12.5 and 11-12.6.
d. Supplying seawater for cooling diesel engine generators is covered in paragraph 11-12.7.
e. Seachest blowdown is covered in paragraph 11-12.8.

Table 11-4. Operating Controls and Indicators

Component /Indicator	Figure	Location
Seawater pressure regulator	11-3	Void 2 port- near air conditioning pump
Seawater pressure gauge	11-3	Void 2 port - near cooling pump
Cooling pump motor controller	11-8	Void 2 port - starboard bulkhead
Seawater pumps 1 and 2 OFF/ON/START switches	11-8 control stations	ROWPU space - ROWPU 1 and 2
Seawater pumps I and 2 START/ STOP control switches	11-8	Void 2 starboard - centerline bulkhead
Ballast tank liquid level indicator	11-10	Void 2 starboard - forward bulkhead
Strainer 1 inlet pressure gauge	11-1	Void 2 starboard - forward bulkhead
Strainer 1 outlet pressure gauge	11-1	Void 2 starboard - forward bulkhead
Strainer 2 inlet pressure gauge	11-1	Void 2 starboard - forward bulkhead
Strainer 2 outlet pressure gauge	11-1	Void 2 starboard - forward bulkhead
Strainer 3 (cooling strainer) inlet pressure gauge	11-3	Void 2 port - centerline bulkhead
Strainer 3 (cooling strainer) outlet pressure gauge	11-3	Void 2 port - centerline bulkhead
Generator cooling strainer inlet pressure gauge	11-5	Void 4 port - aft bulkhead
Generator cooling strainer outlet pressure gauge	11-5	Void 4 port - aft bulkhead
Generator 1 and 2 inlet temperature gauge	11-5	1 in void 4 port, 2 in void 4 starboard
Generator 1 and 2 outlet temperature gauge	11-5	1 in void 4 port, 2 in void 4 starboard

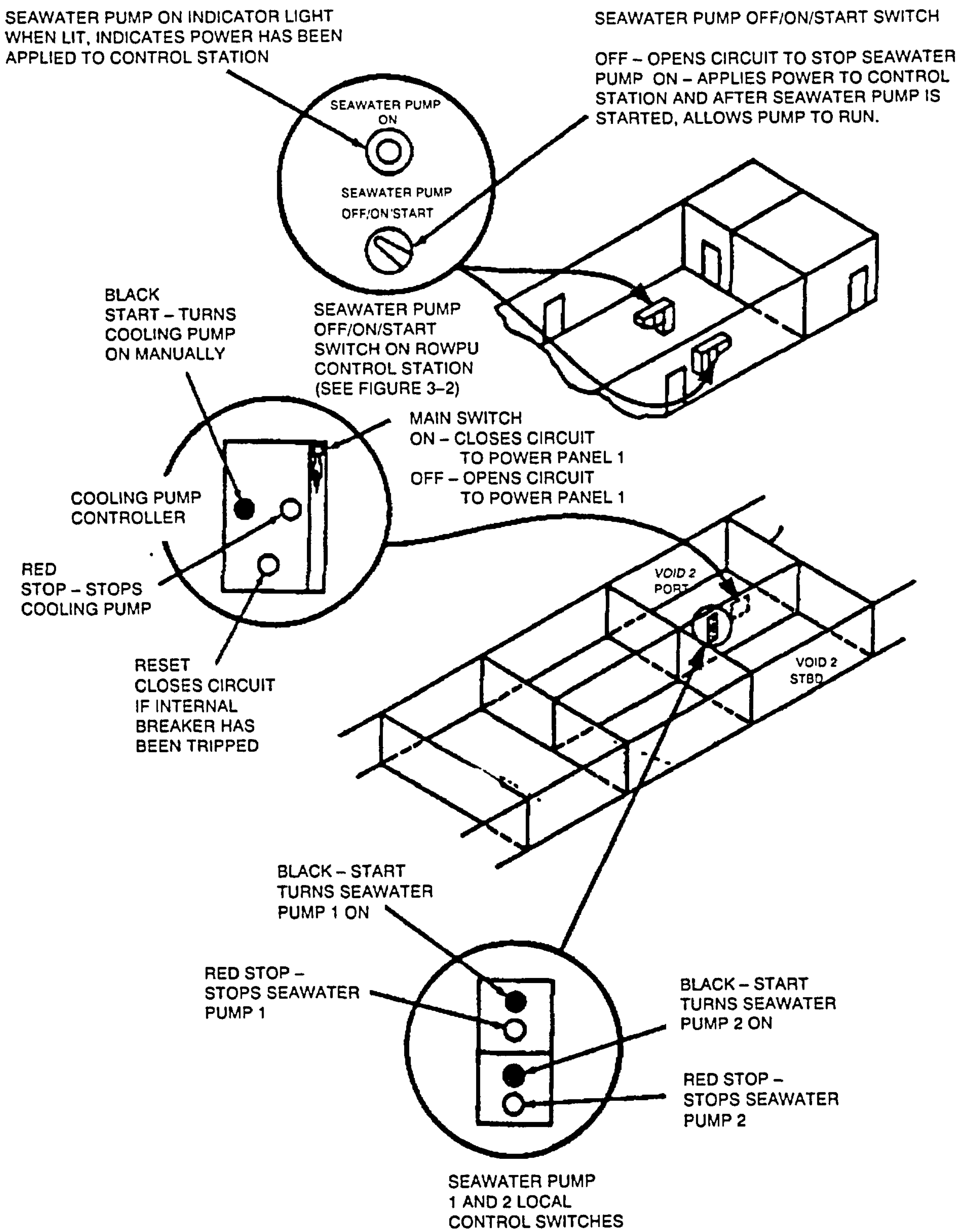


Figure 11-8. Seawater System's Electrical Controls

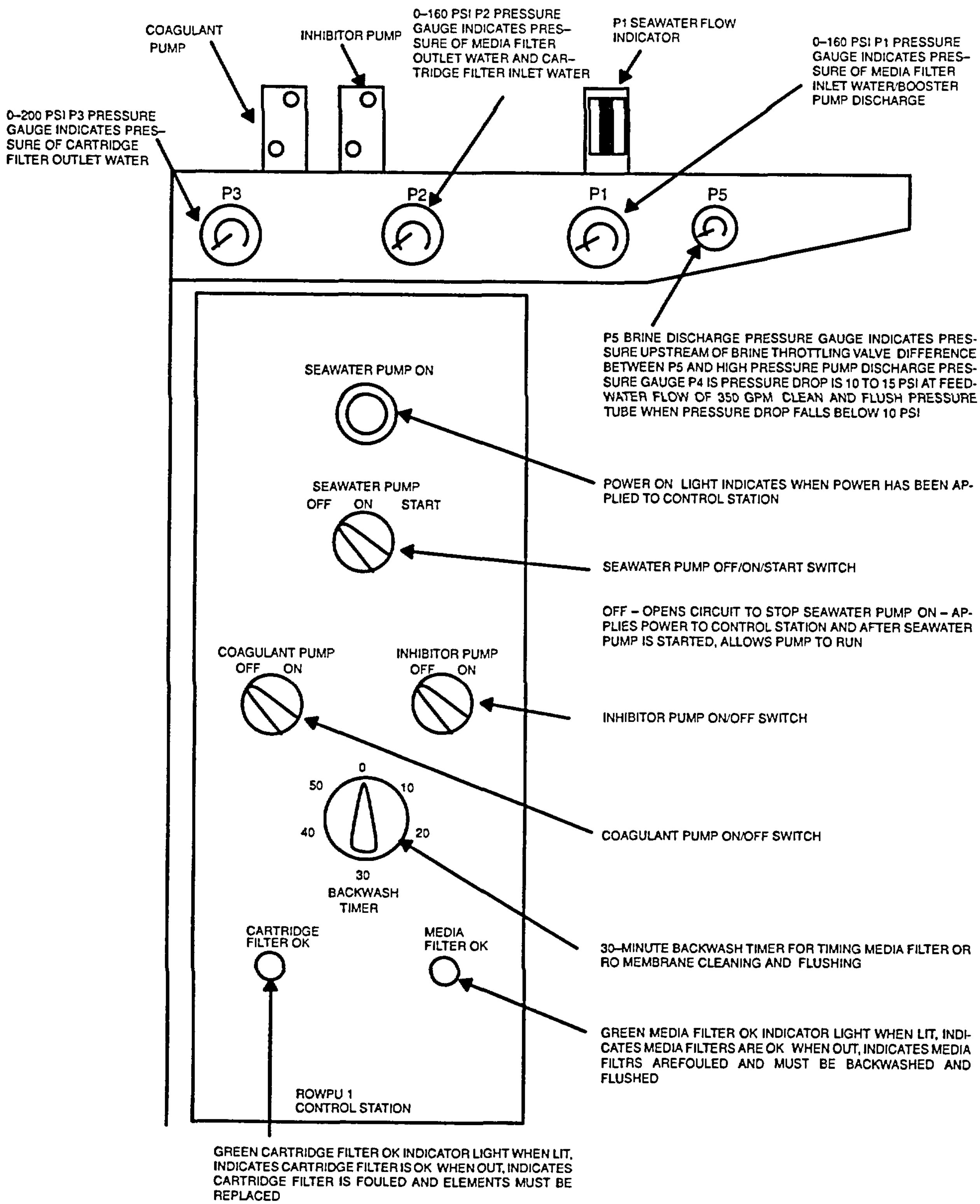


Figure 11-9. ROWPU Control Station (ROWPU 1 Station Shown)

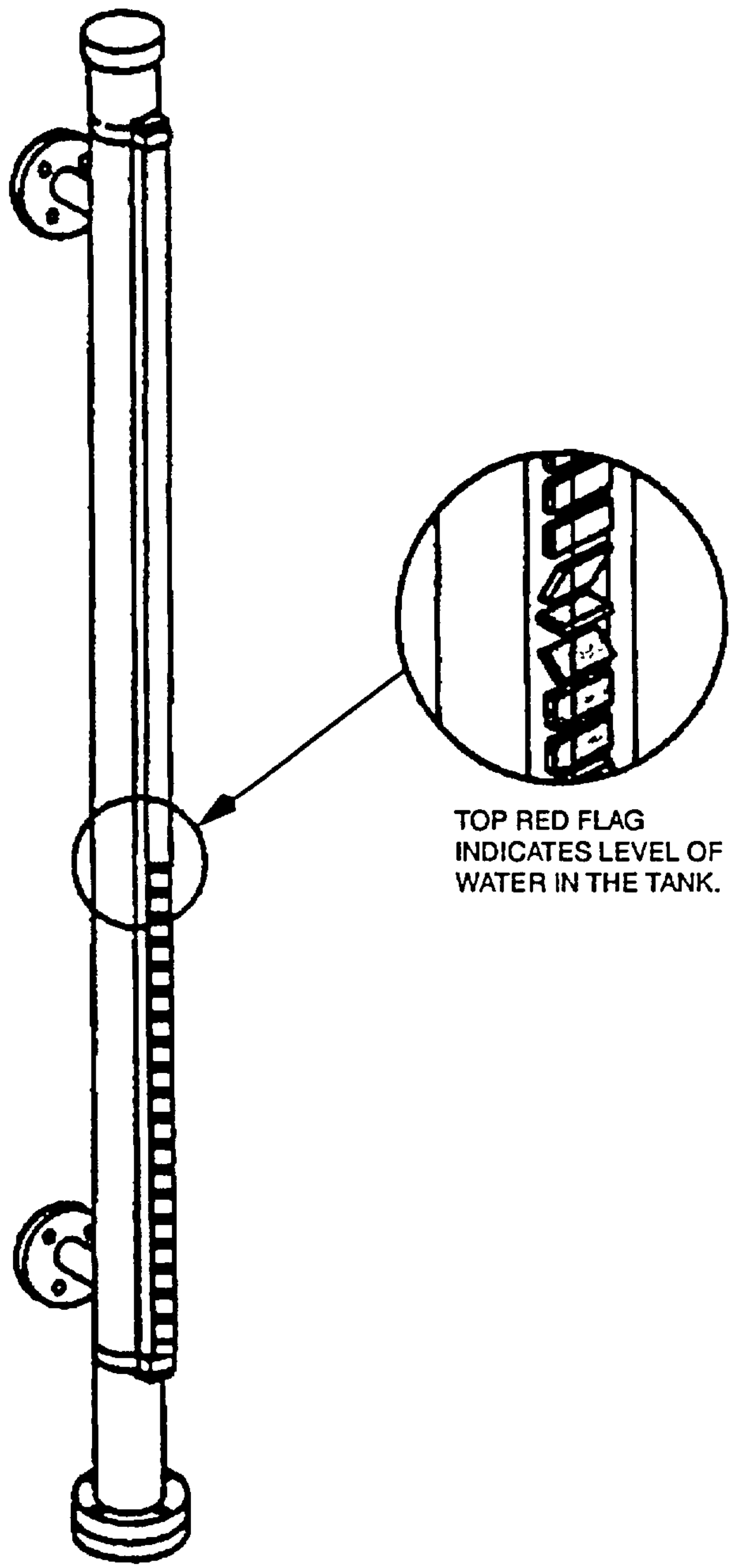


Figure 11-10. Ballast Tank Liquid Level Indicator

Table 11-5. Seawater System Valves

Type	Figure Callout*	Location	Label Identification and Valve Function
6-in gate valve	SW1	Void 2 starboard - In seawater supply line between seachest and seawater strainer	SEAWATER TO STRAINER 1: Allows flow from seachest to seawater strainer and isolates seachest from strainer
6-in gate valve	SW2	Void 2 starboard - In seawater supply line between seachest and strainer 2	SEAWATER TO STRAINER 2: Allows flow from seachest to seawater strainer and isolates seachest from strainer
1 1/2-in gate valve	SW3	Void 2 port - In seawater supply line between seachest and cooling water strainer	SEAWATER TO STRAINER 3: Allows flow from seachest to strainer and isolates seachest from strainer
6-in gate valve	SW4	Void 2 starboard - In seawater supply line from starboard shell	STARBOARD SEAWATER SUPPLY TO STRAINERS. Allows seawater to be supplied from starboard shell to seawater strainers
6-in gate valve	SW5	Void 2 starboard - In seawater supply line from starboard shell	STRAINER 1 INPUT: Allows seawater to be supplied from starboard shell and isolates strainer 1
6-in gate valve	SW6	Void 2 starboard - In seawater supply line from starboard shell	STRAINER 2 INPUT: Allows seawater to be supplied from starboard shell and isolates strainer 2
4-in gate valve	SW7	Void 2 starboard - In ballast tank drain line on suction side of sea-water pump 1	BALLAST DRAIN TO STRAINER 1: Allows seawater to drain from tank to seawater pump 1 and isolates ballast tank
4-in gate valve	SW8	Void 2 starboard - In ballast tank drain line on suction side of seawater pump 2	BALLAST DRAIN TO STRAINER 2: Allows sea-water to drain from tank to seawater pump 2 and isolates ballast tank
6-in gate valve	SW9	Void 2 starboard - In seawater pump 1 supply line	STRAINER 1 TO SEAWATER PUMP: Allows seawater being obtained from seachest or starboard shell seawater supply to flow to seawater pump 1 and isolates seawater strainer from pump 1
6-in gate valve	SW10	Void 2 starboard - In seawater pump 2 supply line	STRAINER 2 TO SEAWATER PUMP. Allows seawater being obtained from seachest or starboard shell seawater supply to flow to seawater pump 2 and isolates seawater strainer from pump 2

Table 11-5. Seawater System Valves (continued)

Type	Figure Callout*	Location	Label Identification and Valve Function
4-in gate valve	SW11	Void 2 starboard - In ROWPU membrane cleaning supply crossover line	SEAWATER PUMP 1 SUPPLY: Allows flow from ROWPU membrane cleaning supply to seawater pump 1
4-in gate valve	SW12	Void 2 starboard - In ROWPU membrane cleaning supply crossover line	SEAWATER PUMP 2 SUPPLY: Allows flow from ROWPU membrane cleaning supply to seawater pump 2
4-in gate valve	SW13	Void 2 starboard - In ROWPU membrane cleaning supply crossover line	SEAWATER PUMP SUPPLY CROSSOVER. Isolates seawater pump 1 supply from seawater pump 2 supply
Valves SW14 and SW15 were eliminated in redesign.			
4-in globe valve	SW16	Void 2 starboard - In seawater pump 1 discharge line	SEAWATER PUMP 1 TO SEAWATER FILTER: Allows seawater to flow from seawater pump 1 to ROWPU's via filter and isolates pump
4-in globe valve	SW17	Void 2 starboard - In seawater pump 2 discharge line	SEAWATER PUMP 2 TO SEAWATER FILTER: Allows seawater to flow from seawater pump 2 to ROWPU's via filter and isolates pump
4-in globe valve	SW18	Void 2 starboard - In ballast tank drain line on discharge side of seawater pumps on starboard shell	OVERBOARD DISCHARGE: Allows seawater being drained from ballast tank to be discharged by seawater pumps directly overboard
4-in gate valve	SW19	Void 2 starboard - In seawater pump discharge crossover line	SEAWATER PUMP DISCHARGE CROSSOVER: Isolates seawater pump 1 discharge from seawater pump 2 discharge
4-in globe valve	SW20	Void 2 starboard - In seawater pump 1 discharge line	SEAWATER FILTER 1 IN: Allows seawater to flow from seawater pump 1 to ROWPU 1 via filter and isolates filter
4-in globe valve	SW21	Void 2 starboard - In seawater pump 2 discharge line	SEAWATER FILTER 2 IN: Allows seawater to flow from seawater pump 2 to ROWPU 2 via filter and isolates filter
1 1/2-in throttle valve	SW22	Void 2 starboard - In seawater filter 1 drain line	SEAWATER FILTER 1 DRAIN: Allows removal of solids from seawater filter 1
1 1/2-in throttle valve	SW23	Void 2 starboard - In seawater filter 2 drain line	SEAWATER FILTER 2 DRAIN: Allows removal of solids from seawater filter 2

Table 11-5. Seawater System Valves (continued)

Type	Figure Callout*	Location	Label Identification and Valve Function
1-in gate valve	SW24	Void 2 starboard - In seawater supply line between seawater pump	SEAWATER PUMP 1 TO CHLORINATION UNIT. Allows seawater from seawater pump 1 to be supplied to chlorination system
1-in gate valve	SW25	Void 2 starboard - In seawater supply line between seawater pump 2 and valve SW48	SEAWATER PUMP 2 TO CHLORINATION UNIT: Allows seawater from seawater pump 2 to be supplied to chlorination system
2 1/2-in gate valve	SW26	Void 2 starboard - In seawater filter drain line on starboard shell lines to discharge directly overboard	SEAWATER FILTER OVERBOARD DISCHARGE: Allows seawater from filter drain
1 1/2-in gate valve	SW27	Void 2 port - In cooling pump supply line	STRAINER 3 TO AIR CONDITIONER COOLING PUMP. Allows seawater to flow to cooling pump and isolates pump from strainer 3
1-in globe valve	SW28 (Barges 2 and 3 only)	Void 2 port - In cooling seawater inlet line	AIR CONDITIONER COOLING WATER. Allows seawater from cooling pump to flow to air conditioning cooling coils and isolates pump from air conditioning unit
4-in globe valve	SW29	Void 2 starboard - In ballast tank fill line on discharge side of seawater pump 1 and isolates ballast tank	SEAWATER PUMPS TO BALLAST TANK: Allows seawater to flow from seawater pumps into ballast tank
2-in gate valve	SW30	Deckhouse workshop - In seachest vent line	SEAWATER SEACHEST VENT: Allows seachest venting
1/4-in gate valve	SW31	Void 2 starboard - In seawater supply line on input side of strainer 1	STRAINER 1 PRESSURE IN: Allows pressure reading on supply side of strainer 1
1/4-in gate valve	SW32	Void 2 starboard - In seawater supply line on discharge side of strainer 1	STRAINER 1 PRESSURE OUT: Allows pressure reading on discharge side of strainer 1
1/4-in gate valve	SW33	Void 2 starboard - In seawater supply line on input side of strainer 2	STRAINER 2 PRESSURE IN: Allows pressure reading on supply side of strainer 2
1/4-in gate valve	SW34	Void 2 starboard - In seawater supply line on discharge side of strainer 2	STRAINER 2 PRESSURE OUT: Allows pressure reading on discharge side of strainer 2

Table 11-5. Seawater System Valves (continued)

Type	Figure Callout*	Location	Label Identification and Valve Function
1/4-in gate valve	SW35	Void 2 port - In seawater supply line between seachest and cooling water strainer	COOLING WATER STRAINER PRESSURE IN: Allows pressure reading on supply side of cooling water strainer
1/4-in gate valve	SW36	Void 2 port - In seawater supply line between cooling water strainer and cooling pump	COOLING WATER STRAINER PRESSURE OUT: Allows pressure reading on discharge side of cooling water strainer
4-in gate valve	SW37	Void 4 port - In seawater supply line between seachest and strainer	GENERATOR COOLING SEACHEST TO STRAINER: Allows flow from seachest to strainer and isolates strainer
2-in gate valve	SW38	Void 4 port - On input side of generator 1 cooling line	STRAINER TO GENERATOR 1 COOLING: Allows cooling flow to generator 1 and isolates strainer
2-in globe valve	SW39	Void 4 port - On discharge side of generator cooling line	GENERATOR 1 COOLING TO OVERBOARD: Allows cooling flow from generator and isolates generator from overboard discharge
2-in gate valve	SW40	Void 4 starboard - On input side of generator 2 cooling line	STRAINER TO GENERATOR 2 COOLING: Allows cooling flow to generator 2 and isolates strainer
2-in globe valve	SW41	Void 4 starboard - On discharge side of generator cooling line	GENERATOR 2 COOLING TO OVERBOARD: Allows cooling flow from generator and Isolates generator from overboard discharge
1 1/4-in gate valve	SW42	Void 4 starboard - On input side of 20 kW generator cooling	STRAINER TO 20 kW GENERATOR COOLING: Allows cooling flow to 20 kW generator and isolates strainer
1 1/4-in globe valve	SW43	Void 4 starboard - On discharge side of 20 kW generator cooling line	20 kW GENERATOR COOLING TO OVERBOARD: Allows cooling flow from generator and isolates generator from overboard discharge
2-in gate valve	SW44	ROWPU space - in cooling water seachest vent line	GENERATOR COOLING SEACHEST VENT: Allows seachest venting

Table 11-5. Seawater System Valves (continued)

Type	Figure Callout*	Location	Label Identification and Valve Function
1/4-in ball valve	SW45 (Barges 2 and 3 only)	Void 4 port - In seawater supply line between seachest and strainer	GENERATOR COOLING STRAINER PRESSURE IN: Allows pressure reading on supply side of cooling water strainer
1/4-in ball valve	SW46 (Barges 2 and 3 only)	Void 4 port - In seawater cooling line on discharge side of strainer	GENERATOR COOLING STRAINER PRESSURE OUT: Allows pressure reading on discharge side of strainer
1-in gate valve	SW47	Void 2 port - In cooling pump line discharge	AIR CONDITIONING COOLING PUMP TO CHLORINATION UNIT: Allows seawater to flow to chlorination unit from cooling pump and isolates pump
1/2-in globe valve	SW48	Void 2 port - In seawater supply line between seawater pumps and chlorination unit pressure regulator	SEAWATER PUMPS TO CHLORINATION UNIT: Allows seawater from seawater pumps to enter chlorination and air conditioning system
3-in gate valve	SW49	Void 4 starboard - In diesel generator cooling line on starboard shell	GENERATOR COOLING OVERBOARD DISCHARGE: Allows seawater from generators to be discharged directly overboard

* See Figures 11-1, 11-3, and 11-5.

11-12.1 Supplying seawater to ROWPU's from seachest (deep water) using seawater pump(s) 1 and/or 2

NOTE

See Figures 11-1, 11-3, and 11-5 for seawater valve locations.

11-12.1.1 Normal Procedures

a. Perform before operation in paragraph 11-11.
b. If seawater is to be supplied to chlorination unit when cooling pump is not being operated, set seawater pressure regulator to 10 psi and open seawater valve SW48 in void 2 port. To supply cooling water to air conditioner, open seawater valves SW47 and SW28 (Barges 2 and 3 only).
c. Close seawater valves SW4 thru SW8, SW11 thru SW13, SW18, SW19, SW22, SW23, SW26, SW27, and SW29. Open seawater valves SW30 thru SW34.
d. Open or close seawater valves as follows:

o = open x = closed - = not affected

Seawater (SW) valve no:

Supplying seawater to:	1	2	3	9	10	16	17	20	21	24	25
Both ROWPU units	o	o	-	o	o	o	o	o	o	o	o
ROWPU1 only	o	x	-	o	-	o	-	o	-	o	x
ROWPU 2 only	x	o	-	-	o	-	o	-	o	x	o

NOTE

In addition to the following procedures, seawater pumps can be started and stopped at local control switches in void 2 starboard.

e. Make sure switchboard circuit breakers P6 and P7 are closed (ON).
f. Before starting seawater pumps, start ROWPU compressed air system according to procedures in Chapter 12.
g. To supply seawater to both ROWPU's, start seawater pumps I and 2 by turning seawater pump OFF/ON/START switch to ON at ROWPU 1 and ROWPU 2 control stations. To supply seawater to only one ROWPU, turn appropriate switch to ON.
h. While operating, perform during operation checks in steps i thru m.
i. Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report leaks to shift leader so corrective action can be taken.
j. Check for loose or missing securements and fasteners. Tighten or replace as necessary.
k Use insulated tools to check wiring for loose connections. De-energize and tighten as necessary.
l. Be alert to unusual noises, smells, or overheating that might indicate a pending malfunction.
m. While supplying seawater to ROWPU's and chlorination unit or for ballasting using seawater pumps 1 and 2, perform the following:

(1) Check for normal operation and for leaks.
(2) Watch seawater strainer input and output pressure gauges:

(a) A pressure of 2-4 Hg is normal.
(b) If pressure difference reaches 8 Hg, turn handle on strainer to move seawater through clean basket.
(c) Remove and dean dirty basket (see seawater strainer placard).

NOTE

If operating in clean water, drain seawater filters 15 seconds for every 8 hours of operation. If operating In dirty water, drain seawater filters 15 seconds for each hour of operation.

(3) Drain seawater filters as follows:

To drain seawater filter	Open SW valves no.:
1	22 and 26
2	23 and 26
1 and 2	22, 23, and 26

(4) Close valves SW22, SW23, and/or SW26 after draining.

11-12.1.2 Alternate procedures

NOTE

Alternate procedures may be followed when normal procedures cannot be used due to maintenance or component breakdown. See Figures 11-1, 11-3, and 11-5 for seawater valve locations.

a. Perform steps a and b in paragraph 11-12.1.1.
b. Close seawater valves SW7, SW8, SW13, SW18, SW26, SW27, and SW29.
c. Open or close seawater valves as follows:

o - open   x = dosed   - = not affected

Seawater (SW) valve no:

Supplying seawater to:	1	2	5	6	9	10	11	12	16	17	19	20	21	22	23	24	25
ROWPU1 from SW pump 2	x	o	-	x	-	o	-	x	x	o	o	o	x	x	-	x	o
ROWPU 2 from SW pump 1	o	x	x	-	o	-	x		o	x	o	x	o	-	x	o	x

d. Perform steps e thru m in paragraph 11-12.1.1.

11-12.2 Supplying seawater to ROWPU's from starboard shell penetration (shallow water) using seawater pump(s) 1 and/or 2

11-12.2.1 Normal procedures

NOTE

See Figures 11-1, 11-3, and 11-5 for seawater valve locations.

a. Perform before operation in paragraph 11-11.
b. If seawater is to be supplied to chlorination unit when cooling pump is not being operated, set seawater pressure regulator to 10 psi and open seawater valve SW48 in void 2 port. To supply cooling water to air conditioner, open seawater valves SW47 and SW28 (Barges 2 and 3 only).
c. Close seawater valves SW7, SW8, SW18, SW26, SW27, and SW29 in void 2. Open seawater valves SW30 thru SW34.
d. Open or close seawater valves as follows:

o - open   x   closed   - = not affected

Seawater (SW) valve no:

Supplying seawater to:	1	2	5	6	9	10	11	12	16	17	19	20	21	22	23	24	25
Both ROWPU's	x	x	o	o	o	o	x	x	o	o	x	o	o	x	x	x	o
ROWPU1	x	x	o	x	o	-	x	-	o	-	x	o	-	x	-	o	x
ROWPU2	x	x	x	o	-	o	-	x	-	o	x	x	o	-	x	x	o

e. Open seawater valve SW4 in void 2 near starboard shell.

NOTE

In addition to the following procedures, seawater pumps can also be started and stopped at local control switches in void 2 starboard.

f. Make sure switchboard circuit breakers P6 and P7 are dosed (ON).
g. To supply seawater to both ROWPU's, start seawater pumps 1 and 2 by turning seawater pump OFF/ON/START switch to ON at ROWPU 1 and ROWPU 2 control stations. To supply seawater to only one ROWPU, turn appropriate switch to ON.
h. Start ROWPU system according to procedures in Chapter 13.
i. While system is operating, perform during operation checks in steps i thru m in paragraph 11-12.1.1.

11-12.2.2 Alternate procedures

NOTE

Alternate procedures may be followed when normal procedures cannot be used due to maintenance or component breakdown. See Figures 11-1, 11-3, and 11-5 for seawater valve locations.

a. Perform steps a and b in paragraph 11-12.2.1.
b. Open or dose seawater valves as follows:

o = open　　x = dosed　　-= not affected

Seawater (SW) valve no:

Supplying seawater to:	1	2	5	6	9	10	11	12	16	17	19	20	21	22	23	24	25
ROWPU 1 from SW pump 2	x	x	x	o	-	o	-	x	x	o	o	o	x	x	-	x	o
ROWPU 2 from SW pump 1	x	x	o	x	o	-	x	-	o	x	o	x	o	-	x	o	x

NOTE

In addition to the following procedures, seawater pumps 1 and 2 can be started and stopped at local control switches in void 2 starboard.

c. Perform steps e thru i in paragraph 11-12.2.1.

11-12.3 Supplying seawater from seawater pumps to chlorination and air conditioning units

NOTE

The following procedures assume that seawater pump(s) are operating. If these pumps are not operating and seawater Is required for chlorination unit, follow procedures in paragraph 11-12.4.

NOTE

See Figures 11-1, 11-3, and 11-5 for seawater valve locations.

a. Perform prestart procedures in paragraph 11-11.

b To obtain seawater from seawater pump(s) for chlorination and/or air conditioning units, open:

(1) Valve SW24 in void 2 port for seawater pump 1,
(2) Valve SW25 in void 2 port for seawater pump 2,
(3) Valves SW24 and SW25 for both seawater pumps.

c. Open valve SW48 in void 2 port.
d. If seawater required for chlorination unit only, dose valve SW47 in void 2 port.
e. If seawater required for both chlorination and air conditioning units, open valves SW47 and SW28 (Barges 2 and 3 only) in void 2 port. Make sure valve SW27 in void 2 port is dosed.
f. If seawater required for air conditioning unit only, open valves SW47 and SW28 (Barges 2 and 3 only). Cooling seawater will be supplied to air conditioner as well as to chlorination unit, but cooling water in chlorination unit will simply circulate through cooling portion of unit and pass overboard through port discharge.
g. While system is operating, perform during operation checks in steps i thru m in paragraph 11-12.1.1.

11-12.4 Supplying seawater from cooling pump to air conditioning and chlorination units

NOTE

See Figures 11-3 and 11-4 for seawater valve locations.

a. Perform prestart operation checks in paragraph 11-11.
b. Close seawater valve SW48 to turn off seawater from nonoperating seawater pumps in void 2 starboard.
c. Open seawater valves SW3 and SW27 in void 2 port to supply seawater to cooling pump.
d. Open seawater valves SW35 and SW36 in void 2 port to monitor pressure differences between input and output of seawater strainer 3 supplying seawater to cooling pump.
e. To supply seawater to chlorination unit and air conditioner, open seawater valves SW28 (Barges 2 and 3 only) and SW47.
f. To supply seawater to air conditioner only, open seawater valve SW28 (Barges 2 and 3 only) and dose SW47.
g. To supply seawater to chlorination only, open seawater valve SW47 and dose SW28 (Barges 2 and 3 only).
h. Set seawater pressure regulator to supply 10 psi of seawater to chlorination unit.
i. Start cooling pump by pressing START button on cooling pump motor controller on center bulkhead in void 2 port.
j. While operating, perform during operation checks in steps i thru I in paragraph 11-12.1.1.

k. While supplying seawater to air conditioning unit and/or chlorination system using cooling pump, perform the following:

(1) Check for normal operation and leaks.
(2) Check cooling water strainer input and output pressure gauges.

(a) A pressure difference of 1 inch between the two reading gauges is normal.
(b) If the pressure difference between the two gauges reaches 2 inches, turn handle on cooling water strainer to move water through dean basket.
(c) Remove and clean dirty basket (see seawater strainer placard).

NOTE

Ballasting may be necessary to establish 9 Inch bow high trim in preparation for towing or to establish barge on an even keel when deployed for processing water.

11-12.5 Filling ballast tank (to correct a bow high condition)

NOTE

Filling ballast tank requires only one seawater pump. The other seawater pump may be used to supply seawater to one ROWPU unit. See Figures 11-1 and 11-2 for seawater valve locations.

11-12.5.1 Filling ballast tank from forward seachest

a. Perform prestart procedures in paragraph 11-11.
b. Open seawater valves SW31 thru SW34 in void 2 starboard.
c. Close seawater valves SW4 thru SW8, SW11, SW12, SW18, and SW20 in void 2 starboard.
d. Open or dose seawater valves as follows:

o = open x = closed - = not affected

Seawater (SW) valve no:

Seawater supplied by:	1	2	9	10	16	17	19	21	29
Seawater pump 1. only	o	-	o	-	o	-	x	-	o
Seawater pump 2 only	-	o	-	o	x	o	o	x	o
Both seawater pumps	o	o	o	o	o	o	o	x	o

e. Make sure switchboard circuit breakers P6 and P7 are closed (ON).
f. Start seawater pump using local control switch in void 2 starboard.

CAUTION

Do not overfill ballast tank.

g. While filling ballast tank, perform during operation checks in steps i thru m in paragraph 11-12.1.1.
h. To prevent overfilling, check ballast tank visual level indicator and display page on EMS video monitor. If EMS alarms sound, stop filling and stop alarms according to procedures in Chapter 8.
i. Stop seawater pump when inclinometer in void 2 starboard indicates desired trim.

11-12.5.2 Filling ballast tank from starboard shell

a. Perform prestart procedures in paragraph 11-11.
b. Open seawater valves SW31 thru SW34.
c. Close seawater valves SW7, SW8, SW11, SW12, SW18, and SW20.

d. Open or dose seawater valves as follows,

o = open x = closed - = not affected

Seawater (SW) valve no:

Seawater supplied by:	1	2	4	5	6	9	10	16	17	19	21	29
Seawater pump 1 only	x	-	o	o	o	x	o					
Seawater pump 2 only	x	o	x	o	o	x	o	o	x	o		
Both seawater pumps	x	x	o	o	o	o	o	o	o	o	x	o

e. Perform steps e thru i in paragraph 11-12.5.1.

11-12.6 Draining ballast tank (to correct a stem high condition)

NOTE

Draining ballast tank requires only one seawater pump. The other seawater pump may be used to supply seawater to one ROWPU unit. See Figures 11-1 and 11-2 for seawater valve locations.

a. Perform prestart procedures in paragraph 11-11.
b. Open seawater valves SW31 thru SW34 in void 2 starboard.
c. Close seawater valves SW4, SW5, SW6, SW11, SW12, SW20, SW21, SW24, SW25, and SW29 in void 2 starboard.
d. Open or dose seawater valves as follows:

o = open x = closed - = not affected

Seawater (SW) valve no:

Ballast drained by:	1	2	7	8	9	10	16	17	18	19
Seawater pump 1 only	x	-	o	x	o	-	o	x	o	o
Seawater pump 2 only	-	x	x	o	-	o	-	o	o	x
Both seawater pumps	x	x	o	o	o	o	o	o	o	o

e. Make sure switchboard circuit breakers P6 and P7 are dosed (ON).
f. Start seawater pump using local control switch in void 2 starboard.
g. While draining ballast tank, perform during operation checks in steps i thru m in paragraph 11-12.1.1.
h. Stop seawater pump when inclinometer in void 2 starboard indicates desired trim.

11-12.7 Supplying seawater for generator cooling

WARNING

Do not open seawater valve SW37 unless valve SW44 is open.

NOTE

See Figures 11-5, 11-6, and 11-7 for seawater valve locations.

a. Perform prestart procedures in paragraph 11-11.
b. Make sure seawater valve SW44 in ROWPU space port aft comer is open to vent seachest to the atmosphere.

c. Open valve SW37 in void 4 port.
d. Open valves SW45 and SW46 to activate strainer pressure gauges (Barges 2 and 3 only).
e. Open valve SW49 near void 4 starboard shell overboard discharge.
f. Open seawater valves for generators to be used as follows:

   (1) SSG 1: SW38, SW39
   (2) SSG 2: SW40, SW41
   (3) SAG (20 kW): SW42, SW43

NOTE

Coolant pumps on generator engines move seawater from seachest through the engine coolant exchange tanks. The used seawater is discharged directly overboard through seawater valve SW49.

g. While operating, perform during operation checks in steps i thru I in paragraph 11-12.1.1 and step h below.
h. While supplying seawater for generator cooling, perform the following:

   (1) Check for normal operation and leaks.
   (2) Watch generator cooling strainer input and output pressure gauges:

      (a) A pressure difference between the two gauges of 2-4 inches is normal.
      (b) if the pressure difference between the two gauges reaches 8 inches, turn handle on generator cooling strainer to move water through dean basket.
      (c) Remove and dean dogged basket. (See seawater strainer placard.)

   (3) When regulator outlet pressure gauge drops from 10 psi to 8 psi, replace in-line filter (TM 55-1930-209-14 & P-2).

11-12.8 Seachest blowdown. Seachest blowdown is needed when gauges on input side of seawater strainers indicate a significant drop in water pressure. Blockage should be eliminated by using the following procedures. If compressed air is not available, start and operate the compressed air system according to Chapter 12.

11-12.8.1 Forward seachest blowdown (serving ROWPU, chlorination, air conditioning, and ballast seawater system).

CAUTION

Before starting forward seachest blowdown, make sure seawater cooling water pumps are not In use.

a. Isolate seachest by dosing valves SW1 and SW2. Make sure cooling pump is off and dose SW3.
b. Check that compressed air pressure regulator 1 is set to 40 psi as shown on regulator gauge.
c. Blowdown seachest on Barge 1 as follows:

   (1) Position valve SW30 to position B so compressed air flows into seawater seachest.
   (2) When air pressure regulator gauge reading stabilizes at 3 - 5 psi, position valve SW30 to position A to allow seachest to vent.
   (3) Proceed to step e.

d. Blowdown seachest on Barges 2 and 3 as follows:

(1) Close valve SW30 (in workshop).
(2) Open compressed air seawater seachest blowdown valve (in workshop).
(3) When air pressure regulator gauge reading stabilizes at 3-5 psi, dose compressed air seawater seachest valve SW30 to vent seachest.

WARNING

Do not open seachest valves SW1, SW2, or SW3 unless valve SW30 is positioned to allow seachest to vent.

e. To return seachest to normal operation, open valves SW1, SW2, and SW3 and turn on cooling pump and seawater pumps as needed.
f. If sea strainer inlet gauges do not indicate near normal reading, repeat steps a thru c.

11-12.8.2 Aft seachest blowdown (serving generator cooling seawater system)

CAUTION

Before starting aft seachest blowdown, make sure generator sets are not operating.

a. Isolate generator cooling seawater seachest by dosing seawater valve SW37. Make sure all generators are shut down and not pulling seawater from seachest.
b. Check that compressed air pressure regulator 2 is set to 40 psi as shown on regulator gauge.
c. Close seawater valve SW44.
d. Open generator cooling seachest blowdown valve in aft port comer of ROWPU space.
e. When air pressure regulator gauge reading stabilizes at 3-5 psi, open valve SW44 to vent seachest.
f. Close generator cooling seachest blowdown valve.

WARNING

Do not open seachest valve SW37 unless valve SW44 is open.

g. To return seachest to normal operation, open valves SW37 and SW49. Start at least one of the generators and check sea strainer inlet gauges.
h. If sea strainer inlet gauges do not indicate near normal reading, repeat steps a thru g above.
i. Return seachest to operation by opening valves SW37 and SW49, and starting at least one generator.

11-13 Seawater system shutdown procedures

a. Shutdown procedures for ballasting are incorporated in paragraphs 11-12.5 and 11-12.6.
b. Shutdown procedures when supplying seawater to ROWPU's using seawater pump(s) 1 and/or 2 are in paragraph 11-13.1.
c. Shutdown procedures when supplying seawater for generator cooling are in paragraph 11-13.2.
d. Shutdown procedures when supplying seawater to air conditioning and chlorination units using cooling pump are in paragraph 11-13.3.

e. Perform following after operation checks upon completion of shutdown:

(1) Wipe components dean, especially gauges and control panels.
(2) Check for damaged or missing items, loose wires, connections, and securements. Repair, replace, and/or tighten as required.
(3) Remove rust and corrosion. Touch up or paint as necessary. Do not paint threads.

11-13.1 Shutdown seawater supply to ROWPU's

a. Stop seawater pump(s) by turning OFF/ON/START switch to OFF on ROWPU 1 and/or ROWPU 2 control station(s).
b. Close valves SW1 and SW2 in void 2 starboard.

CAUTION

The following shutdown procedure shuts off seawater to the chlorination and air conditioning units. If these units are obtaining seawater from the seawater pumps, an alternative supply of seawater must be provided by following procedures in paragraph 11-12.4.

11-13.2 Shutdown generator cooling seawater supply

a. Make sure all generator engines are stopped.
b. Close valve SW37.

11-13.3 Shutdown seawater supply to air conditioning and/or chlorination units when using cooling pump.

a. Push STOP button on cooling pump motor controller.
b. .Push main switch on motor controller to OFF.
c. Close valve SW3.

11-14 Emergency shutdown

11-14.1 General. The barge has two emergency shutdown modes. One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Seven red system shutdown buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These system shutdown buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG1, and SSG2.

Six red total shutdown buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system shutdown buttons.
- Outside ROWPU space starboard door on weatherdeck
- Outside ROWPU space port door on weatherdeck.
- Inside ROWPU space port door to weatherdeck
- Outside dayroom door to weatherdeck
- Inside dayroom door to weatherdeck.

11-14.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.
b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.
c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

CHAPTER 12 COMPRESSED AIR SYSTEM

Section I. General

12-1 General. Compressed air system provides air to nine air stations Six of these (stations 1, 2, 4, 5, and 7 in ROWPU space, station 3 in workshop) are for operating air-powered Impact tools and general cleaning blowdown. The seventh outlet (station 6) provides air for propelling a PIG (an 8-inch long polyfoam cylinder) through the shore discharge hose to force out water in the hose before reeling in the hose. Stations 8 and 9 provide regulated compressed air for blowdown of two seachests to remove foreign material that may be clogging seachest intakes.

12-2 Description. This system provides compressed air to five air stations in the ROWPU space, one in the workshop, and one on stern weatherdeck. It also provides compressed air to two air stations for blowdown of seachests in void 2 starboard and void 4 port. These outlets, with other major components, valves, and piping are shown schematically in Figure 12-11 for Barge 1 and In Figure 12-2 for Barges 2 and 3 and are listed in Table 12-1 Equipment specifications, maintenance information, and manufacturer's service manuals are contained in TM 55-1930-209-14 & P-7.

12-3 Capabilities. This system provides compressed air up to 155 psi for seven air stations and 40 psi for two air stations for seachests blowdown.

12-4 Special limitations. Use of air station 6 and its associated 25-foot air hose is restricted to providing compressed air for forcing water out of the shore discharge hose prior to reeling In this hose.

Section II. Description of operation

12-5 Activation. When compressor starts, air is drawn through intake filter, manifold, and suction discs into compressor cylinders. This air is compressed, then discharged through delivery discs to temperature reducer where heat is partially removed. From temperature reducer, compressed air Is discharged through a check valve into receiver, increasing air pressure in receiver. When system is set on automatic (normal setting), compressor is controlled by an automatic air regulator switch (pressure switch). When air pressure in receiver reaches factory set upper limit, compressor will unload and turn itself off. When air In receiver reaches factory set lower limit on pressure switch, compressor will be activated and pump air into receiver. When system is set on manual and START button Is pushed, compressor pumps air into receiver until STOP button is pushed.

12-6 Air flow. Opening air compressor main air supply valve directs compressed air from receiver through air filter 1 for removal of moisture and particles. This air then flows to the air stations in the ROWPU space and workshop. Quick disconnect couplings at these air stations permit connection of a 50-foot air hose so pneumatic tools may be used Air also goes through air filter 2 before reaching air station 6 This filter traps oil and grease and prevents contamination of drinking water shore discharge hose when compressed air pushes PIG through hose prior to hose retrieval. Compressed air pressure regulators 1 and 2 further reduce air pressure to a manually set level, normally 40 psi, for blowdown of seachests in void 2 starboard and void 4 port.

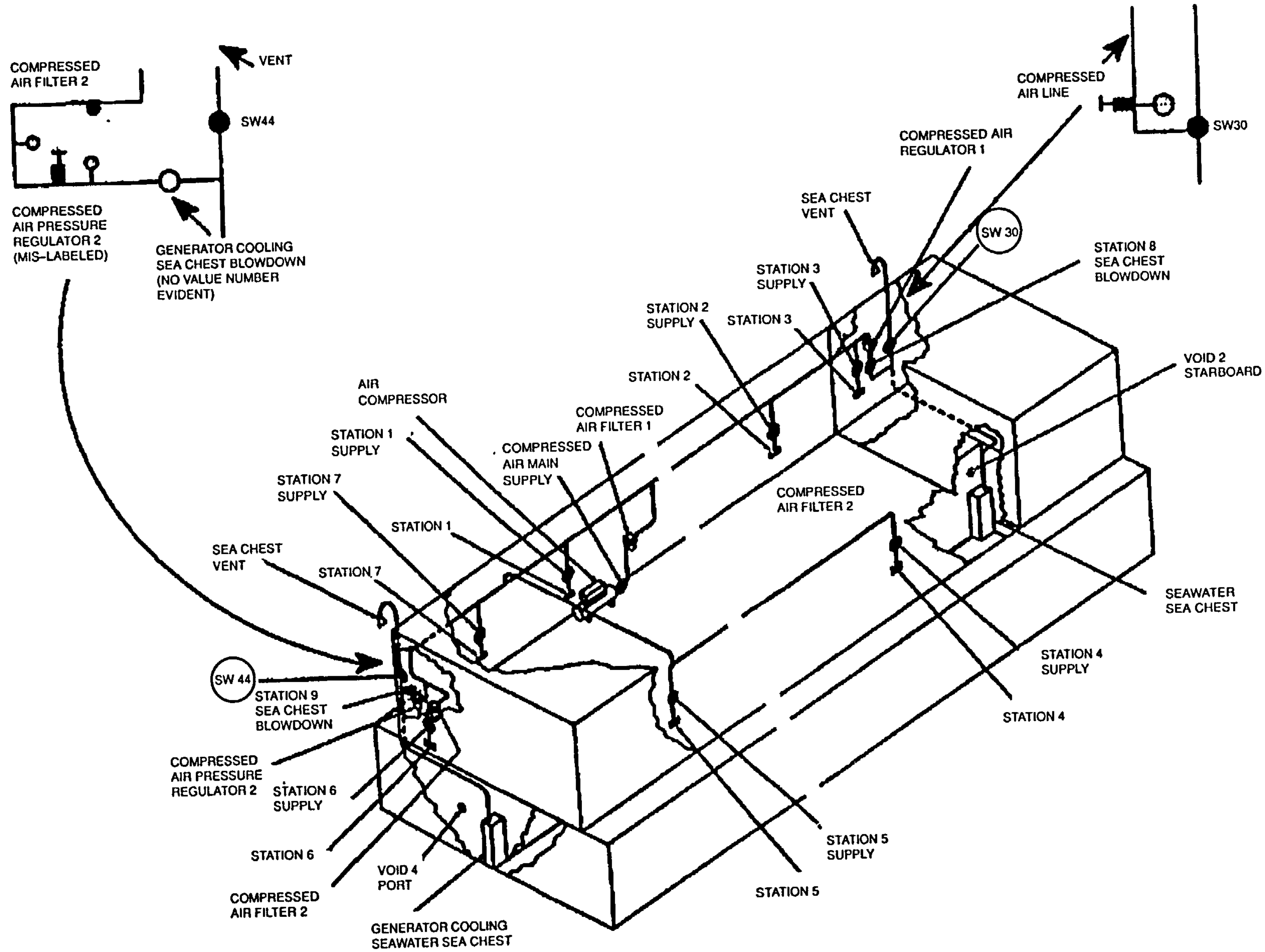


Figure 12-1. Location of Compressed Air System Components (Barge 1)

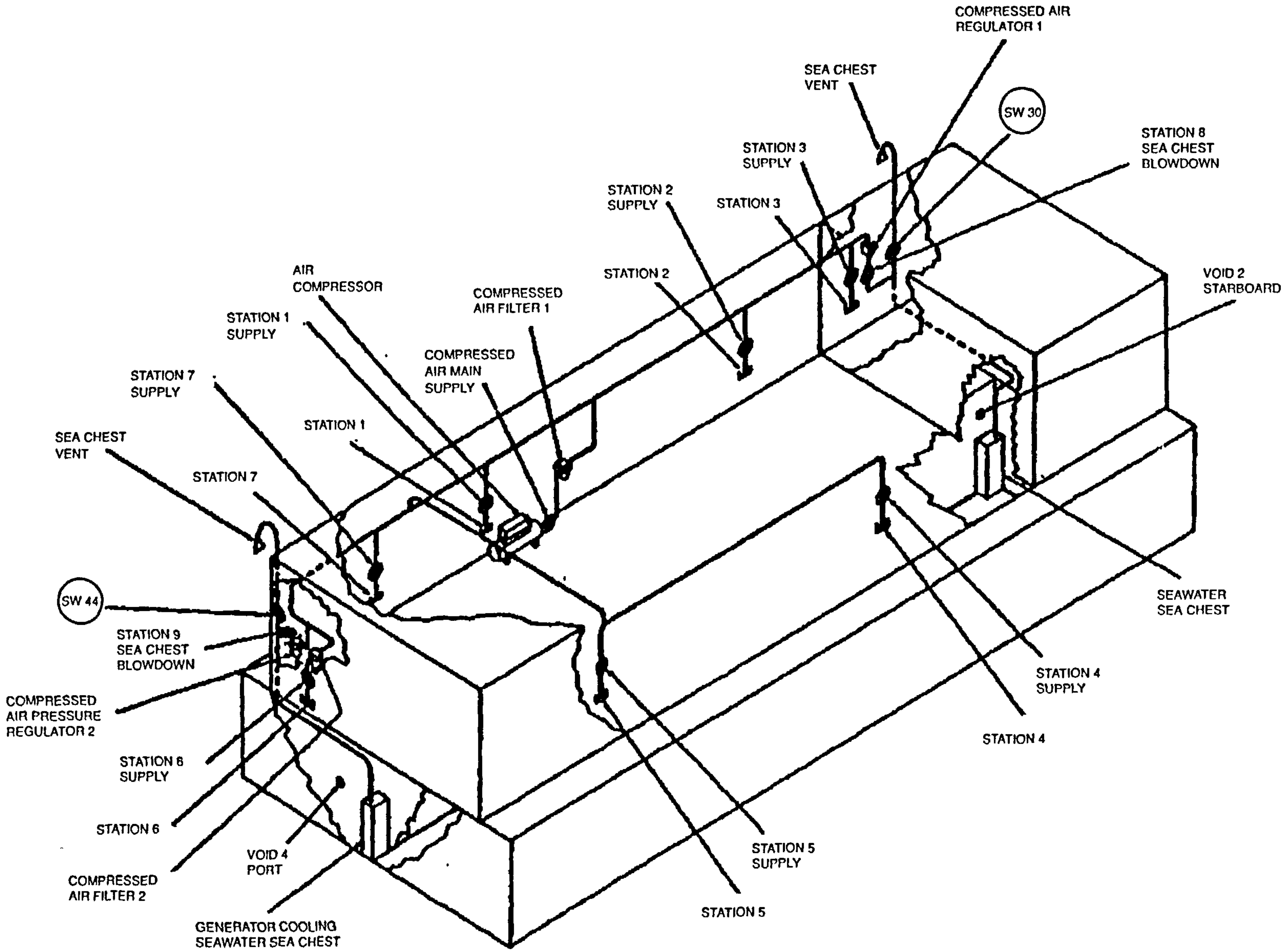


Figure 12-2. Location of Compressed Air System Components (Barges 2 and 3)

Table 12-1. Compressed Air System Major Components

Component	Location and Function
Electric Controller	ROWPU space port bulkhead near compressor. Starts, stops, and provides automatic compressor operation.
Compressor w/l Receiver	ROWPU space portside aft. Compresses air to 155 psi and stores it in an 80-gallon receiver.
Automatic Air Pressure Regulator (Pressure Switch)	On top of receiver. When compressor controller is in AUTO, this mechanism turns compressor on and off to maintain pressure in receiver within factory set limits.
Receiver Pressure Gauge	Mounted on side of receiver. Indicates air pressure in receiver.
Receiver Safety Valve	Mounted on top of receiver. Factory set to relieve air pressure in receiver if it exceeds 175 psi.
Receiver Drain Cock	On bottom of receiver. Provides opening for relieving air pressure in receiver. Drains moisture from receiver.
Main Supply Valve	Forward end of receiver. Controls flow of compressed air to air supply lines. Isolates receiver from lines.
Air Filter 1	In air supply pipe near compressor. Removes particles and moisture from air passing from receiver to air supply lines.
Air Filter 2	In air supply line immediately in front of air station 6. Removes oil and particles from line to air station 6 to preclude contamination of drinking water shore discharge hose.
Air Pressure Regulator 1 with Air Pressure Gauge	Workshop port bulkhead. Reduces air pressure to 40 psi for blowdown of seachest in void port 2. Indicates air pressure in line beyond regulator.
Air Pressure Regulator 2 with Air Pressure Gauge	ROWPU space aft bulkhead behind void 4 air ducts. Reduces air pressure to 40 psi for blowdown of seachest in void 4 port. Indicates air pressure in line beyond regulator.
Air Station 1	ROWPU space port bulkhead near air compressor. Provides air to quick disconnect coupling for pneumatic equipment.
Air Station 2	ROWPU space port bulkhead amidships. Same function as Air
Station 1.	
Air Station 3	Workshop port bulkhead. Same function as Air Station 1.
Air Station 4	ROWPU space starboard bulkhead forward. Same function as
Air Station 1.	
Air Station 5	ROWPU space starboard bulkhead aft of sliding door. Same function as Air Station 1.
Air Station 6	Weatherdeck stern portside. Provides 155 psi to quick disconnect exclusively for powering PIG through shore discharge hose.
Air Station 7	ROWPU space port bulkhead aft of switchboard. Same function as Air Station 1.

Table 12-1. Compressed Air System Major Components (continued)

Component	Location and Function
Air Station 8 Seawater Seachest Blowdown Valve	Workshop port bulkhead In air supply line beyond air pressure pressure regulator 1 with air pressure gauge Controls air for blowdown of seachest in void 2 port. Used in conjunction with seawater valve SW30.
Air Station 9 Generator Cooling Seachest Blowdown Valve	ROWPU space aft bulkhead in air supply line beyond air pressure regulator 2 with air pressure gauge. Controls air for blowdown of seachest in void 4 port. Used In conjunction with seawater valve SW44.
Airhose, 50 Feet Self-Retracting	Attached to air stations Provides air pressure from air stations to pneumatic equipment.
Airhose, 25 Feet Self-Retracting	Dedicated hose used only for providing air pressure to drive PIG through shore discharge hose.
Seawater Valve SW30*	Workshop port bulkhead. Used with seawater seachest blowdown valve to blowdown seachest in void 2 port. When opened, this valve vents forward seachest to atmosphere through venting pipe to deckhouse top. When closed, valve forces air from air station into seachest for blowdown.
Seawater Valve SW44*	ROWPU space rear bulkhead. Similar function as SW30.

Section III. Operating instructions

12-7 Operating controls and indicators

12-7.1 Controls

a. Power panel 1 circuit breaker 3P5, on ROWPU space port bulkhead, controls power to air compressor's electrical controller. See TM 55-1930-209-14 & P-9 for details on electrical power panels.

b. Air compressor electric controller (Figure 12-3), on ROWPU space port bulkhead above compressor, controls electrical power to compressor.

c. Receiver drain cock, on bottom of receiver (Figures 12-4 and 12-5), drains moisture and air from receiver. Turn T-handle clockwise to open and counterclockwise to close.

d. Safety valve, on receiver topside forward, automatically maintains pressure in receiver at not more than 155 psi.

e. Automatic air regulator (pressure switch), on receiver topside, automatically maintains air pressure in receiver between factory set limits indicated on name/data plates by switching power ON and OFF.

f. Main supply valve, on forward end of receiver, controls air supply to system. Turn handle parallel with pipe to turn air pressure ON; turn handle to right angle with pipe to turn air pressure OFF.

g. Air pressure regulator 1 (Figure 12-6), on workshop port bulkhead, controls air pressure for blowdown of forward seachest in void 2 starboard. Regulator is normally set to 40 psi. Turn T-handle on regulator clockwise to decrease pressure, counterclockwise to Increase pressure.

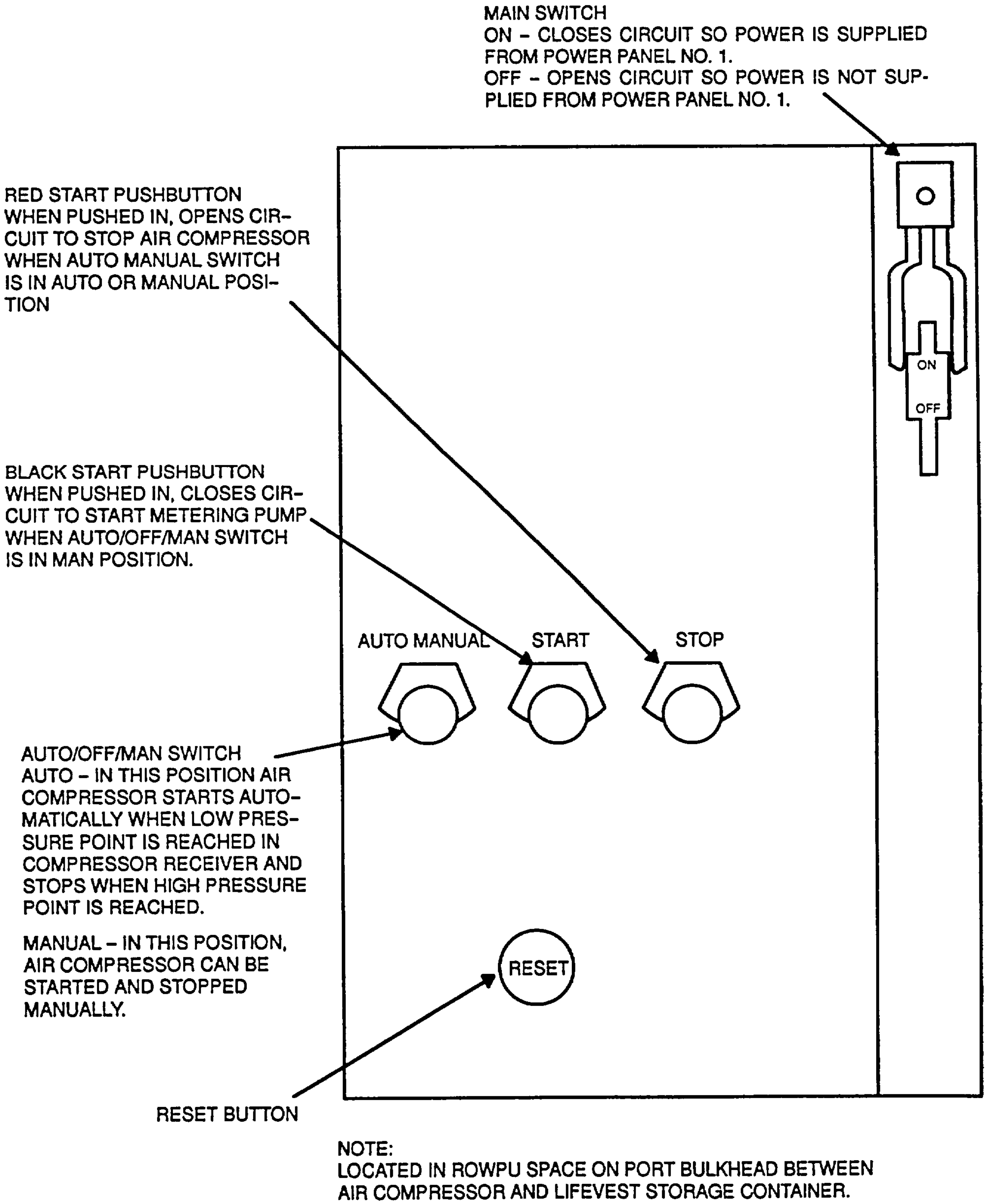


Figure 12-3. Air Compressor Electric Controller

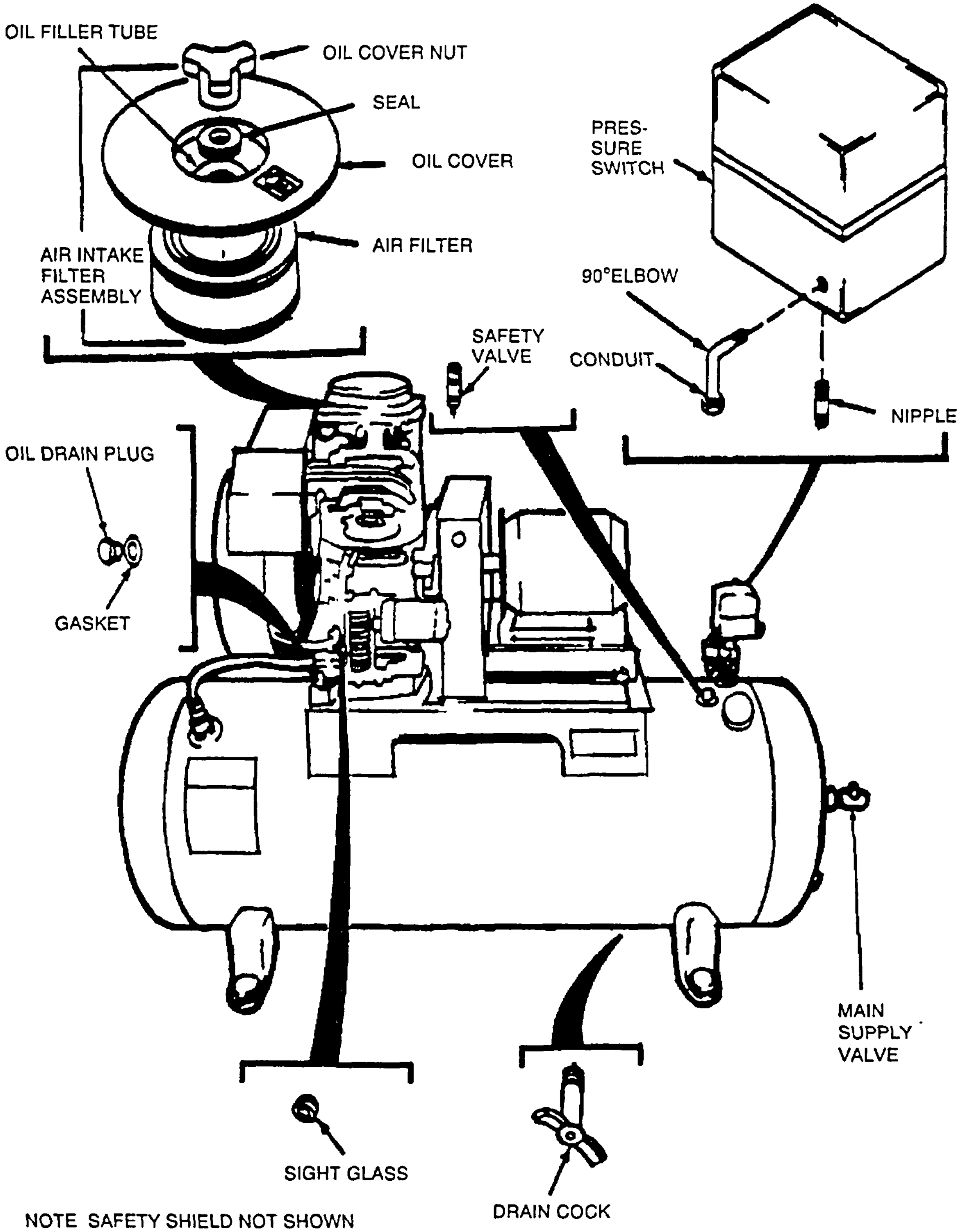


Figure 12-4. Barge 1 Air Compressor/Receiver

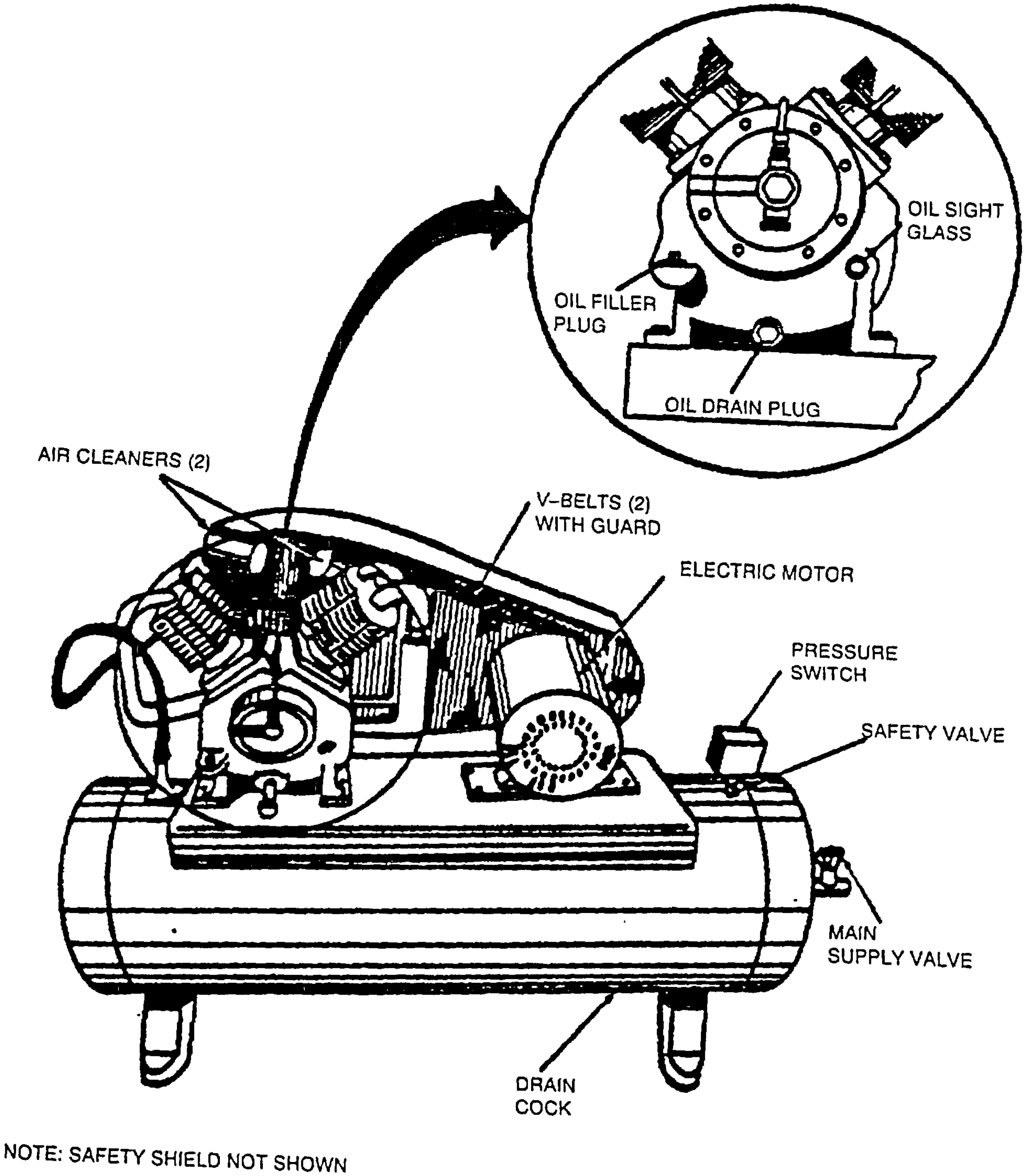
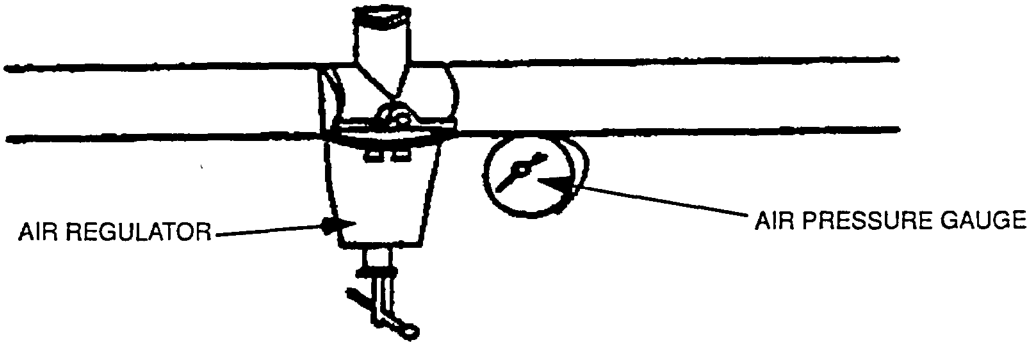


Figure 12-5. Barges 2 and 3 Air Compressor/Receiver



NOTE: AIR REGULATOR PRESSURE ADJUSTING SCREW.
TURN CLOCKWISE TO DECREASE PRESSURE.
COUNTERCLOCKWISE TO INCREASE PRESSURE.

Figure 12-6. Exterior View of Air Pressure Regulator with Gauge

h. Air station 8 seachest blowdown valve (Figure 12-1 and 12-2), on workshop port bulkhead, controls compressed air for blowdown of forward seachest. Valve is used with SW30.

i. Seawater system valve SW30, on workshop port bulkhead, controls air vent for forward seawater seachest. Its normal position is open to vent air from seachest to atmosphere through venting pipe to deckhouse top.

   When closed, and air station 8 seawater seachest blowdown valve is open, air pressure is forced into seachest to blow out debris.

j. Air pressure regulator 2 (Figure 12-6), on ROWPU space aft bulkhead near port bulkhead, controls air pressure used in blowdown of generator cooling water seachest. Regulator is normally set to 40 psi and works the same as air pressure regulator 1.

k. Air station 9 generator cooling seachest blowdown valve, on ROWPU space aft bulkhead, controls compressed air for blowdown of generator cooling seachest in void 4 port. Valve is used with SW44.

l. Seawater valve SW44, on ROWPU space aft bulkhead, controls air vent for generator cooling water seachest. It works with generator cooling water seachest blowdown valve in similar manner as forward seachest blowdown valve and SW30.

12-7.2 Indicators.

a. Air compressor electric controller, on ROWPU space port bulkhead near compressor, indicates status of compressor as either START, STOP, AUTOMATIC, or MANUAL (Figure 12-3).

b. Receiver pressure gauge, located on top side forward of air receiver, indicates amount of pressure in air receiver.

c. Oil sight glass on compressor indicates oil level in compressor.

d. Air regulator pressure gauge 1, on workshop port bulkhead, indicates air pressure as regulated by pressure regulator 1. Normal reading should be 40 psi for air station 8 forward seachest blowdown.

e. Air regulator pressure gauge 2, on ROWPU space aft bulkhead near port bulkhead, indicates air pressure as regulated by pressure regulator 2. Normal reading should be 40 psi for air station 9 generator cooling water seachest blowdown.

12-8 Prestart procedures Prestart procedures include before operation checks and procedures.

12-8.1 Startup after extended shutdown. Refer to paragraph 12-10.2 for extended shutdown information.

a. Check system components for loose wires. Make sure fittings are tight, gauges are dean and have intact glass faces. Check pipes for leaks. Repair or replace as necessary.

b. Check oil level in sight glass on compressor as follows:

(1) Barge 1 (Figure 12-4). Oil should be visible in lower half of sight glass. If oil cannot be seen in sight glass, remove oil cover nut in center of air intake assembly. Carefully pour not more than one pint of oil into oil tube. Do not spill oil onto air filter assembly. Continue to add oil one pint at a time until oil level is between bottom and halfway mark on sight glass. Do not overfill. Use only non-detergent oil, SAE 10W, API classification CD or SF, or MIL-L-2104 or MIL-L-46152.

CAUTION

On Barges 2 and 3 air compressors, NEVER allow oil level to fall more than 1/8 Inch below full level mark on sight glass.

(2) Barges 2 and 3, (Figure 12-5). Oil should be up to full level mark on sight glass. If not, unscrew oil plug to left of sight glass and add a non-detergent, rust and oxidation inhibiting industrial oil with viscosity equivalent to an SAE grade 20 weight motor oil. See page 5, Form 5S 1408, Operating and Service Guide for Dayton Speedaire Models, for recommended oils by brand name and designation. Add oil until it reaches full level mark on sight glass. DO NOT OVERFILL. Replace oil filler plug.

c. Close compressed air main supply valve on forward end of receiver by turning handle at right angle to pipe.

d. Drain air filters 1 and 2 by opening drain valves on bottom of filters (Figure 12-7). When water and moisture have drained, close drain valves.

WARNING

When bleeding pressure from air compressor drain cock ALWAYS use protective shield to protect eyes and face from flying particles. Wear gloves and avoid skin damage by closing buttons and collars and by rolling down shirt sleeves on work clothing.

e. Drain receiver by turning drain cock clockwise (small T-handle) on bottom of tank (Figures 12-4 and 12-5). When draining is complete, dose valve.

f. Turn adjusting screw on bottom of pressure regulators 1 and 2 counterclockwise until screw turns freely (Figure 12-6).

g. Check that air station valves 1 thru 9 are dosed.

h. Make sure switchboard circuit breaker P5 is dosed (ON) to provide power to power panel 1.

i. Make sure power panel 1 circuit breaker 3P5 is dosed (ON) to provide power to air compressor electric controller.

j. Turn controller AUTO MANUAL switch to MANUAL (Figure 12-3).

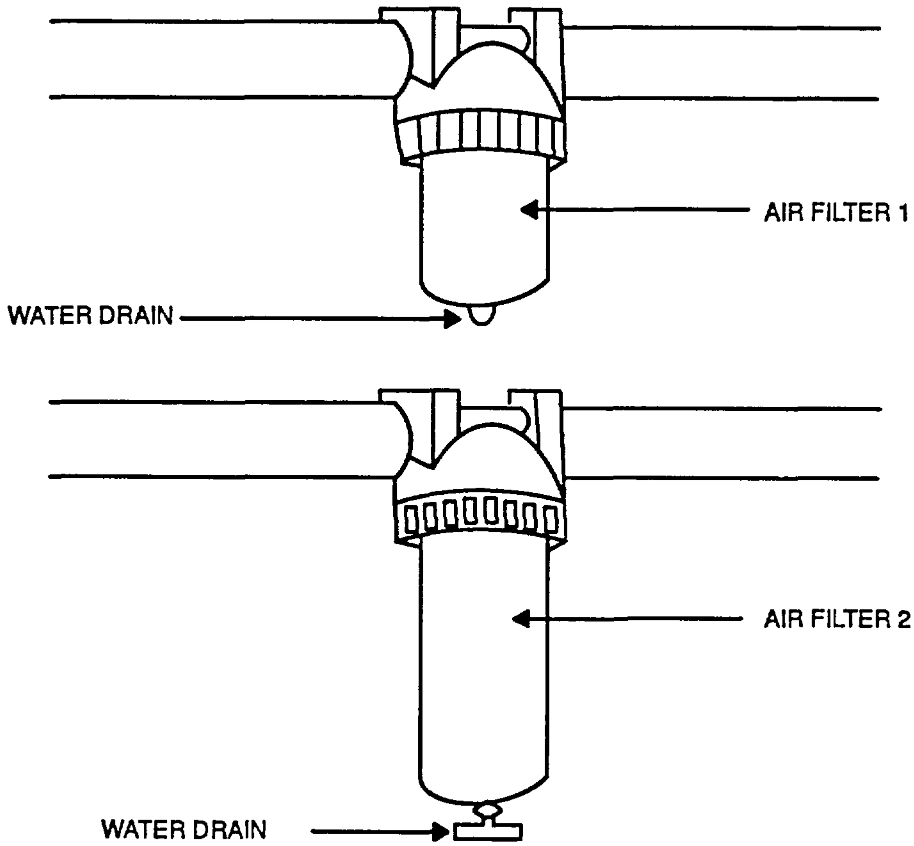


Figure 12-7. Exterior View of Air Filter 1 and Air Filter 2

WARNING

DO NOT leave air compressor unattended when controller is set to MANUAL mode of operation.

k. Push controller ON-OFF main switch ON (Figure 12-3).
l. Push controller START button (Figure 12-3).

WARNING

Never allow air pressure to reach more than 155 psi as shown on receiver pressure gauge.

m. When receiver pressure gauge reads 155 psi, push controller STOP button.
n. Open main supply valve by turning handle parallel with pipe (Figures 12-4 and 12-5).
o. Set pressure regulators 1 and 2 by turning adjusting screw on bottom of regulators to obtain following pressures: regulator 1 and regulator 2 each set to 40 psi. Turn clockwise to decrease air pressure beyond regulator and turn counterclockwise to increase air pressure beyond regulator.
p. Turn AUTO-MANUAL switch to AUTO. Compressor now automatically turns on and off to maintain air pressure in the system.

12-8.2 Startup after temporary shutdown. (Refer to paragraph 12-10.1)

a. Make sure electric controller ON-OFF switch is ON.
b. Turn AUTO-MANUAL switch to AUTO.
c. When receiver pressure gauge indicates 155 psi, open main supply valve by turning handle parallel with pipe.
d. Make sure pressure regulators 1 and 2 indicate 40 psi each. If not, adjust as indicated in step 12-8.1.o.
e. Compressor now automatically turns on and off to maintain air pressure in the system.

12-9 Operating procedures

12-9.1 General. During operations, perform following preventive maintenance checks:

WARNING

System MUST NOT be operated without an operating safety valve.

a. Make sure receiver pressure gauge indicates no more than 155 psi when compressor is set for AUTO. If gauge indicates greater pressure, pull test link on air safety valve. Air should escape from receiver. If air does not escape, replace safety valve by following procedures in TM 55-1930-209-14&P-7. This valve cannot be adjusted or repaired.
b. Make sure air pressure gauges on air pressure regulators 1 and 2 indicate 40 psi. If not, adjust according to step 12-8.1.o.
c. Make sure system is operating normally. When set on AUTO, compressor should cycle on and off to maintain proper air pressure. If not, shut down using extended shutdown procedures in paragraph 12-10.2 and troubleshoot using troubleshooting procedures in Table 4-1 in TM 55-1930-209-14&P-7. Make required repairs/adjustments.
d. Check for damage to pressure gauges, regulators, filters, and compressor/receiver. Repair or replace as necessary.
e. Check pipes for loose or missing fasteners or leaks. Repair or replace as necessary.

12-9.2 Operating compressed air stations 1 thru 5 and 7

WARNING

DO NOT use compressed air to clean clothing or work space. High pressure air turns small particles into dangerous projectiles that may Injure people.

When using compressed air to clean equipment, ALWAYS use protective shield to protect eyes and face from flying particles. Wear gloves and avoid skin damage by closing buttons and collars and rolling down shirt sleeves on work clothing.

a. Connect air hose to compressed air station quick disconnect coupling (Figure 12-8). Open air station air valve by turning counterclockwise.
b. Upon completion, dose compressed air station air valve by turning clockwise.
c. If hose is self-retracting, it may remain attached to quick disconnect coupling. If not self-retracting, remove hose and stow in workshop storage area.

12-9.3 Using air Impact wrench with air stations 1 thru 5 and 7

WARNING

Always wear safety glasses when operating an air impact wrench.

Use only impact wrench sockets. DO NOT use sockets from a hand wrench set.

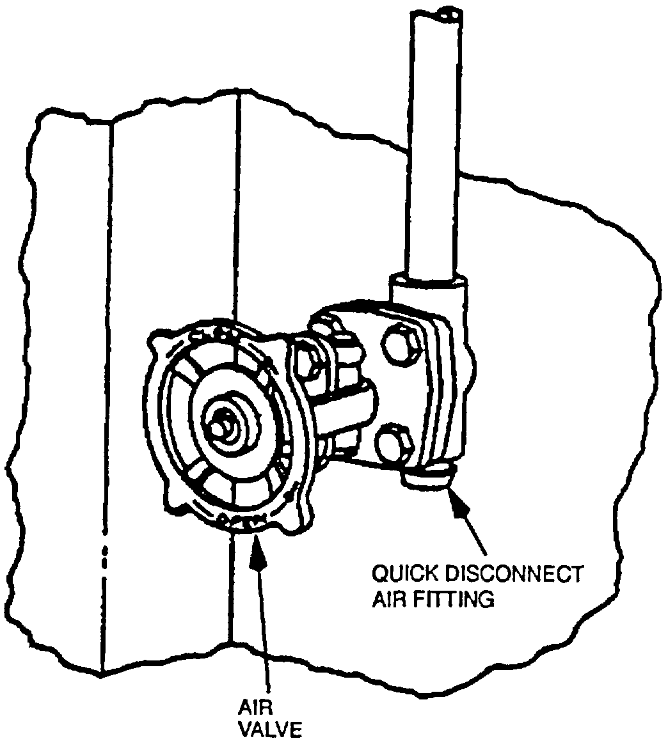


Figure 12-8. Air Station Valve and Quick Disconnect

12-9.3.1 Pre-operational procedures

a. Make sure compressed air system has been purged of moisture within last 4 hours. If not, open draincock on bottom of air filter 1 until all moisture has been drained from system.

b. Select proper sockets for the assigned task. Loose, worn, or cracked sockets reduce wrench impact power and may create a hazard for the operator. When possible, use deep sockets in place of long, springy extension bars which absorb impact. Always use simplest socket hookup possible, as multiple connections reduce available impact.

c. If more than one air hose is necessary to reach the job location, all except the short leader hose to the tool should be 1/2 inch inside diameter. If couplers are used, they must not be directly connected to the wrench air inlet. This makes the tool bulky and unwieldy and puts unnecessary strain on the tool inlet threads.

d. Once a day, before using the wrench, pour about one tablespoon of oil into air inlet. Use a turbine or spindle grade oil with a 100-150 Saybalt Universal Seconds viscosity which contains a rust inhibitor. This oil goes in the air inlet where the hose is connected, not in the oil hole on the side of the wrench body.

e. Make sure air inlet screen is clean and installed in hose adapter.

12-9.3.2 Operating the air impact wrench

a. Turn torque regulator on front of handle to low power position by rotating knurled knob fully clockwise as you look down on the tool from above.
b. Place tool on bolt or nut to be worked and squeeze trigger. Slowly rotate knurled knob counterclockwise until desired power is being applied. If disassembling rusty or other hard to remove bolts/nuts, turn knob fully counterclockwise. If nut/bolt does not start to move in three to five seconds, try other means of removing it.
c. If wrench appears to be losing power, follow troubleshooting procedures in TM 55-1930-209-14&P-7.

12-9.4 Operating compressed air station 6 to power the PIG

CAUTION

Shore discharge hose must remain free of oil and dirt Use only designated 25-foot air hose on compressed air station 6 for supplying compressed air to power PIG through shore discharge hose.

a. Hold a dry, clean white cloth in front of air station 6 air outlet and open air valve by turning valve counterclockwise. Blow compressed air through cloth. Smell air coming out of air valve. If air smells oily or specks of dirt or oil and grease show on white cloth, check oil level in air compressor. If overfilled, drain to authorized level. Change air filter 2 by following procedures in TM 55-1930-209-14&P-7 and again check air quality with white cloth. Continue to troubleshoot and change air filter 2 until air from air station 6 is free of oil smell and stain.
b. Close shore discharge valves SD1 and SD2 by turning clockwise until tight.
c. On PIG launcher insertion point, unlock two quick disconnect couplers and pull cap off insertion tube (Figure 12-9). Insert clean PIG into tube, replace cap, and lock two quick disconnect couplers.
d. Connect designated 25-foot air hose to compressed air station 6 quick disconnect coupling and to compressed air fitting on PIG insertion point cap (Figure 12-9).
e. Make sure PIG receiver has been installed on shore end of shore discharge hose and is ready to receive PIG.
f. Open shore discharge valve SD2 by turning counterclockwise until it stops.
g. Notify all crewmembers not to use any other compressed air stations until PIG has pushed all water out of shore discharge hose.
h. Open compressed air station 6 air valve by turning valve counterclockwise until it stops.

NOTE

PIG normally takes about 15 to 20 minutes to push water out of shore discharge hose.

i. When PIG arrives in PIG receiver onshore, close compressed air station 6 air valve by turning clockwise until it stops.
j. Close valve SD2 by turning clockwise until tight.
k. Disconnect air hose and return to storage.

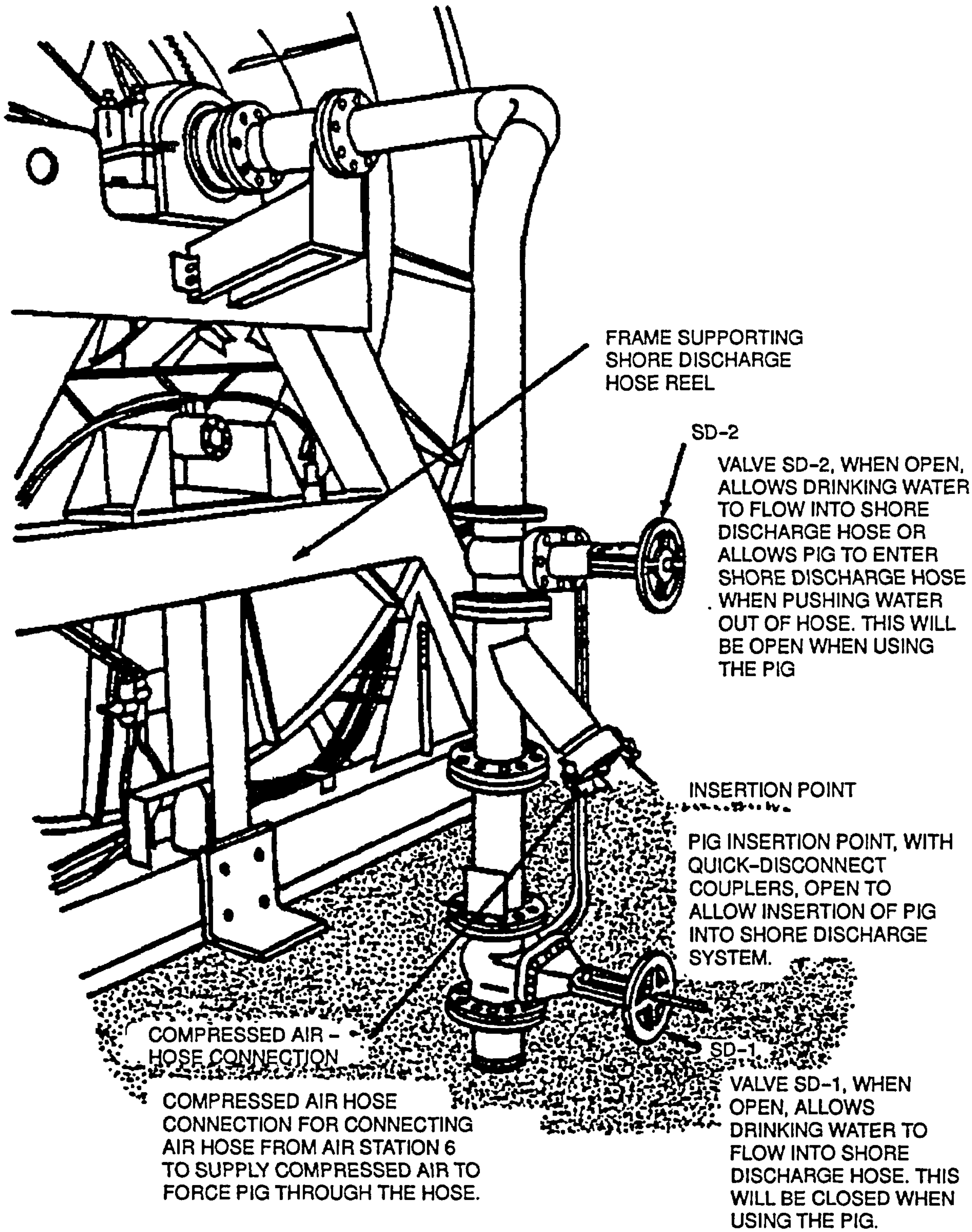


Figure 12-9. PIG Launcher Controls

12-9.5 Operating compressed air system for seachests blowdown

a. Make sure air pressure gauges on air pressure regulators 1 and 2 indicate 40 psi. If not, adjust according to step 12-8.1.o.
b. Follow procedures in TM 55-1930-209-14&P-2 for seachests blowdown.

12-10 Shutdown procedures This section provides temporary and extended shutdown procedures, including after operation preventive maintenance checks and services. Temporary shutdown is for a period of less than 12 hours. Extended shutdown is for a period greater than 12 hours, but less than 7 days If system is to be shut down longer than 7 days, refer to TM 55-1930-209-14&P-7.

12-10.1 Temporary shutdown (less than 12 hours)

a. Turn AUTO-MANUAL switch on electric controller (Figure 12-3) to MANUAL.
b. Push electric controller STOP button.
c. Close main supply valve on forward end of receiver by turning handle at right angles to pipe.

WARNING

When bleeding receiver and air filters 1 and 2, ALWAYS use protective shield to protect eyes and face from flying particles. Wear gloves and avoid skin damage by closing buttons and collars and rolling down shirt sleeves on work clothing.

d. Drain air filters 1 and 2 by opening drain valves on bottom of filters (Figure 12-7). When all moisture has drained, close valves.
e. Open receiver drain cock in bottom of receiver by turning clockwise (Figures 12-4 and 12-5). Allow air and moisture to escape. When all moisture has drained, close valve.
f. .Check oil level in sight glass on compressor as follows:

(1) Barge 1 (Figure 12-4). Oil should be visible in lower half of sight glass. If oil cannot be seen in sight glass, remove oil cover nut in center of air intake assembly. Carefully pour no more than one pint of oil into oil tube. Do not spill oil onto air filter assembly. Continue to add oil one pint at a time until oil level is between bottom and halfway mark on sight glass. Do NOT overfill. Use only detergent oil, SAE 10W, API classification CD or SF, or MIL-L-2104 or MIL-L-46152.

CAUTION

On Barges 2 and 3 air compressors, never allow oil level to fall more than 1/8 Inch below full level.

(2) Barges 2 and 3 (Figure 12-5). Oil should be up to full level mark on sight glass. If not, unscrew oil plug to left of sight glass and add a non-detergent, rust and oxidation inhibiting industrial oil with viscosity equivalent to an SAE grade 20 weight motor oil. See page 5, Form 5S 1408, Operating and Service Guide for Dayton Speedaire Models, for recommended oils by brand name and designation. Add oil until it reaches full level mark on sight glass. DO NOT OVERFILL Replace oil filler plug.

12-10.2 Extended shutdown

a. Perform procedures in paragraph 12-10.1.
b. Pull controller main ON-OFF switch (Figure 12-3) to OFF.
c. Open (OFF) power panel 1 circuit breaker 3P5.

WARNING

When bleeding receiver drain cock, ALWAYS use protective shield to protect eyes and face from flying particles. Wear gloves and avoid side damage by closing buttons and collars and by rolling down shirt sleeves on work clothing.

d. Drain air and water from receiver by opening drain cock on bottom of receiver (Figures 12-4 and 12-5). Turn small handle clockwise until it stops. When receiver pressure gauge reads 0 psi, close drain cock.
e. Open drain valves on bottom of air filters 1 and 2 (Figure 12-7).
f. Open air station valves 1 through 5 and 7 by turning counterclockwise until they stop (Figure 12-8). Leave them open.
g. Make sure air station valves 6, 8, and 9 are closed.
h. Check for damage to pressure gauges and regulators, filters, and compressor/receiver. Repair or replace as necessary.
i. Check pipes for loose or missing fasteners or leaks. Repair as necessary.

12-11 Emergency shutdown

12-11.1 General. The barge has two emergency shutdown modes One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other mode shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard On individual system shutdowns, this button shuts off either fuel or electrical power to that system only. On total shutdown, this button shuts off all fuel and electrical power to all operating systems.

Seven red system shutdown buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These seven emergency system shutoff buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, ship auxiliary generator, ship service generator 1, and ship service generator 2.

Six red total shutdown buttons are:

- On ROWPU space starboard bulkhead aft of personnel door above and forward of row of system shutdown buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck

12-11.2 Emergency shutdown procedures

a. In an emergency, push appropriate red button to shut down either a selected system or all operating systems.
b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in ready position.
c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

CHAPTER 13 ROWPU SYSTEM

Section I. General

13-1 General. The ROWPU system processes seawater or brackish water into drinking water. Normally, this system processes seawater supplied by the seawater system discussed in Chapter 11, and creates product water. Chlorine is then added to this product water by the chlorination system discussed in Chapter 9. The resultant drinking water is discharged into four storage tanks that are part of drinking water system described in Chapter 14.

13-2 System description. The ROWPU system has two identical units, ROWPU 1 and ROWPU 2, that process feedwater (seawater or brackish water from a river or lake) provided by the seawater system discussed In Chapter 11. This ROWPU system produces two products; brine water or dirty water that is dumped overboard and highly filtered nonsaltwater called product water. The product water, with the addition of chlorine from the chlorination system described in Chapter 9, becomes drinking water. Drinking water is pumped either into the drinking water system's four drinking water storage tanks or directly overboard Components of the ROWPU system are listed in Table 13-1. Location of ROWPU 1 components is shown in Figure 13-1 and ROWPU 2 components in Figure 13-2. A block diagram of the ROWPU system is shown in Figure 13-3. Equipment specifications, maintenance information, and manufacturer's service manuals are contained in TM 55-1930-209-14&P-3.

13-3 Component description ROWPU system main components are described below. Main components are shown in figure 13-4. Valves, controls, and indicators are discussed In paragraph 13-9.

13-3.1 Pretreatment skid assembly. The pretreatment skid assembly controls water flow and monitors water processing from the seawater pumps through various cleaning procedures before water is delivered to the HP pumps. This assembly consists of a control station, two chemical metering pumps for adding coagulant and inhibiter, four water pressure gauges, a cartridge filter assembly, interconnecting piping, and valves. Seawater pumps, part of the seawater system, establish the required flow rate through the pretreatment skid, the cartridge filter assembly, and the media filters.

The control station contains electrical circuitry for operating one seawater pump and two chemical metering pump motors. It also mounts the seawater pump OFF/ON/START switch; OFF/ON switch for each chemical metering pump; BACKWASH TIMER; and POWER ON, CARTRIDGE FILTER OK, and MEDIA FILTER OK indicator lights.

The coagulant metering pump is a reciprocating, positive displacement unit designed to move specific volumes of liquid against positive or negative pressure. The pump delivers a manually adjusted dosage of coagulant (Hydrapol-50) into the feedwater stream before the raw water enters the seawater filter (part of the seawater system). The metering pump is on top of the pretreatment skid and the ON/OFF switch is on the control panel. Output capacity is adjustable by a micrometer handknob located on the pump head.

The scale inhibitor metering pump delivers a manually adjusted dosage of scale inhibitor (Hydrapol-100) into the feedwater stream before the filtered water enters the RO block. Pump description, location, and characteristics are the same as the coagulant pump.

Four water pressure gauges across the top of the control station monitor feedwater pressure at critical points in its passage from the seawater pumps to the HP pumps. Pressure gauge P1 indicates pressure going into the media filters. Pressure gauge P2 indicates pressure coming out of the media filters and going into the cartridge filter assembly. Pressure gauge P3 indicates pressure coming out of the cartridge filter assembly. Pressure gauge P5 indicates brine water pressure as it leaves the RO block. Pressure gauge P4, located on the HP pump outlet, measures feedwater pressure in the HP pump discharge line.

The cartridge filter assembly removes any suspended particles that may escape the media filters. The filter assembly housing is constructed of fiberglass and polyvinyl chloride, and contains 12 polypropylene filter elements whose filtration rating is 10 microns. During operation, the differential pressure drop across the cartridge filter assembly may be monitored by subtracting the reading of P3 from P2. A pressure difference of 12 psi or more indicates the need to replace the filter cartridges. Filter replacement is also indicated when the green CARTRIDGE FILTER OK light on the control panel goes out.

Table 13-1. ROWPU System Components*

Component	Quantity	Function	Location
Pretreatment skid assembly	1 per ROWPU	Controls flow of sea-water and chemicals to media filters and cartridge filter assembly. Indicates status of pre-treatment filters	Forward of media filters
Seawater pump flow rate indicator F1	1 per ROWPU	Monitors flow rate of incoming seawater	On pretreatment skid
Pressure gauge P1	1 per ROWPU	Indicates pressure of media filter inlet water (seawater pump discharge)	On pretreatment skid top panel
Pressure gauge P2	1 per ROWPU	Indicates pressure of media filter outlet water and cartridge filter assembly inlet water	On pretreatment skid top panel
Pressure gauge P3	1 per ROWPU	Indicates water pressure at cartridge filter assembly outlet	On pretreatment skid top panel
Pressure gauge P4	1 per ROWPU	Indicates HP pump discharge pressure	On HP pump outlet
Pressure gauge P5	1 per ROWPU	Indicates water pressure upstream of R07	On pretreatment skid top panel
Temperature gauge T1	1 per ROWPU	Monitors incoming sea-water temperature	Aft of pre-treatment skid
Product water flowmeter F2	I per ROWPU	Measures flow of product water to storage tanks	Aft of RO block assembly
Sight glass flow indicator	1 per ROWPU	Indicates presence of water flow from RO block	Brine discharge line
Media filter	3 per ROWPU	Filters water from seawater pump before entering cartridge filter assembly	Between pretreatment skid cartridge filter assembly and HP pump skid
Cartridge filter assembly	1 per ROWPU	Filters water from media filters before it enters HP pump	Mounted on pre-treatment skid
HP pump assembly	1 per ROWPU	Boosts pressure of chemically treated seawater to high level required for RO block processing	Aft of media filters and RO block assembly

Table 13-1. ROWPU System Components (continued)

Component	Quantity	Function	Location
RO block assembly	1 per ROWPU	Processes chemically treated seawater from HP pump	Inboard of media filters
Hydrakleen-20 (55-gallon cleaning agent drum)	1 per ROWPU	Cleans RO membrane elements	Inboard of Hydrapol-50 drum
Chemical metering pumps	2 per ROWPU	Adds measured amounts of chemicals (coagulant aid and inhibitor) to feedwater	On top of pretreatment skid
Hydrapol-50 (55-gallon coagulant drum)	1 per ROWPU	Added to seawater as a coagulant aid before entering media filters	Forward of pretreatment skid
Hydrapol-100 (55-gallon Inhibitor drum)	1 per ROWPU	Added to seawater as a scale Inhibitor before entering cartridge filter assembly	Outboard of Hydrapol-50 drum

* See Table 13-3 for listing of ROWPU system valves.

13-3.2 Media filters. Three identical media filters are provided for each ROWPU. Each filter has a capacity of 120 gpm and all filters are used constantly during water processing. Inlet water is pumped into the top of the filters where it is spread out across the filter media and forced downward through four different kinds of media to the outlet. The top layer consists of a layer of relatively coarse, high density anthracite coal. Below the anthracite is a layer of medium fine silica sand. The next layer is fine garnet and below that Is a layer of coarse garnet which covers the radial laterals of the bottom distributor. These four media rest upon a supporting bed of gravel placed in the bottom of the filter body. Media filters require periodic backwashing to remove minute particles collected from the seawater during normal operation. The need for backwashing is indicated when the difference between pressure gauges P1 and P2 exceeds 35 psi or when green MEDIA FILTER OK light on control panel goes out. Valves on the pretreatment skid control backwashing and flushing Drinking water production must be stopped while backwashing media filters. Because media materials are progressively denser from top to bottom, they rearrange themselves after backwashing to the original layers for correct filtering.

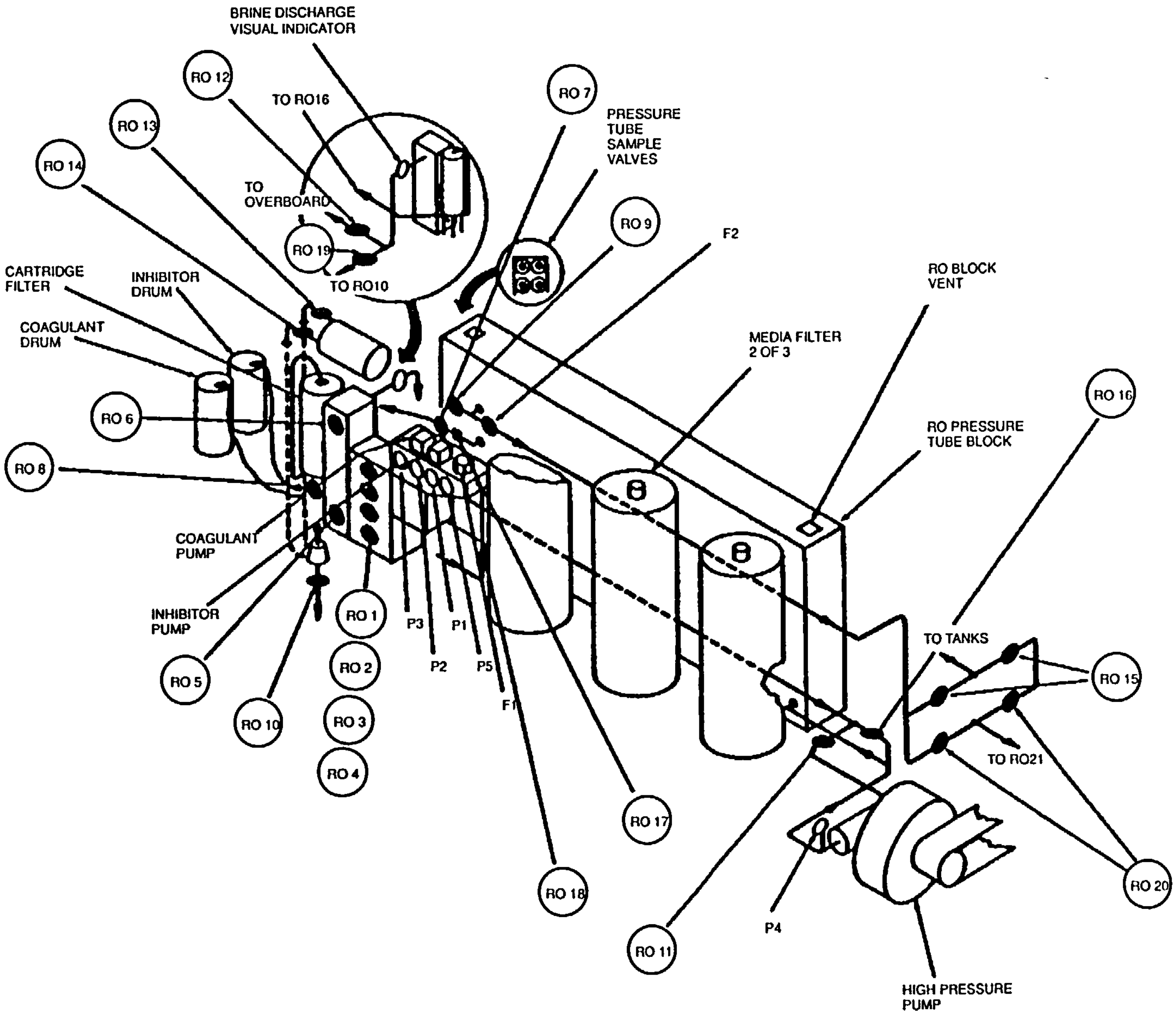


Figure 13-1. ROWPU 1 Installation

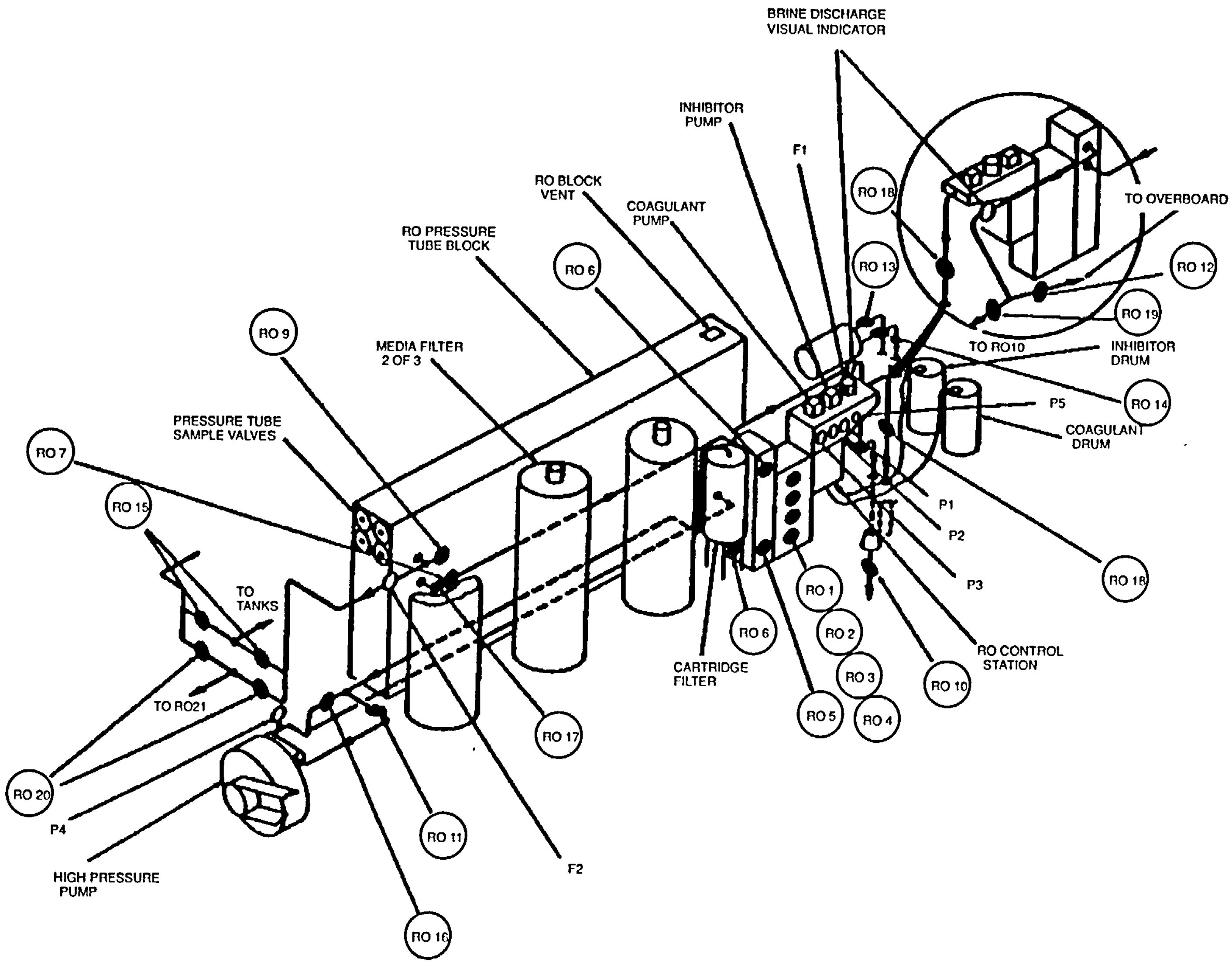


Figure 13-2. ROWPU 2 Installation

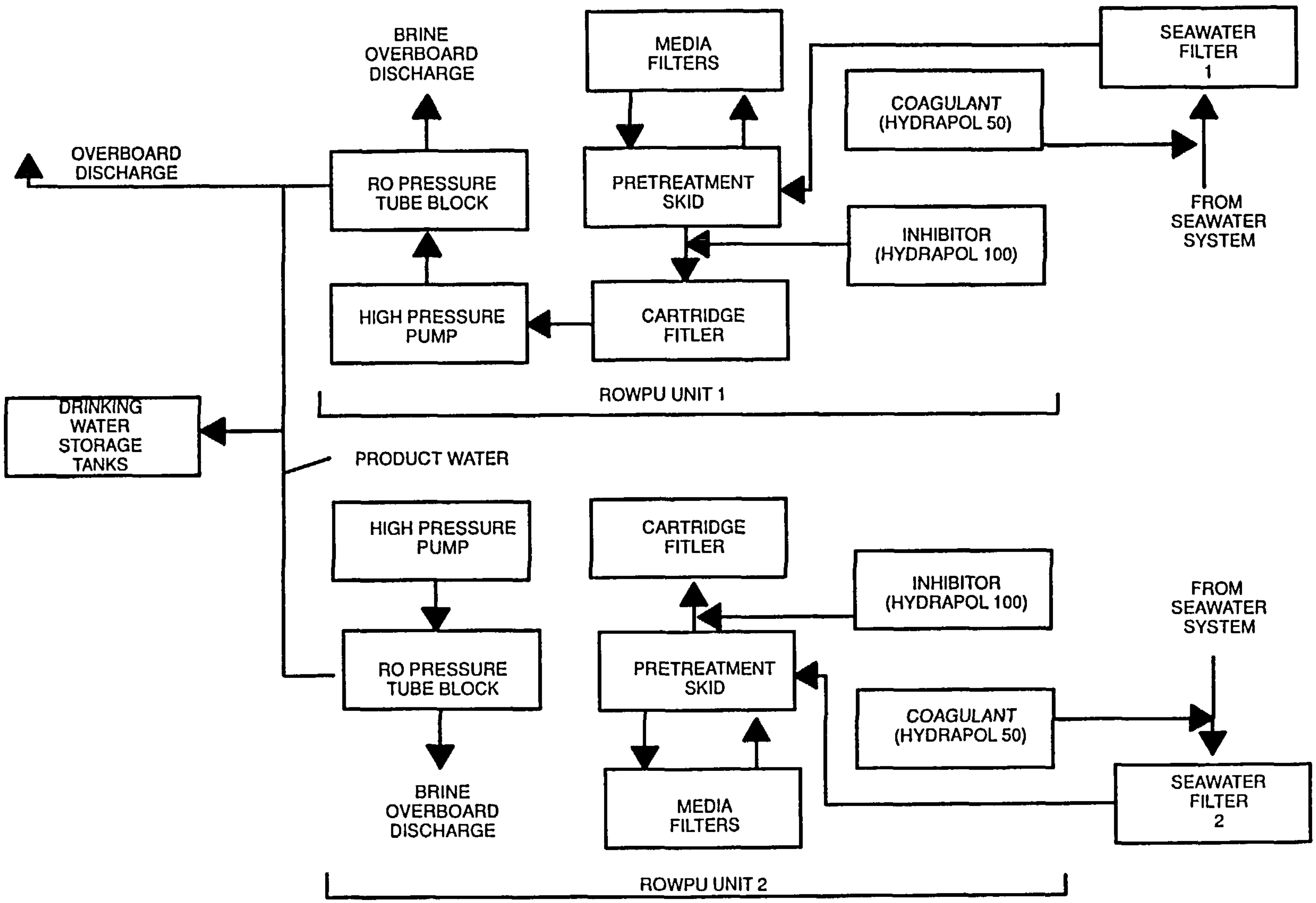


Figure 13-3. ROWPU System Block Diagram

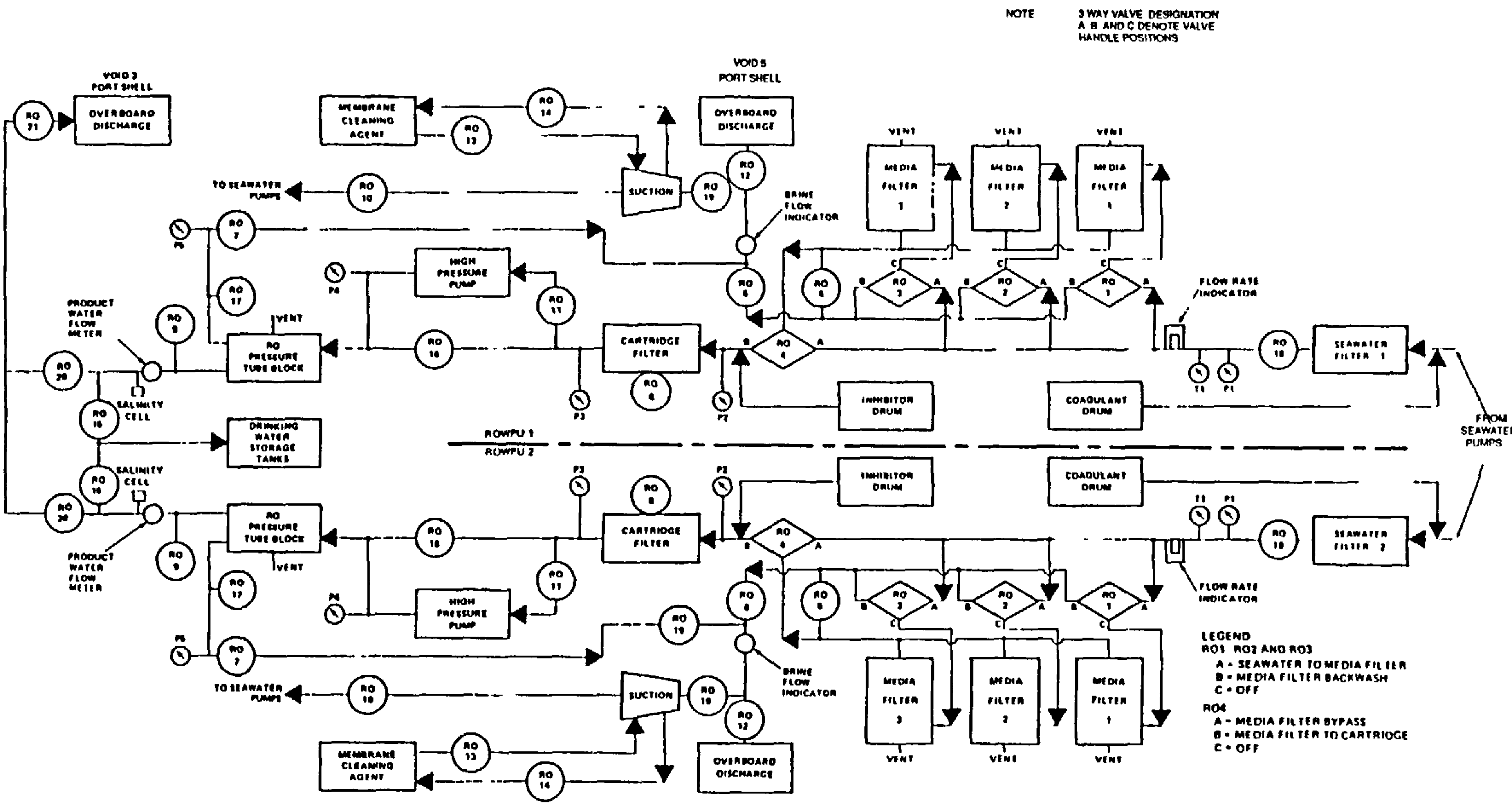


Figure 13-4. ROWPU System Flow Diagram

13-3.3 High Pressure (HP) pump skid. The HP pump skid consists of a steel skid frame with a diesel engine, an HP pump, and a multiple V-belt drive mounted on it. The diesel engine drives the HP pump through the V-bell drive system. The HP pump, in turn, boosts feedwater pressure from the pretreatment skid to the higher pressure required for the reverse osmosis process in the RO block assembly. The skid carries all engine accessory equipment such as batteries, exhaust system, and alternator. Diesel engine controls are mounted on top of the V-belt housing.

13-3.4 Reverse Osmosis (RO) block assembly. The RO block assembly is a steel skid and frame that supports 16 pressure tube assemblies and their associated manifolds and piping. The pressure tubes each hold five RO membrane elements. Sample valves are located at the end of each pressure tube for monitoring water quality. A product water sample valve is also located in the piping leading to the drinking water tanks. A flowmeter measures product water flow. A throttling valve in the brine discharge piping provides a means of controlling product water flow and is adjusted in conjunction with the HP pump output pressure. The HP pump output is adjusted by varying diesel engine speed to increase or decrease seawater pressure flowing to the RO block.

13-4 System Capabilities

24-hr production per ROWPU	150,000 gal
24-hr production (total)	300,000 gal

The above figures are for a production cycle of 10 hours of operating time followed by 2 hours of nonoperating time to accomplish backflushing, cartridge changing, and other maintenance.

13-5 Limitations. Seawater (feedwater) must be free of chlorine, detergents, and other contaminants. In addition, the ROWPU cannot be operated in sea conditions that exceed Sea State 3.

13-6. Performance characteristics

a. Seawater flow rate from seawater pump
   Each ROWPU — 347 gpm

b. Product water flow rate from RO block
   Each ROWPU — 104 gpm

c. Brine flow rate from RO block
   Each ROWPU — 243 gpm

d. Power required
   Each ROWPU — 440 Vac, 3 ph, 60 Hz

Section II. Description of operation

13-7 Reverse Osmosis process. The reverse osmosis process separates clean water from salt water or brackish water. During the natural osmosis process, pure water and saltwater can be separated by a semipermeable membrane In a container at atmospheric pressure. Because of the difference in salt concentration, pure water will naturally diffuse through the membrane and raise the water level in the saltwater side as though pressure were being applied to it. The effective driving force causing this flow is called osmotic pressure. The magnitude of osmotic pressure depends upon the concentration of dissolved solids in the saltwater and the temperature of the water. The greater the concentration of salt in the saltwater and the higher the water temperature, the higher the osmotic pressure. To reverse the natural osmosis process, therefore, pressure is applied to the saltwater side (Figure 13-5). When the applied pressure is greater than the osmotic pressure, purified water diffuses through the semipermeable membrane from the saltwater side to the freshwater side. Thus the term reverse osmosis. To use this principle, feedwater is cleaned by several types of filters and pumped under pressure across semipermeable membranes In the RO block assembly. The resulting purified water, called product water, flows to the storage tanks. The water on the outside of the membrane that now has a higher salt concentration, called brine concentrate, is discharged overboard.

13-8 ROWPU system operation. As shown in Figure 13-3, seawater (feedwater) to be processed by the ROWPU's flows from seawater filters (part of the seawater system) to the pretreatment skid. A flow rate indicator on top of the pretreatment skid monitors the feedwater's degree of cloudiness and flow rate. In addition, incoming water temperature may be read on gauge (T1) located in the line on the supply side of the pretreatment skid three-way valves.

The coagulant pump adds coagulant (Hydrapol-50) to the seawater before it enters the seawater filter. Seawater containing coagulant then flows through the seawater filter to three media filters. The coagulant helps the media filters to remove fine particles and colloids (clouds of fine particles suspended in water). Normally, a dose of 1.0 ppm is adequate. Dosage can be increased, however, if a seawater sample taken at valve RO8 contains more impurities than usual. Dosage is increased by manually adjusting metering pump stroke length and speed.

In the media filters, seawater flows from the top downward. Fine particles and colloids are thus removed from the seawater so it is suitable for processing by the RO block assembly.

Scale Inhibitor (Hydrapol-100) Is added to the seawater as it is discharged from the media filters and collected into a single stream. Scale inhibitor limits formation of scale on the RO block membranes. A dose of 4.0 ppm is added to the seawater by a small, diaphragm type, positive displacement pump similar to the coagulant metering pump. If necessary, however, dosage can be manually adjusted by changing metering pump stroke length and speed.

Seawater containing scale inhibitor then flows through the cartridge filter assembly on pretreatment skid. The cartridge filter assembly removes any particles not removed by the media filters that would be harmful to the HP pump. This filtered seawater then flows to the HP pump where pressure is increased to the 825 psi (maximum) required for reverse osmosis processing in the RO block.

Pressurized seawater enters RO block inlet manifold which divides the water flow among 16 pressure tubes. Each pressure tube separates seawater by reverse osmosis into a high purity product water and a brine concentrate stream. Product water from each pressure tube flows to a common manifold, through a flowmeter, and then through piping to drinking water tanks or overboard. Normal flow rate as indicated on the flowmeter is 104 gpm. The brine stream from each pressure tube also flows to a common manifold from which the brine flows through a throttling valve. This throttling valve allows adjustment of pressure and flow. The adjusted pressure is shown on pressure gauge P5 on the pretreatment skid. Brine is then discharged overboard through the void 5 port shell.

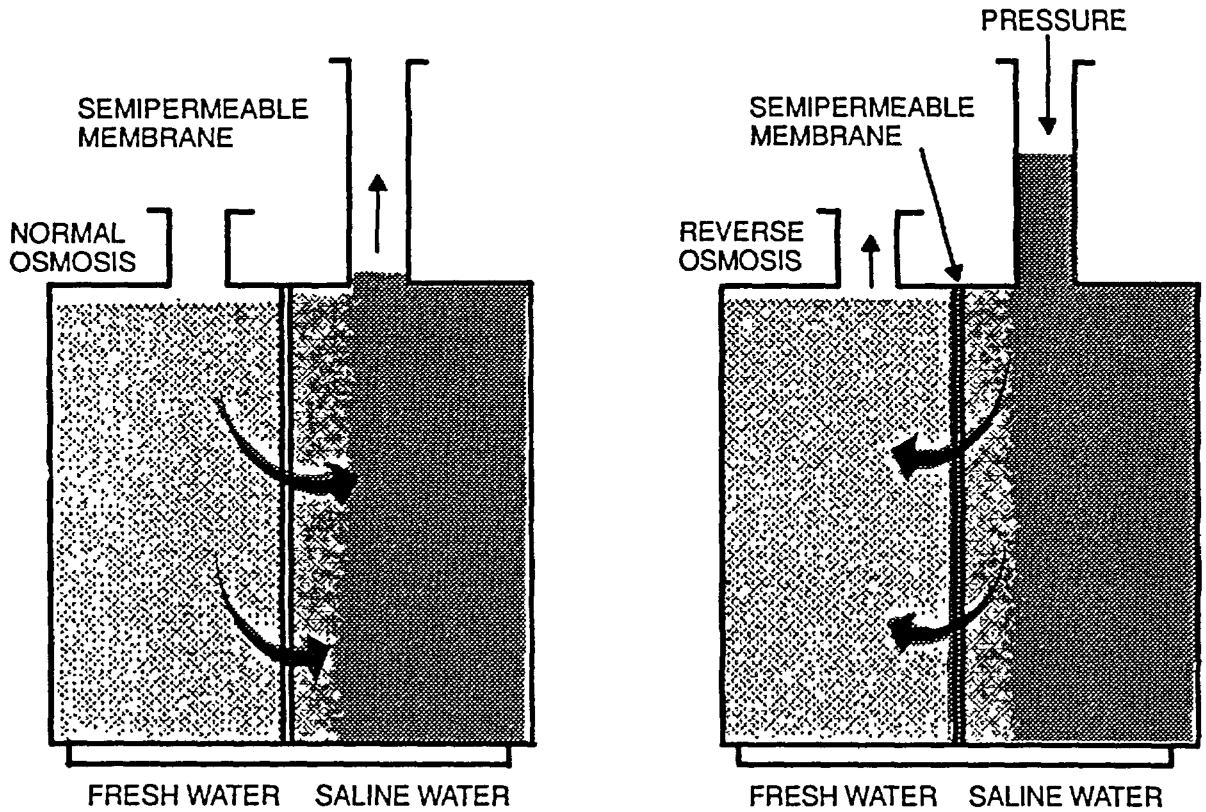


Figure 13-5. Reverse Osmosis Demonstration

While ROWPU is operating, the following items are monitored on designated gauges or on the EMS:

Indication	Gauge no.	Indicator
Product water salinity	-	EMS monitor salinity page
Seawater pump (feedwater) flow rate	F1	Flow indicator
Product water flow rate	F2	Flowmeter
Seawater pump (feedwater) temperature	T1	Temperature gauge
Seawater pump discharge pressure	P1	Pressure gauge
Brine discharge pressure (RO pressure tube block discharge)	P5	Pressure gauge
Media filters output pressure	P2	Pressure gauge
Cartridge filter output pressure	P3	Pressure gauge
HP pump discharge pressure (RO pressure tube block inlet pressure)	P4	Pressure gauge
HP pump diesel engine low oil pressure	-	EMS HP water pumps display page
HP pump diesel engine high cooling water temperature	-	EMS HP water pumps display page

Section III. Operating instructions

13-9 Operating controls and indicators. Information about ROWPU system operating controls and indicators in Table 13-2 are shown in Figures 13-6 thru 13-12. Information about ROWPU system valves, shown in Figures 13-1, 13-2, and 13-4, is In Table 13-3.

Table 13-2. Operating Controls and Indicators

Control/Indicator	Figure	Location
Control station	13-6	Pretreatment skid
Seawater pump discharge pressure gauge P1	13-6	Pretreatment skid, above control panel
Media filters output pressure gauge P2	13-6	Pretreatment skid, above control Panel
Cartridge filter assembly output pressure gauge P3	13-6	Pretreatment skid, above control panel

Table 13-2. Operating Controls and Indicators (continued)

Control/Indicator	Figure	Location
Brine discharge pressure gauge P5	13-6	Pretreatment skid, above control Panel
Seawater pump flow rate indicator F1	13-6	Pretreatment skid, above pressure gauges
HP pump discharge pressure gauge P4	13-7	HP pump discharge line
HP pump diesel engine controls and indicators	13-7	HP pump
Product water flow rate meter F2	13-8	RO block, product water discharge line
Seawater temperature gauge T1	13-9	Pretreatment skid, near valve RO1
Coagulant (Hydrapol-50) metering pump controls	13-10	Pretreatment skid, above pressure gauges
Inhibitor (Hydrapol-100) metering pump controls	13-10	Pretreatment skid, above pressure gauges
Monitoring system SALINITY display page	13-11	ROWPU space forward bulkhead
Monitoring system HIGH PRESSURE WATER PUMPS display page	13-12	ROWPU space forward bulkhead

NOTE

ROWPU 1 controls, Indicators, and valve number designators, such as RO1 or F2, are Identified as 1-RO1 or 1-F2. ROWPU 2 component numbers are preceded by 2-, such as, 2-RO1 or 2-F1.

13-10 Prestart procedures

NOTE

Chlorination system injects chlorine Into ROWPU product water before water enters drinking water storage tanks. If starting ROWPU from a storage or travel status, 4 hours are required for chlorination system to develop sufficient supply of chlorine to treat output from both ROWPU units.

a. Make sure chlorination system is operating and has sufficient chlorine stored in its tanks to treat product water from ROWPU system. If not operating, start up chlorination system according to Chapter 9.

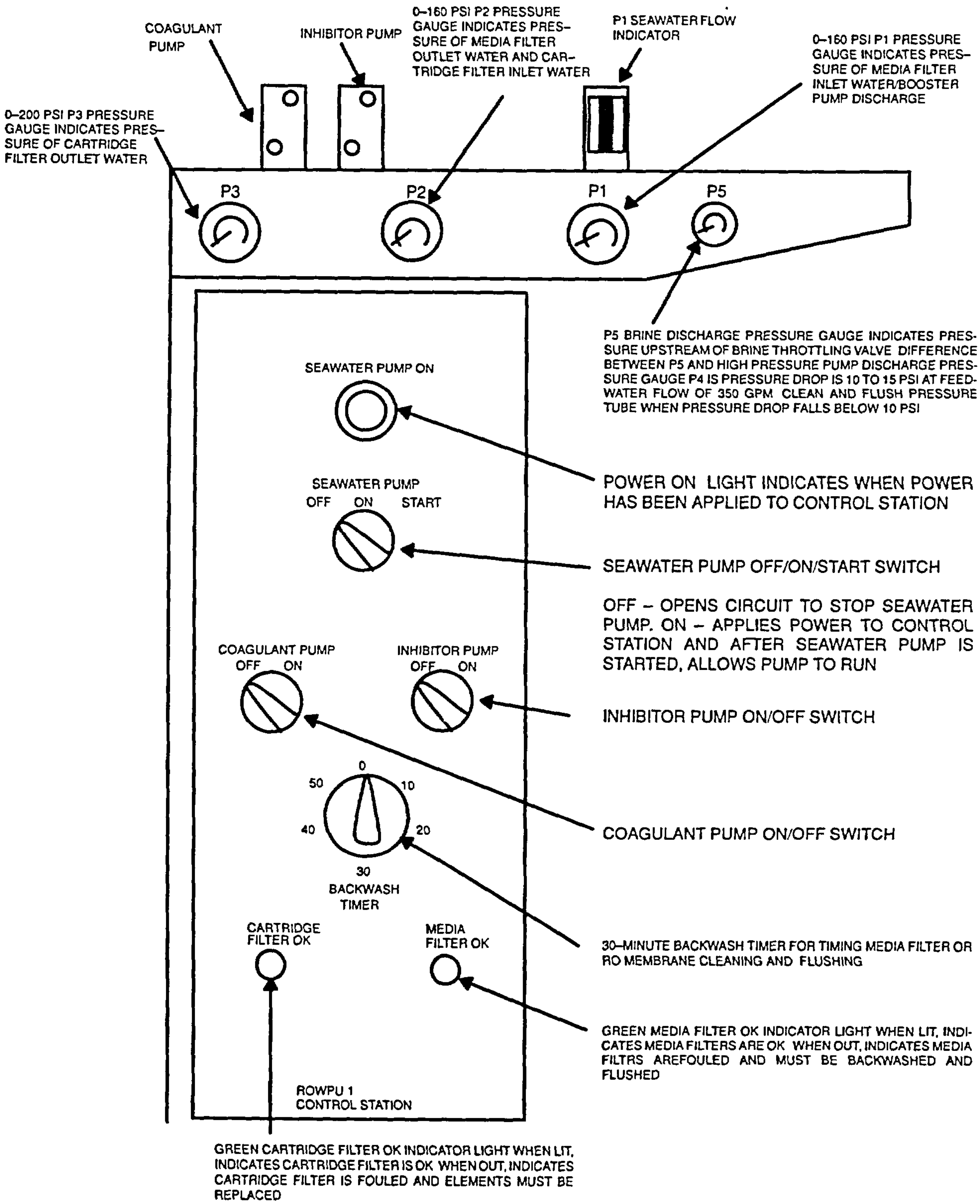


Figure 13-6. ROWPU Control Station (ROWPU 1 Station Shown)

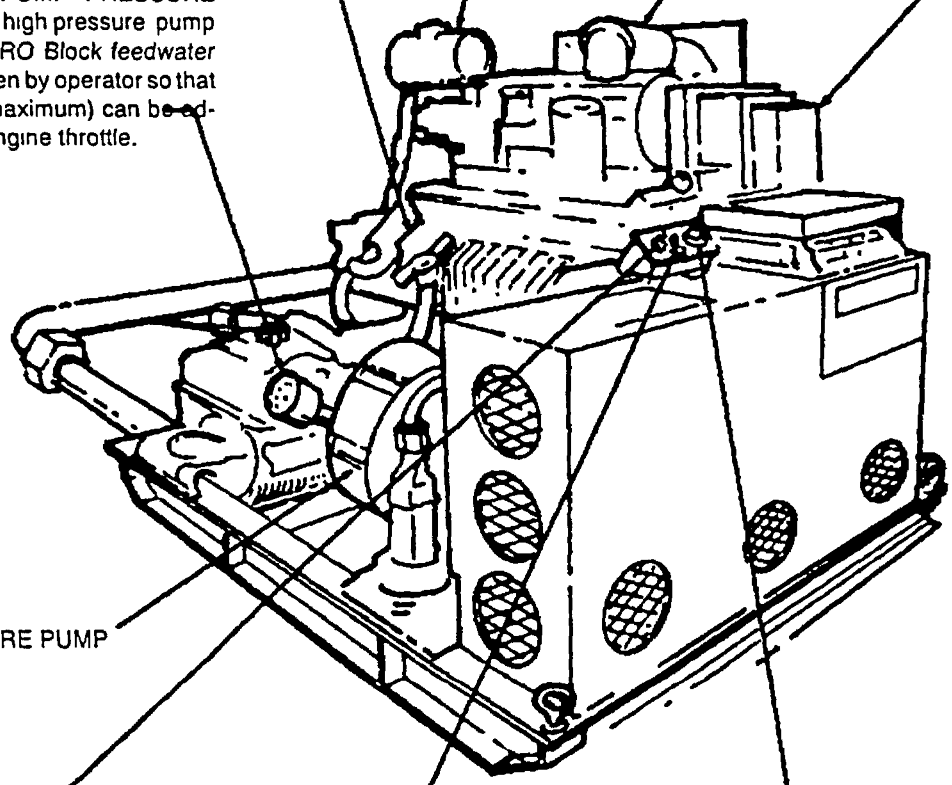
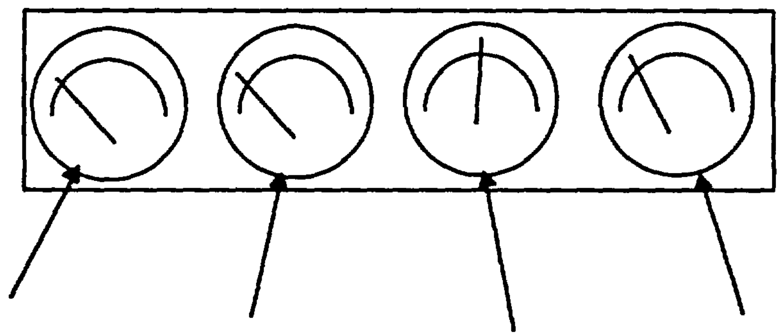


Figure 13-7. HP Pump Diesel Engine Controls and Indicators (Sheet 1 of 2)



OIL PRESSURE GAUGE

WHEN IDLING IN WHITE ZONE WHEN ENGINE IS RUNNING AT RATED SPEED IN GREEN ZONE, STOP ENGINE AT ONCE WHEN IN RED ZONE

WATER TEMPERATURE GAUGE

NORMAL WHEN IN GREEN ZONE STOP AT ONCE IF READING CONTINUES TO RISE INTO RED ZONE

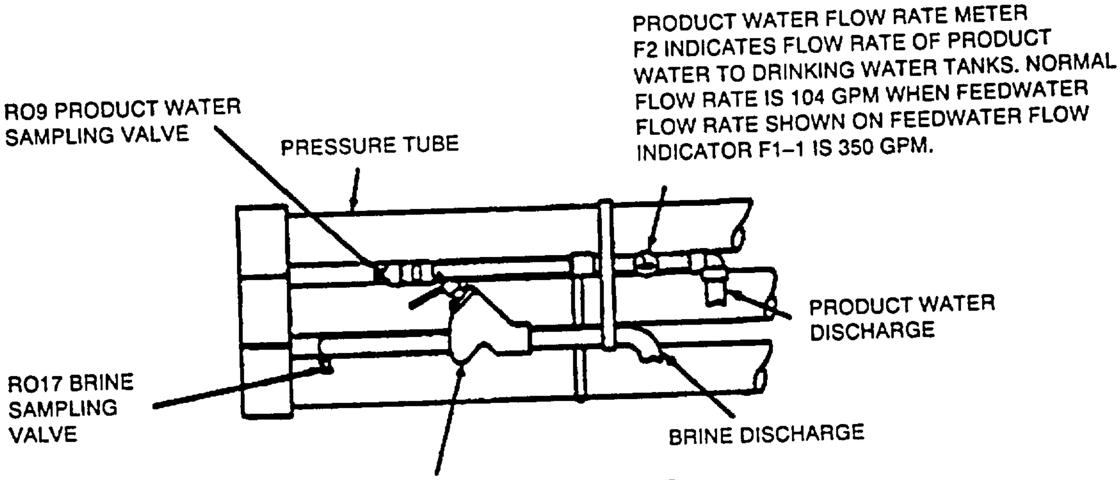
AMMETER

INDICATES BATTERY CHARGING CONDITION. NORMALLY INDICATES SLIGHTLY POSITIVE (NEAR ZERO)

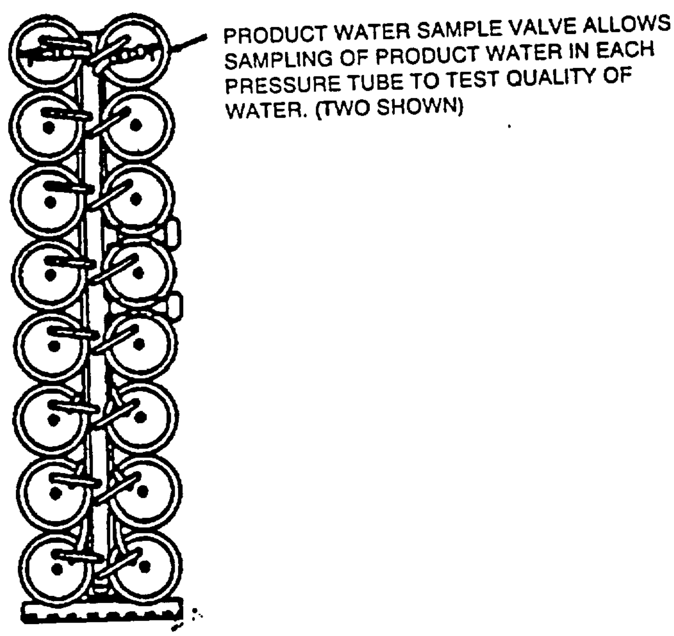
FUEL PRESSURE GAUGE

NORMAL WHEN IN GREEN ZONE WHEN INDICATOR MOVES TO OUT (RED) ZONE, WASH PRIMARY FUEL FILTER AND REPLACE SECONDARY FUEL FILTER ELEMENT.

Figure 13-7. HP Pump Diesel Engine Controls and Indicators (Sheet 2 of 2)



RO BLOCK – LOOKING OUTBOARD FROM CENTERLINE



ROWPU 1 RO BLOCK – FORWARD END LOOKING AFT
ROWPU 2 RO BLOCK AFT END LOOKING FORWARD

Figure 13-8. RO Block Valves and Indicators

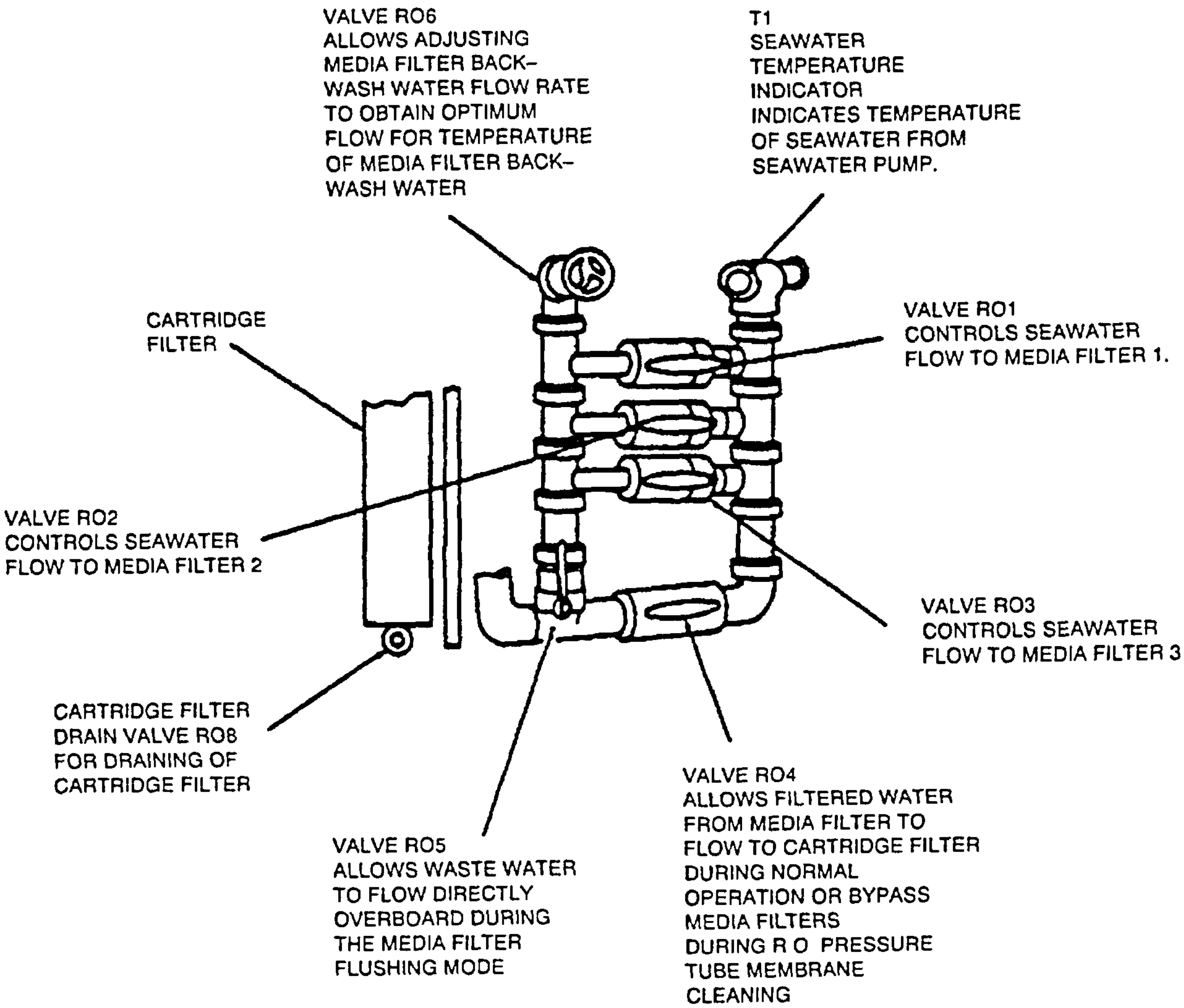


Figure 13-9. Pretreatment Skid Valves and Temperature Indicator

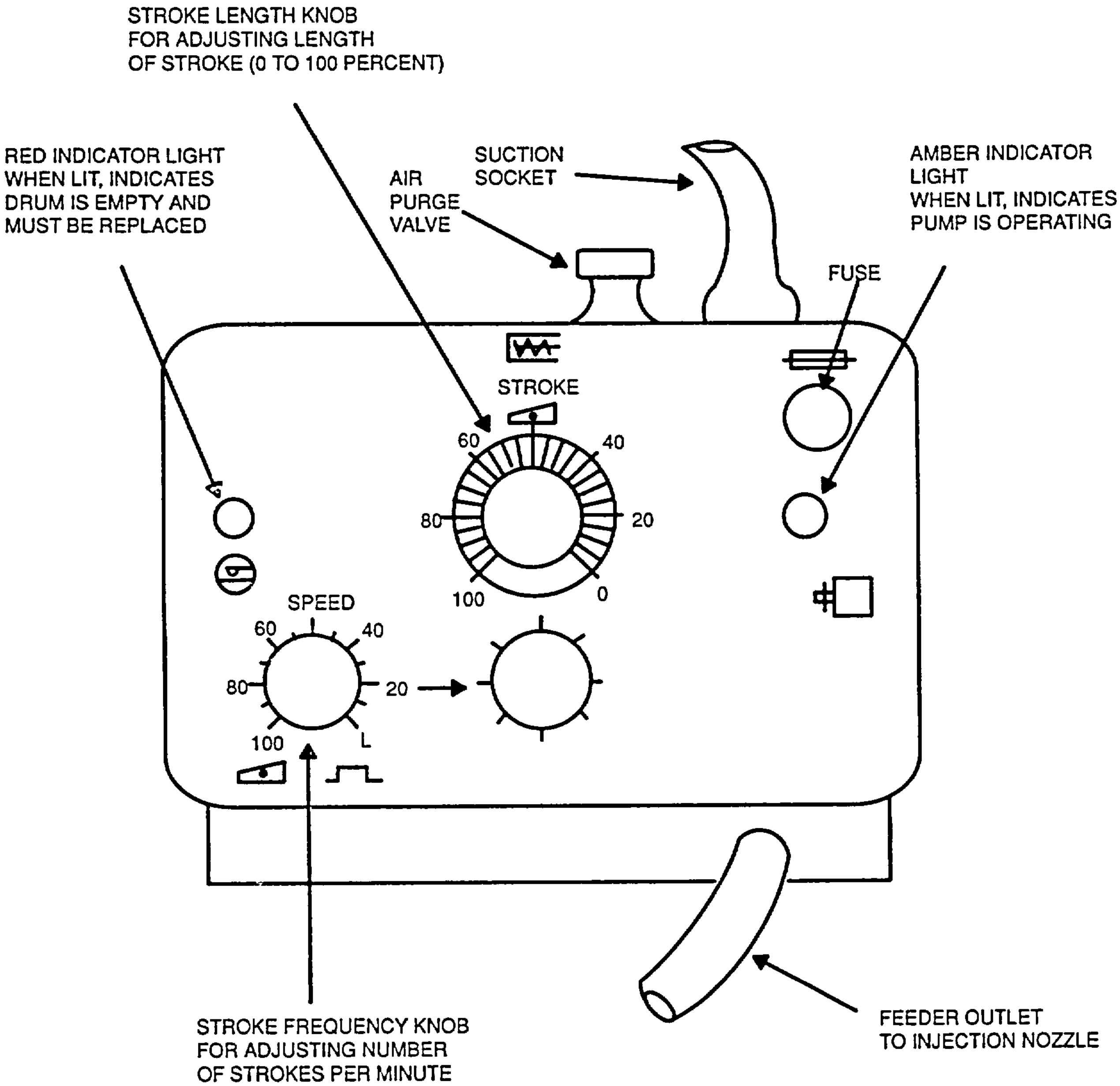
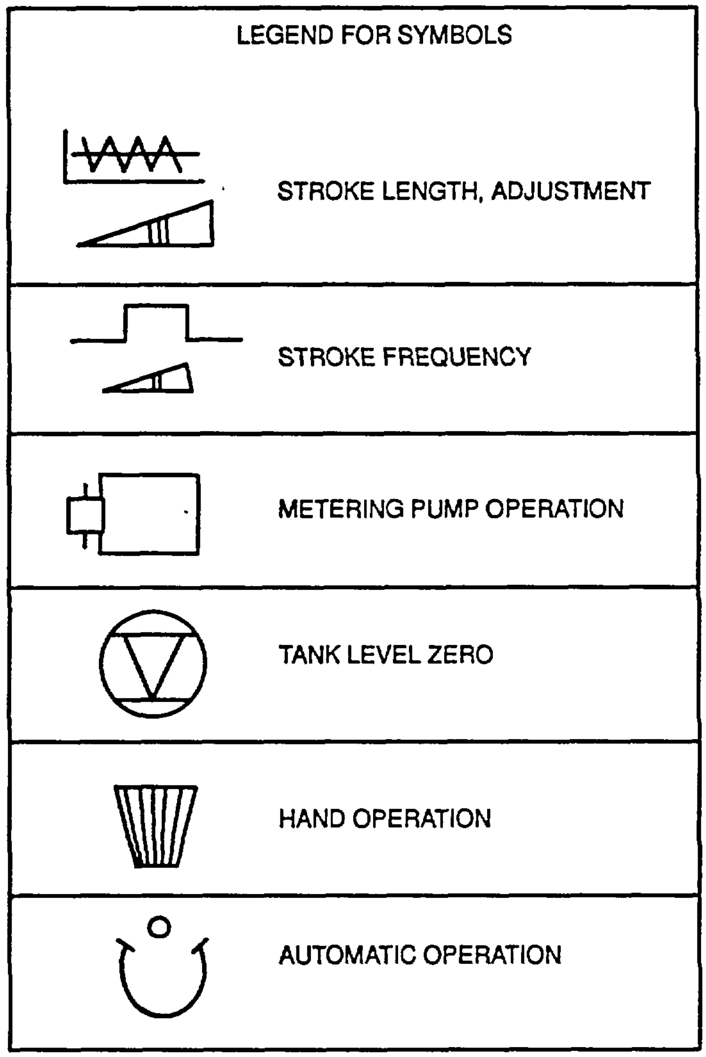


Figure 13-10. Coagulant and Inhibitor Pump Controls (Sheet 1 of 2)



Legend for Control Symbols Located on Inhibitor Pump and Coagulant Covers

Figure 13-10. Coagulant and Inhibitor Pump Controls (Sheet 2 of 2)

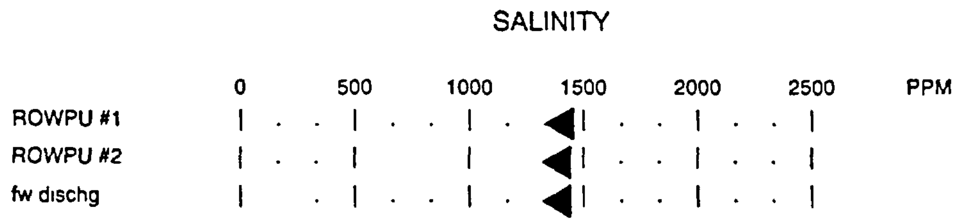


Figure 13-11. Monitoring System Salinity Display Page

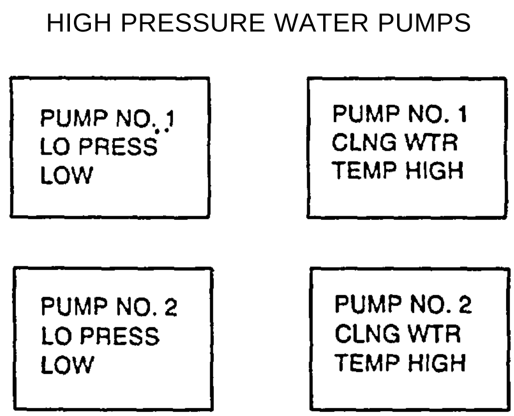


Figure 13-12. Monitoring System High Pressure Water Pumps Display Page

Table 13-3. ROWPU System Valves

Type	Valves	Location	Label Identification and Valve Function
3-in. 3-way ball valve	RO1	ROWPU space - on pretreatment skid ball valve	MEDIA FILTER 1 FLOW; allows seawater to flow to media filter 1 when making product water and when backflushing media filter 1
3-in. 3-way ball valve	RO2	ROWPU space - on pretreatment skid	MEDIA FILTER 2 FLOW; allows seawater to flow to media filter 2 when making product water and when backflushing media filter 2
3-in. 3-way ball valve	RO3	ROWPU space - on pretreatment skid	MEDIA FILTER 3 FLOW; allows seawater to flow to media filter 3 when making product water and when backflushing media filter 3
3-in. 3-way ball valve	RO4	ROWPU space - on retreatment skid	MEDIA FILTERS FLOW; allows seawater from media filters to flow to cartridge filter assembly and HP pump when making product water
2-in. globe diaphragm valve	RO5	ROWPU space - on pretreatment skid	MEDIA FILTER BACKWASH; allows waste water to flow through R06 and RO12 directly overboard during media filter backflushing
3-in. 2-way ball valve	RO6	ROWPU space - on pretreatment skid	MEDIA FILTER BACKWASH FLOW; allows adjusting media filter backflushing water flow to obtain optimum flow
2-in. 2-way throttling valve	RO7	ROWPU space - in brine discharge line	BRINE THROTTLE VALVE; adjusts brine flow rate so that product water is 1/3 of seawater flow. Product water flow is controlled by adjusting valve RO7 and HP pump diesel engine speed
3/4-in. 2-way ball valve	RO8	ROWPU space - bottom of cartridge filter assembly	CARTRIDGE FILTER DRAIN; for taking filtered seawater samples and draining cartridge filter assembly
3/4-in. 2-way ball valve	RO9	ROWPU space - on end of each pressure tube	PRODUCT WATER SAMPLING; for sampling product water in RO block pressure tube
4-in. gate valve	RO10	Void 2 starboard - above seawater pump	MEMBRANE CLEANING SOLUTION RECIRCULATION; allows membrane cleaning solution to recirculate through seawater pumps

Table 13-3. ROWPU System Valves (continued)

Type	Valves	Location	Label Identification and Valve Function
3-in. gate valve	RO11	ROWPU space - in HP pump suction line	CARTRIDGE FILTER TO HIGH PRESSURE PUMP; Allows filtered seawater from cartridge filter assembly to flow to HP pump
3-in. gate valve	RO12	ROWPU space - in-board of pretreatment skid	BRINE TO OVERBOARD DISCHARGE; allows brine to flow overboard from RO block when making product water
3/4-in. 2-way ball valve	RO13	ROWPU space - near membrane cleaning solution drum	MEMBRANE CLEANING SOLUTION RETURN; allows flow of membrane cleaning solution back to drum
3/4-in. 2-way ball valve	RO14	ROWPU space - near membrane cleaning solution drum	MEMBRANE CLEANING SOLUTION INPUT; allows membrane cleaning solution to flow from drum
3-in. gate valve	RO15	ROWPU space - be-tween RO block and HP pump	PRODUCT WATER TO STORAGE TANKS; allows product water from RO block to flow to drinking water storage tank
3-in. gate valve	RO16	ROWPU space - between RO block and HP pump	HIGH PRESSURE PUMP BYPASS; allows flow of membrane cleaning solution to RO block bypassing HP pumps
1/4-in. 2-way ball valve	RO17	ROWPU space - in brine discharge piping near valve RO7	BRINE SAMPLING; for taking samples of brine output from RO block
3-in. gate valve	RO18	ROWPU space - in pretreatment skid seawater Input piping	SEAWATER TO ROWPU; allows flow of seawater to ROWPU pretreatment skid
3-in. gate valve	RO19 (Barges 2 and 3 only)	ROWPU space - inboard of pretreatment skid	MEMBRANE CLEANING SOLUTION RECIRCULATION; during RO block membrane cleaning, allows cleaning solution to recirculate through seawater pump
3-in. gate valve	RO20 (Barges 2 and 3 only)	ROWPU space - between RO block and HP pump	PRODUCT WATER TO OVERBOARD; allows flow of product water from RO block to overboard
4-in. gate valve	R021 (Barges 2 and 3 only)	Void 3 port shell	PRODUCT WATER OVERBOARD DISCHARGE; allows product water from RO block and RO 20 to flow overboard

b. Before operating any ROWPU system, check system for damage and perform following before operation checks:

(1) Wipe components dean, especially pressure gauges, flowmeters, indicators, and control panels.

(2) Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report uncorrectable leaks to shift leaders so repairs can be made.

(3) Check for physical damage and broken welds, especially to pressure gauges, flowmeters, indicators and control panels. Notify shift leader of any damage affecting normal operations.

(4) Check for loose or missing securements and fasteners. Tighten or replace as necessary.

(5) Check wiring for loose connections and frayed cables. Tighten or replace as necessary.

(6) Make sure chemical metering pump hoses are properly connected to pumps and drums. Check tubing and connections for leaks and cracks.

(7) Make sure coagulant and inhibitor drums contain at least 2 to 3 gallons of liquid. If not, replace drums according to paragraph 4-14.1.3 in TM 55-1930-209-14&P-3.

(8) Make sure membrane cleaning agent (Hydrakleen-20) drums are full. If not, replace drums according to paragraph 4-14.4.3 in TM 55-1930-209-14&P-3.

(9) Make sure media filters are ready for normal operations. If necessary, backwash and flush filters according to paragraph 4-14.2 in TM 55-1930-209-14& P-3.

(10) Make sure RO pressure tube block membranes are ready for normal operations. If necessary, clean and flush membranes according to paragraph 4-14.4 in TM 55-1930-209-14& P-3.

(11) Make sure cartridge filter is ready for normal operations. If necessary, change cartridge cage assembly according to paragraph 4-14.1.1 in TM 55-1930-209-14 & P-3.

(12) Check diesel-driven HP pump as follows:

(a) Check engine crankcase oil level (Figure 13-13). If necessary, add oil (OE/HDO-15/40) until oil level is between FULL and ADD on dipstick.

(b) Check pump lubricant level in sight glass (Figure 13-13). If necessary, unscrew oil breather and add Mobil Delvac, or equivalent, oil until oil level is between MAX and MIN marks on oil level gauge.

(c) Check power takeoff oil level (Figure 13-13). If necessary, add oil.

WARNING

At operating temperatures, engine coolant is hot and under pressure. It also contains alkaline materials harmful to eyes and skin. To avoid personal Injury, check coolant level only when engine is stopped and radiator cap is cool enough to be touched with a bare hand. Should engine coolant come in contact with eyes or skin, immediately flush affected area with clean water and seek medical assistance If necessary.

(d) Check coolant level. When engine is cool, slowly open coolant tank filler cap. Inspect filler cap gasket. Replace if damaged. Add coolant if necessary and install filler cap.

(e) Check air cleaner condition. If service indicator red piston is locked in raised position, service the air cleaner. Indicator is in lower comer of air cleaner on the side next to the engine. For servicing instructions, see TM 55-1930-209-14& P-3.

(f) Check fuel oil day tank supply by checking liquid level indicator. If necessary, fill day tank according to TM 55-1930-209-14& P-8.

(g) Check alternator belt for general condition and tension. If frayed, cracked, or loose, maintain or replace according to instructions in TM 55-1930-209-14&P-3.

(h) Check tension on V-belts driving the pump. If they appear to be cracked, frayed, or slack, maintain or replace according to instructions in TM 55-1930-209-14&P-3.

(i) Check battery fluid level. Add fluid if necessary. Make sure that all electrical connections are clean and tight and that batteries are dean and secured.

(j) Check diesel engine and HP pump for leaks, general cleanliness, and placement and tightness of guards.

NOTE

Seawater system provides seawater (feedwater) to ROWPU's 1 and 2 for processing into product water.

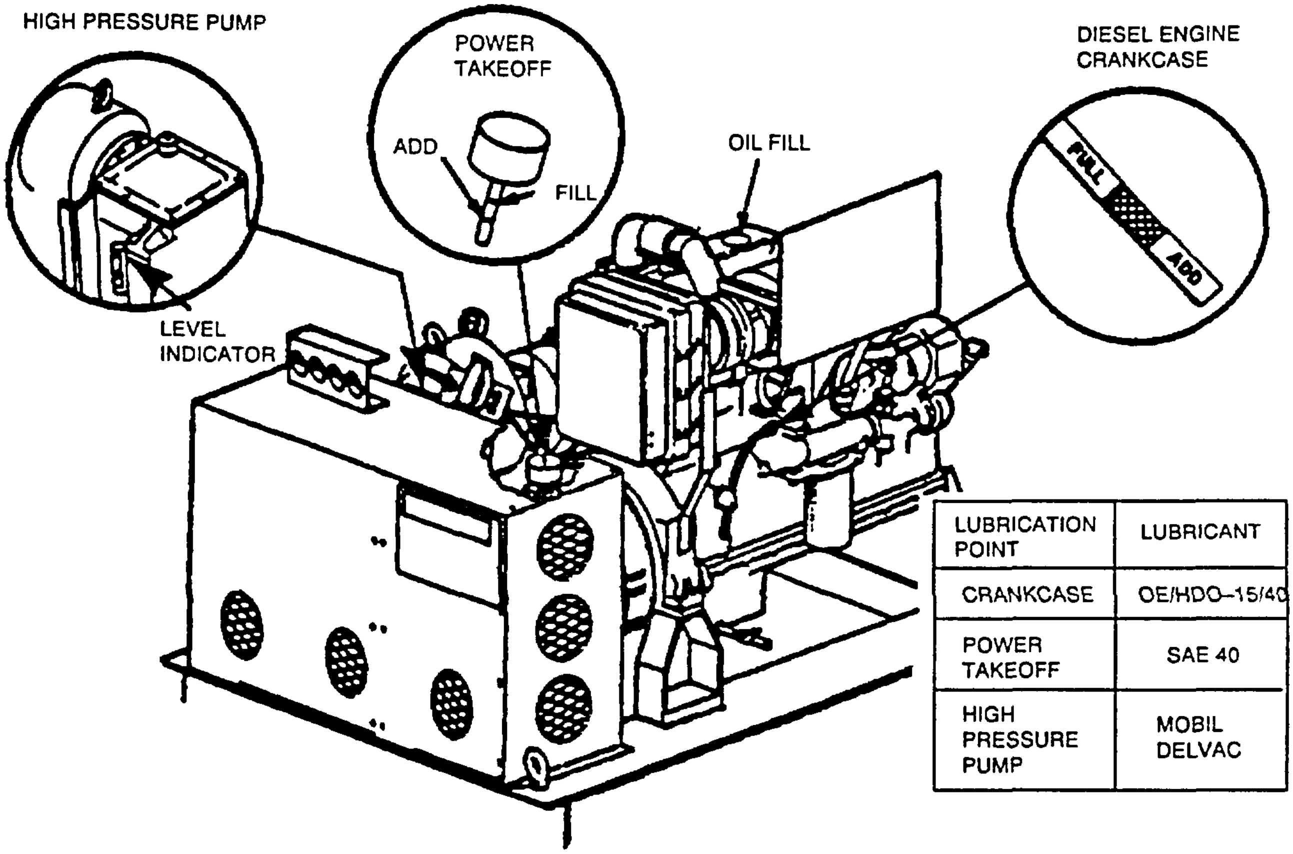
c. Make sure seawater system is ready for operation by ensuring that strainers are clean and that filters have been drained. Set seawater system valves to provide seawater to either ROWPU 1 or 2 according to Chapter 11.

NOTE

EMS monitors ROWPU's 1 and 2, product water salinity and HP pump diesel engine, cooling water temperature, and oil pressure.

d. Make sure EMS is operating normally. If not, start up according to Chapter 8.

LUBRICATION



LUBRICATION POINT	LUBRICANT
CRANKCASE	OE/HDO–15/40
POWER TAKEOFF	SAE 40
HIGH PRESSURE PUMP	MOBIL DELVAC

Figure 13-13. High Pressure Diesel Pump Lubrication

13-11 Operating procedures

13-11.1 General. ROWPU's 1 and 2 are normally started on a staggered schedule with at least 2-hour interval separating startup of the two units. After each unit operates for 10 hours, it is shut down for 2 hours for required maintenance such as membrane cleaning, media backflushing, and cartridge filter changing. This staggered startup keeps product water flowing ashore and keeps the barge workload within the capabilities of crew complement required to maintain a continuous 24 hour operation.

13-11.2 Startup procedures

a. Perform prestart procedures in paragraph 13-10.

NOTES

Valves are positioned Initially to bypass the HP pump and to discharge seawater (feedwater) overboard. As soon as the flow is satisfactory, flow is directed through HP pump.

The RO valves are Identified in Figures 13-1,13-2, and 13-4 and Table 13-3.

b. Position RO valves as shown in table below. Make sure valve RO7 is fully open.

o = open x = dosed A = position A B = position B

RO valve no.	1	2	3	4	5	6	7	8	9	10	
Valve position	A	A	A	B	x	x	o	x	x	x	
RO valve no.	11	12	13	14	15	16	17	18	19	20	21
Valve position	x	o	x	x	x	o	x	o	x	o	o

CAUTION

Do not start seawater pumps until seawater valves are positioned to supply seawater to ROWPU's and RO valves are positioned to bypass HP pump and discharge feedwater through void 5 port overboard discharge.

c. Start seawater pump by turning OFF/ON/START switch (Figure 13-6) to START. When pump starts, release switch. Switch will return to ON position.

d. Check appearance of feedwater in seawater pump flow rate indicator, F1 (Figure 13-6).
   (1) If feedwater is not too dirty (cloudy), go to step e.
   (2) If water is very dirty, stop pumps. Make sure seawater strainer is clean and seawater filter has been drained.
   (3) Repeat steps c and d.

e. Start coagulant pump by turning coagulant pump ON/OFF switch (Figure 13-6) to ON.
   (1) Set pump stroke to 50 and speed control to 35 on coagulant pump control panel (Figure 13-10).
   (2) Make sure amber indicator light comes on (Figure 13-10). If amber indicator lamp does not light (Figure 13-10), troubleshoot according to Table 4-1 in TM 55-1930-209-14 & P-3.
   (3) Make sure red indicator light does not come on. if red indicator light comes on, replace coagulant drum according to paragraph 4-14.1.3 in TM 55-1930-209-14&P-3.

f. Start inhibitor pump by turning inhibitor pump ON/OFF switch (Figure 13-6) to ON.
   (1) Set pump stroke control to 100 and speed control to 46 (Figure 13-10).
   (2) Make sure amber indicator light comes on. If amber indicator lamp on control panel does not light (Figure 13-10), troubleshoot according to Table 4-1 in TM 55-1930-209-14&P-3.
   (3) Make sure red indicator light does not come on. If red indicator light comes on, replace inhibitor drum according to paragraph 4-14.1.3 in TM 55-1930-209-14&P-3

NOTE

As media filters fill up, vent valves on top of each filter may spew air and water until filters are filled with water. Valves automatically close when filters are full. These valves may open at any time during operation if air accumulates in media filters.

g. Ensure that vent valves close when media filters are full of water.
h. Check MEDIA FILTER OK indicator light (Figure 13-6).
   (1) If light is on, go to step i.
   (2) If light is out, check pressure readings on seawater pump discharge pressure gauge P1 and media filters outlet pressure gauge P2.
   (3) If pressure difference exceeds 35 psi, backwash and flush media filters according to paragraph 4-14.2 in TM 55-1930-209-14 & P-3.
   (4) If difference is less than 35 psi, check bulb. Replace if burned out
i. Check CARTRIDGE FILTER OK indicator light (Figure 13-6).
   (1) If light is on, go to step j.
   (2) If light is out, check pressure difference between media filters outlet pressure gauge P2 and cartridge filter outlet pressure gauge P3.
   (3) If pressure difference exceeds 12 psi, change cartridge cage assembly according to paragraph 4-14.1.1 in TM 55-1930-209-14& P-3.
j. Check flow rate on seawater pump flow rate indicator F1 (Figure 13-6).
   (1) If flow rate is near 350 gpm, go to step k.
   (2) If flow rate is very much less than 350 gpm, make sure seawater valves are fully open or completely dosed as specified in seawater systems operations procedures in Chapter 11.
   (3) Make sure seawater strainer and seawater filter are not dogged.
   (4) Repeat step j.
k. Open valve RO11 to allow feedwater from cartridge filter to flow through HP pump.
l. Close valve RO16 to prevent HP pump discharge water from flowing back to cartridge filter.
m. Make sure valves RO20 and R021 are open to allow product water from RO block to flow directly overboard through port shell overboard discharge in void 3.

n. Make sure valve RO15 is dosed to prevent water from flowing to drinking water storage tanks.

CAUTION

The HP pump may be damaged if run dry. Since flow from the seawater pump primes HP pump, never start HP pump unless seawater pump is on and feedwater is flowing to HP pump. Cartridge filter output pressure gauge P3 must show 20 psi minimum. Do not apply throttle when starting engines.

o. Start HP pump (Figure 13-7, 1 of 2).
  (1) Set speed control to idle position, full forward.
  (2) Pull shutdown (kill) lever out to start position and hold while rotating START switch to the right. Hold shutdown lever out until oil pressure builds up in engine and holds shutdown lever in out position.
  (3) If engine does not start in 30 seconds, release START switch and wait 2 minutes for starter to cool before trying again.
  (4) After engine starts:
    (a) Release starter switch.
    (b) Continue to hold shutdown lever out until it stays in run position.
    (c) Allow engine to idle for 3-5 minutes or until all systems reach operating temperatures.
    (d) Check gauges on side of speed control (Figure 13-7, 2 of 2) for readings listed below.

Gauge	Initial reading
Oil pressure	Out of red zone (oil pressure should rise within 15 seconds after engine starts). Will indicate normal (green) range when engine is running at rated speed.
Water temperature	Will rise out of white zone into green zone as engine continues to idle.
Ammeter	Slightly positive near zero
Fuel pressure	Normal (green) range. If indicator registers below 20 psi (red zone), wash primary fuel filter and replace with secondary fuel filter element

p. When gauges indicate acceptable (normal) readings, slowly increase engine speed by turning speed control counterclockwise until seawater pump flow rate indicator F1 reads 350 gpm (Figure 13-6).

q. Make sure seawater pump discharge pressure gauge P1 reads 100 psi and product water flowmeter F2 reads 0.

r. Set up normal product water flow as follows:
  (1) Gradually close brine throttling valve RO7 and increase engine speed until product water flowmeter F2 reads about 108 gpm.
  (2) At the same time, make sure HP pump discharge pressure gauge P4 reading does not exceed 835 psi.
  (3) Make sure brine discharge pressure gauge P5 reading does not exceed 820 psi.

s. While closing valve RO7, ensure brine discharge flow is evident in brine flow indicator glass
   (1) If flow rate indicator Fl reading drops below 350 gpm during this operation, slowly open R07 and increase engine speed until F1 reads 350 gpm.
   (2) Make sure readings do not exceed 108 at F2 and 820 psi at P5.

NOTE

During Initial startup or after a shutdown longer than 3 days, product water should be discharged overboard until quality is acceptable.

t. Allow product water from RO block to flow directly overboard through overboard discharge in void 3 port for at least 15 minutes.

u. While dumping product water overboard, perform the following checks:
   (1) Monitor pressure gauges and flow indicators for normal readings.

RO component	P1	P2	P3	P4	P5	F1	F2
Normal reading	About 100	More than 65	More than 53	No more than 835	No more than 820	About 350	About 108

   (2) Monitor MEDIA FILTER OK indicator light (Figure 13-6).
      (a) If light goes out, check pressure difference between seawater pump discharge pressure gauge P1 and media filters output pressure gauge P2.
      (b) If pressure difference exceeds 35 psi, backwash and flush media filters according to paragraph 4-14.2 in TM 55-1930-209-14& P-3.
      (c) If difference is less than 35 psi, check indicator light. Replace bulb if faulty.

v. When dumping product water overboard, monitor CARTRIDGE FILTER OK indicator light on control station:
   (1) If light goes out, check pressure difference between media fitters output pressure gauge P2 and cartridge filter output pressure gauge P3.
   (2) If pressure difference exceeds 12 psi, change cartridge cage assembly according to paragraph 4-14.1.1 in TM 55-1930-209-14& P-3.
   (3) If difference is less than 12 psi, check indicator light and replace bulb if faulty.
   (4) Monitor difference between HP pump discharge pressure gauge P4 and brine discharge pressure gauge P5. If difference exceeds 25 psi, clean RO block membranes according to paragraph 4-14.4 in TM 55-1930-209-14& P-3.

CAUTION

Operating temperature is critical in diesel engines. Shut down HP pump diesels Immediately if EMS Indicates lubricating oil pressure Is too low or cooling water temperature Is too high.

w. When dumping product water overboard, monitor EMS video monitor.
   (1) SALINITY display page values (Figure 13-11) should read less than 1500 ppm.
   (2) HIGH PRESSURE WATER PUMPS (Figure 13-12) display page should show in normal white (non-blinking, non-double intensity) light.
   (3) Monitor HP pump gauges (Figure 13-7, 2 of 2) as backup to the EMS.

x. After dumping product water overboard for 15 minutes, check water quality:
   (1) Obtain product water sample at valve RO9.
   (2) Manually check total dissolved solids (TDS), salinity, and the acidity and alkalinity (pH) of product water being discharged according to TM 5-6630-215-12.
   (3) Make sure salinity reading is less than 1500 ppm and pH factor is about 7.

y. If quality of product water in step x is acceptable, proceed to paragraph 13-11.3
   (1) If quality of product water is not acceptable, continue to discharge water directly overboard for another 15 minutes.
   (2) Repeat step x. Continue to discharge water overboard if water quality remains unacceptable.
   (3) If quality is not acceptable after an additional 15 minutes, troubleshoot according to Table 4-1 in TM 55-1930-209-14 & P-3.

13-11.3 Operating procedures

NOTE

Product water can NOT be discharged to drinking water storage tanks until chlorination system is operational and providing sufficient chlorine additive to the product water. The only exception to this would be when chlorination system is not operational. As a temporary emergency measure, and with prior coordination with water unit ashore, product water may be stored in tanks and pumped ashore where chlorination can be added by the water unit on the beach.

a. Make sure chlorine is being added to ROWPU product water before water enters storage tanks. If chlorination system is unable to provide proper amounts of chlorine, continue to pump product water overboard or suspend seawater and ROWPU system operation until chlorine is available. For operation of chlorination system, see Chapter 9.

b. Make sure drinking water system storage tank valve(s) in Table below are open for tanks to be filled.

Tank	1	2	3	4
Valve no.	DW1	DW2	DW3	DW4

c. Open valve RO15 and close valve RO20 to allow product water to flow to drinking water storage tanks.

NOTE

The EMS monitors salinity of output from each ROWPU, amount of chlorine in water entering the tanks, water level in the four storage tanks, and HP pump diesel engine lubrication oil pressure and cooling water temperature. Salinity Is shown on SALINITY display page, chlorine entering storage tanks Is shown on CHLORINE STATUS display page, storage tank levels are shown on POTABLE WATER TANKS display page, and engine Indicators are shown on HIGH PRESSURE WATER PUMPS display page.

d. Monitor water level in each storage tank, total level in all four storage tanks, and the amount of chlorine entering tanks.

e. ROWPU(s) will continue to operate and fill drinking water storage tanks until manually shut down. Stop and restart ROWPU's as often as necessary to maintain water flow into storage tanks.

f. Perform following during operation checks.

(1) Check for leaks, paying special attention to all joints, valves, fittings, and piping Report uncorrectable leaks to shift leader.

(2) Check for loose or missing securements and fasteners. Tighten or replace as necessary.

(3) Check wiring for loose connections Tighten as necessary

(4) Be alert to unusual noises or overheating that might indicate a pending malfunction.

g. While ROWPU's are operating, periodically perform the following eight steps to ensure normal operation:

(1) Monitor pressure gauges and flow indicators for normal readings listed below:

RO component	P1	P2	P3	P4	P5	F1	F2
Normal reading	About 100	More than 65	More than 53	No more than 835	No more than 820	About 350	About 108

(2) Monitor MEDIA FILTER OK Indicator light on control station If light goes out, check difference between media filter output pressure gauge P1 and media filters output pressure gauge P2. If difference exceeds 35 psi, backwash media filters according to paragraph 4-14.2 In TM 55-1930-209-14 & P-3. if pressure difference is acceptable, check indicator light. Replace bulb if faulty.

(3) Monitor CARTRIDGE FILTER OK indicator light on control station. If light goes out, check pressure difference between media filters output pressure gauge P2 and cartridge filter output pressure gauge P3. If difference exceeds 12 psi, change cartridge cage assembly according to paragraph 4-14.1.1 in TM 55-1930-209-14 & P-3. If pressure difference Is acceptable, check indicator light Replace bulb If faulty.

(4) Monitor difference between HP pump discharge pressure gauge P4 and brine discharge pressure gauge P5. If difference exceeds 25 psi, clean RO block membranes according to paragraph 4-14.4.2 In TM 55-1930-209-14 & P-3.

(5) Monitor EMS salinity, HP WATER PUMPS, POTABLE WATER TANKS, and CHLORINE STATUS display pages for normal readings. Alarms are activated when any of these parameters exceed normal limits. These Indications should be periodically checked, however, in case of alarm failures. When alarms sound, turn off alarms as described In Chapter 8 (6) Monitor coagulant pump and inhibitor pump amber and red indicator lights on pump control panel (Figure 13-10, 1 of 2). When amber light goes out, pump may be malfunctioning Troubleshoot according to Table 4-1 in TM 55-1930-209-14&P-3. When red indicator light comes on, supply drum may be empty. Replace drum, if necessary.

(7) Monitor HP pump diesel engine gauges (Figure 13-7, 2 of 2) for normal readings listed below. If not normal, troubleshoot according to paragraph 4-11 in TM 55-1930-209-14&P-3.

Gauge	Reading
Oil pressure	Normal (green) zone
Water temperature	Normal (green) zone
Ammeter	Slightly positive near zero
Fuel pressure	Normal (green) range

(8) Periodically check product water quality being discharged for TDS (salinity) and pH according to TM 5-6630-215-12. Obtain product water sample at valve R09. Make sure salinity reading is less than 1500 ppm and pH factor is about 7. If readings are not within these values, troubleshoot according to Table 4-1 In TM 55-1930-209-14 & P-3.

13-12 Shutdown procedures

13-12.1 Normal shutdown

a. Stop HP pump as follows:
   (1) Depress inner button on speed control and push forward to idle setting.
   (2) Open throttling valve RO7 and RO20 to allow product water to flow overboard through void 3 port overboard discharge and close valve RO1 5 to stop product water from flowing to drinking water storage tanks.

CAUTION

Do not Immediately stop engine. Operating engine for 5 minutes at low idle allows hot areas of engine to cool and turbo charger to slow while maintaining oil pressure in the turbine shaft.

   (3) Idle engine for about 5 minutes.

b. Push shutdown lever forward to stop engine (Figure 13-7, 1 of 2).
c. Stop coagulant pump by turning ON/OFF switch to OFF (Figure 13-6).
d. Stop inhibitor pump by turning ON/OFF switch to OFF (Figure 13-6).
e. Stop seawater pump by turning OFF/ON/START switch to OFF (Figure 13-6).
f. Perform following after operation checks.
   (1) Wipe components clean, especially pressure gauges, flowmeters, indicators, and control panels.
   (2) Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report uncorrectable leaks to shift leader so that repairs can be ordered.
   (3) Check for damage, especially to pressure gauges, flowmeters, indicators, and control panels.
   (4) Check for loose or missing securements and fasteners. Tighten or replace as necessary.
   (5) Check wiring for loose connections and frayed cables.
   (6) If required, backwash media filters according to paragraph 4-14.2 in TM 55-1930-209-14&P-3.
   (7) If required, dean RO block membranes according to paragraph 4-14.4.2 in TM 55-1930-209-14&P-3.
   (8) If required, replace cartridge filter elements according to paragraph 4-14.1.2.
   (9) Make sure coagulant and inhibitor drums contain at least 2 or 3 gallons of liquid each. If not, replace drum according to paragraph 4-14.1.3 in TM 55-1930-209-14&P-3.
   (10) Make sure membrane cleaning agent (Hydrakleen-20) drums are full. If not, replace according to paragraph 4-14.4.3 in TM 55-1930-209-14&P-3.
   (11) Check HP pump assembly as follows:
      (a) Check diesel engine crankcase. If oil level on dipstick (Figure 13-13) indicates ADD, add oil until level is between FULL and ADD.
      (b) Check pump lubricant level. If oil level in sight glass (Figure 13-13) is below MIN line, add lubricant according to paragraph 4-14.3.9 in TM 55-1930-209-14&P-3.
      (c) Check power takeoff lubricant. If dipstick indicates ADD, add oil according to paragraph 4-14.3.14 in TM 55-1930-209-14 & P-3.

WARNING

At operating temperatures, engine coolant is hot and under pressure. It also contains alkaline materials harmful to eyes and skin. To avoid personal Injury, check coolant level only when engine is stopped and radiator cap is cool enough to be touched with a bare hand. Should engine coolant come in contact with eyes or skin, immediately flush affected area with clean water and seek medical assistance If necessary.

(d) Check coolant level. Slowly open coolant tank filter cap. Inspect filler cap gasket. Replace if damaged. Install filter cap. Add coolant if necessary.

(e) Check air cleaner. If service indicator red piston is locked in raised position, service air cleaner according to paragraph 4-14.3.4 in TM 55-1930-209-14&P-3. Indicator is in lower comer of air cleaner on side next to engine.

(f) Check alternator belt for general condition and tension. If frayed or cracked, replace belt. If loose, tighten with tensioner rod attached to alternator.

(g) Check V-belts driving the pump for general condition and tension. If frayed or cracked, replace belt according to paragraph 4-15.3.11 in TM 55-1930-209-14&P-3. If slack, adjust tension according to paragraph 4-14.3.11 in TM 55-1930-209-14&P-3.

(h) Check batteries for correct level of fluid. Add fluid if necessary. Make sure electrical connections are clean and tight and batteries are clean and secure.

(i) Make sure exhaust system is secure, undamaged, and not leaking. Leaks may be revealed with dirty smudges around fittings or cracks in piping.

(j) Drain water and sediment from fuel filter. Use cloth to catch sediment.

(12) Check components, piping, and associated equipment for rust, corrosion, and worn or chipped paint. Remove rust and corrosion by wire brushing, scraping, or chipping. Immediately paint cleaned area with zinc chromate primer and finish paint to match surrounding area in accordance with TB 43-0144.

13-12.2 Emergency shutdown

13-12.2.1 General. The barge has two emergency shutdown modes (Chapter 3). One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Emergency system shutdown red buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These seven emergency system shutoff buttons (Figure 13-6) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG1, and SSG2.

Emergency total shutdown red buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system emergency shutoff buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

13-12.2.2 Emergency shutdown procedures

a. Local emergency ROWPU shutdown. Pull emergency shutdown cord surrounding diesel engine (Figure 13-7, 1 of 2) to stop engine and HP pump.

b. Remote emergency ROWPU shutdown. Push appropriate system shutdown button, either "ROWPU 1 diesel HP pump" or "ROWPU 2 diesel HP pump" on starboard side of ROWPU space near personnel door. This stops the ROWPU HP pump but not the seawater pump feeding that ROWPU system. If this shutdown is used, immediate action must be taken to turn off the appropriate seawater pump.

c. Remote total system shutdown. Push any total shutdown red button to stop all pumps (Chapter 3).

d. When the situation that caused the emergency has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

e. When emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

CHAPTER 14 DRINKING WATER SYSTEM

Section I. General

14-1 General. The drinking water system provides storage for water produced by the Reverse Osmosis Water Purification Units (ROWPU's) and includes pumps and valves to move that water from onboard storage tanks to the shore discharge system or overboard to another vessel. It also provides a pressurized water supply for drinking and washing onboard the barge.

14-2 Description. The drinking water system for Barge 1 (Figure 14-1) and for Barges 2 and 3 (Figure 14-2) stores 15,000 gallons of drinking water in four 3,750-gallon tanks and 250 gallons in a reserve tank. The system supplies drinking water by one of two discharge pumps to a shore facility or to another vessel, or water can be discharged directly overboard through a port discharge valve. The pressure set supplies onboard drinking water to the reserve tank, to the dayroom drinking fountain and sink, to the shower on the forward deck, to four washdown stations in the ROWPU space, to the chlorination system in void 2 port, and to the washdown station on deckhouse top. Major components of the drinking water system are shown in Figures 14-1 and 14-2, and listed in Table 14-1. A block diagram of the drinking water system is shown in Figure 14-3 for Barge 1 and Figure 14-4 for Barges 2 and 3. Equipment specifications, maintenance information, and manufacturer's service manuals are contained in TM 55-1930-209-14 & P-5.

14-3 Capabilities. The total onboard storage capacity is 15,000 gallons plus 250 gallons reserve. The maximum discharge pressure is 140 pounds psi and the maximum discharge rate with both ROWPU's operating is 300,000 gpd, 15,000 gph, or 260 gpm.

14-4 Limitations. The drinking water system shall not be operated in rough sea conditions exceeding Sea State 3. For acceptable drinking water standards, the chlorine content must be from 2 to 5 ppm and the salinity level must not be greater than 1000 ppm.

14-5 Performance characteristics

a Drinking water discharge pump

Rating	260 gpm 250 ft
Revolutions	1,750 rpm
Rating	440 Vac, 3 ph, 60 Hz, 30 hp
Flow sensor capacity	600 gpm, 5 gpm minimum
Pressure sensor rating	0-300 psi

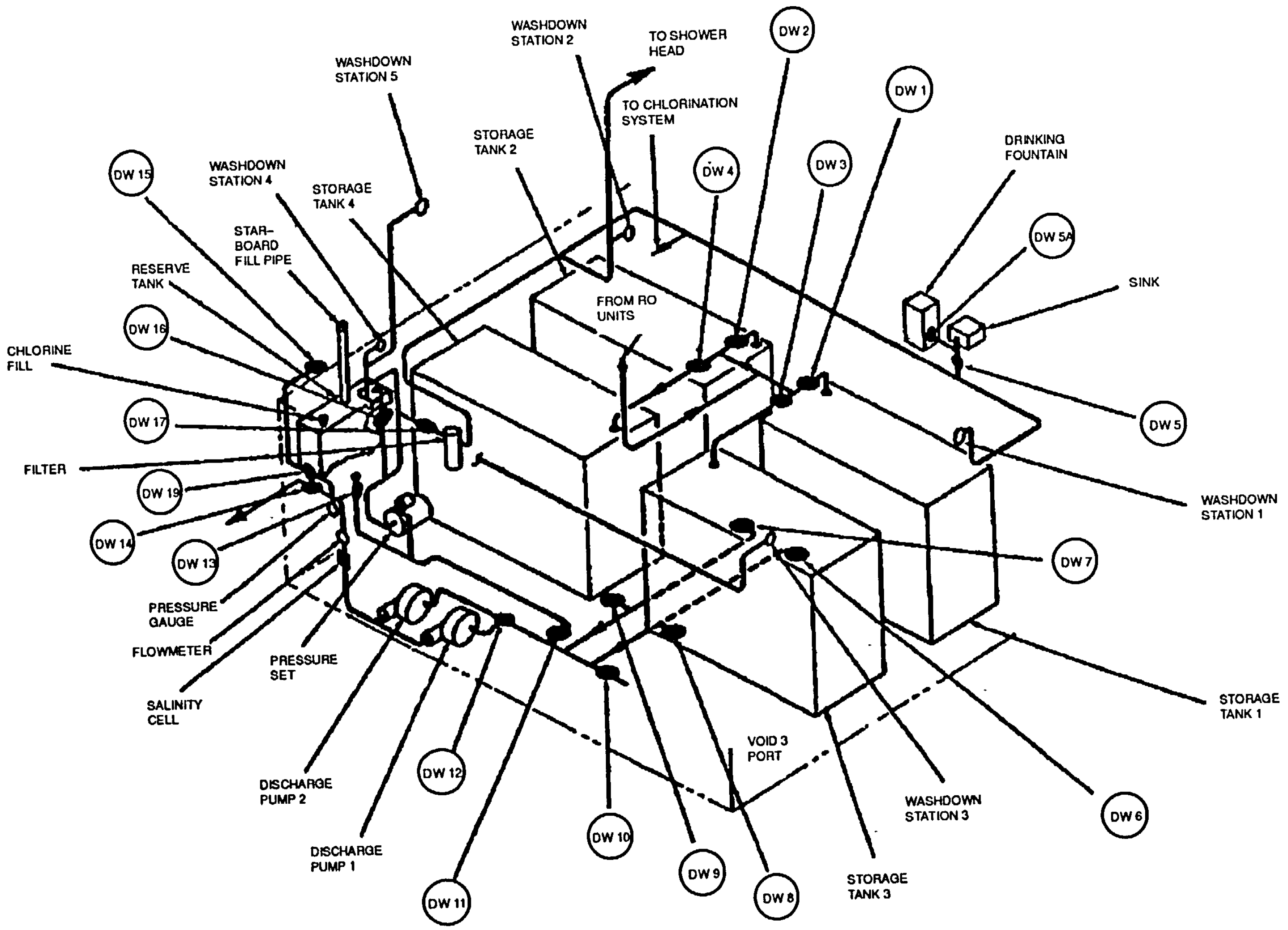


Figure 14-1. Drinking Water System Installation (Barge 1)

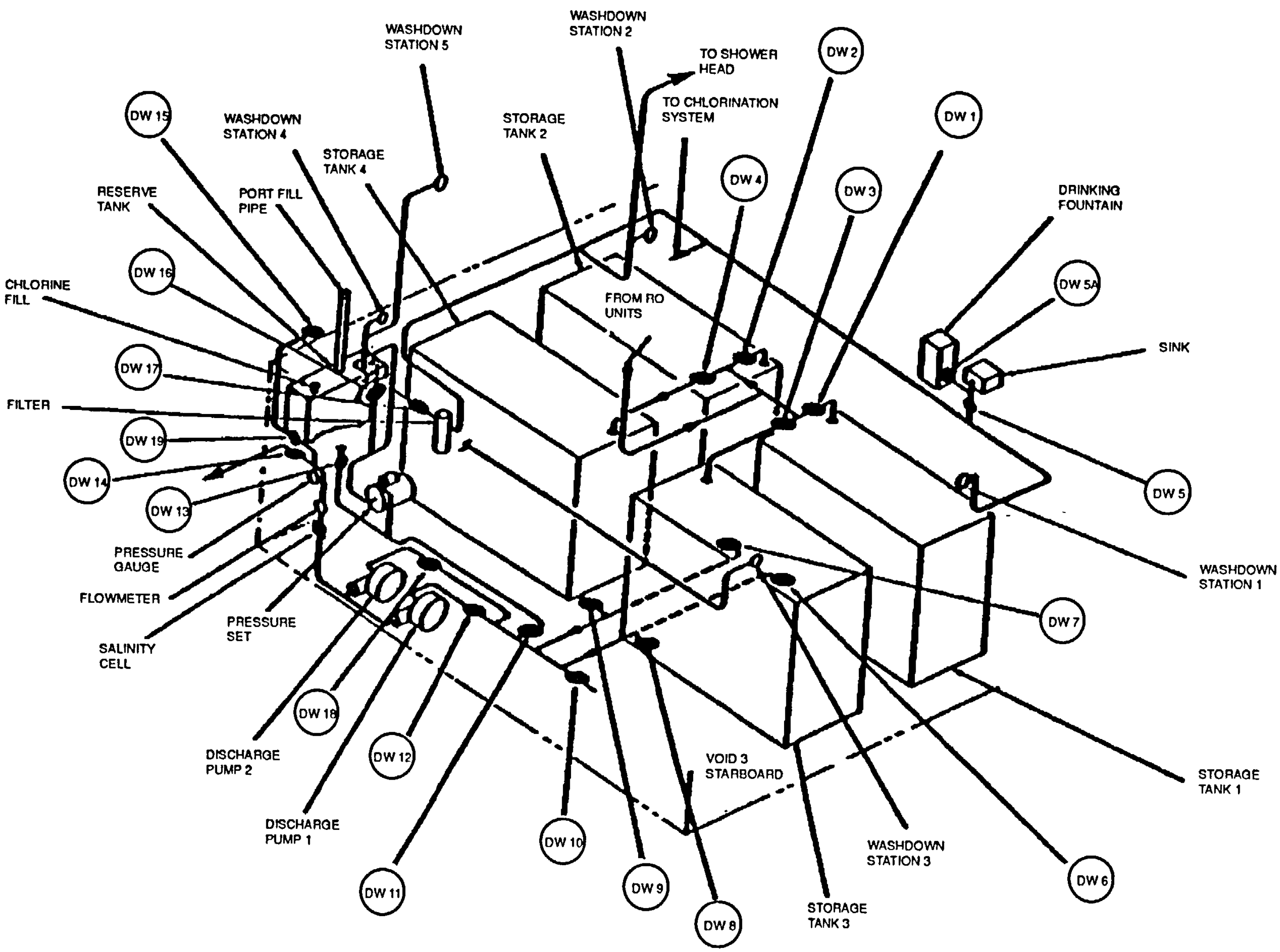


Figure 14-2. Drinking Water System Installation (Barges 2 and 3)

Table 14-1. Major Components of Drinking Water System

Component	Function	Location
4 storage tanks	Store drinking water	Tanks 1 and 3 - void 3 starboard Tanks 2 and 4 - void 3 port
4 storage tank liquid tank level indicators with level switches	Indicate water level in storage tanks. High and low level switches automatically start/stop discharge pump. Liquid level data is monitored and transmitted to monitoring system	One on each storage tank
250-gallon reserve tank	Stores drinking water for use onboard barge	Void 3 port - near shell
Reserve tank liquid level indicator	Indicates water level in reserve tank	On reserve tank
Drinking fountain	Provides drinking water onboard barge	Dayroom
Sink	Provides water onboard barge for personal hygiene and other uses	Dayroom
2 discharge pumps	Pump drinking water to shore facility or to port discharge	Discharge pumps 1 and 2 - Void 3 port near aft bulkhead
Drinking water pressure set	Supplies drinking water for use onboard barge including filling of reserve tank	Void 3 port - near shell
Salinity cell	Monitors drinking water salinity and transmits data to monitoring system	Void- 3 port - in discharge pump discharge line
Flow sensor	Monitors drinking water flow rate, transmits data to monitoring system and indicates flow rate on meter	Void 3 port- in discharge pump discharge line
Pressure sensor	Monitors drinking water pressure, transmits data to monitoring system	Void 3 port - in discharge pump discharge line
Pressure gauge	Indicates pressure in discharge line	Void 3 port - in discharge pump discharge line
Water filter	Filters any immunities in drinking water	Void 3 port - in pressure set discharge line
5 washdown stations	For washing down decks and shore discharge hose during retrieval	4 stations in ROWPU space and 1 on top of deckhouse

Table 14-1. Major Components of Drinking Water System (continued)

Component	Function	Location
Shower	Personal hygiene	Weatherdeck forward
2 motor controllers for discharge pumps 1 and 2	Control automatic and manual operation of discharge pumps	Void 3 port on aft bulkhead
Motor controller for pressure set	Controls manual operation of pressure set water	Void 3 port near filter
2 remote switches for discharge pumps 1 and 2	Control remote operation of discharge pumps	ROWPU space on forward bulkhead
Pump and storage tank selection switch	Selects discharge pump and storage tank whose liquid level switches automatically start and stop discharge pump	Void 3 port on aft bulkhead

Section II. Description of operation

14-6 Drinking water supply. When product water flows from the ROWPU's, chlorine is added. With the addition of chlorine, this ROWPU product water becomes drinking water and flows into four storage tanks As the drinking water in each tank rises, the water level is shown on a liquid level indicator mounted on each tank. The water level In each tank is also sensed by a level sensor, which transmits a signal to the EMS. The EMS video monitor's POTABLE WATER TANKS display page shows the water level, in gallons, In each tank and the total amount in all four tanks.

14-7 Drinking water supplied to shore or port discharge valve. With the pump motor controller AUTO/OFF/HAND switch in AUTO, the shore discharge pump automatically transfers drinking water to one of two delivery systems when water in a tank reaches the high level switch. In normal operation, water is pumped to the stern-mounted shore discharge hose which transports the water to a storage facility ashore. In the other option, the water is pumped through a valve on the portside to another vessel or simply overboard When the tanks are being filled and the high level switch does not start the pump, alarms sound when the water in the tank reaches another switch at a higher level. These alarms warn the crew that corrective action must be taken. When the tanks are being emptied and the water level reaches the low level switch, the discharge pump automatically stops. If this low level switch does not stop the pumps, alarms sound when tank water levels reach another switch at a lower level in the tank. These alarms warn the crew that the pumps must be stopped and corrective action taken.

The tanks can be emptied manually, when motor controller AUTO/OFF/HAND switch is in HAND, by operating the START and STOP buttons on the local motor controller or the remote switches on the forward bulkhead in the ROWPU space. As the drinking water is discharged by the pump, the following items are monitored: water pressure, flow rate, salinity, and total water discharged. A pressure sensor measures the discharge water pressure (indicated on a pressure gauge in void 3 port and shown on the EMS video monitor). The flow rate and total gallons of water pumped are shown on a meter in void 3 port. In addition, flow rate and salinity values are shown on the EMS video monitor. If either discharge pressure or salinity falls outside acceptable values, visual and sound alarms are activated. These alarms warn the crew that corrective action must be taken.

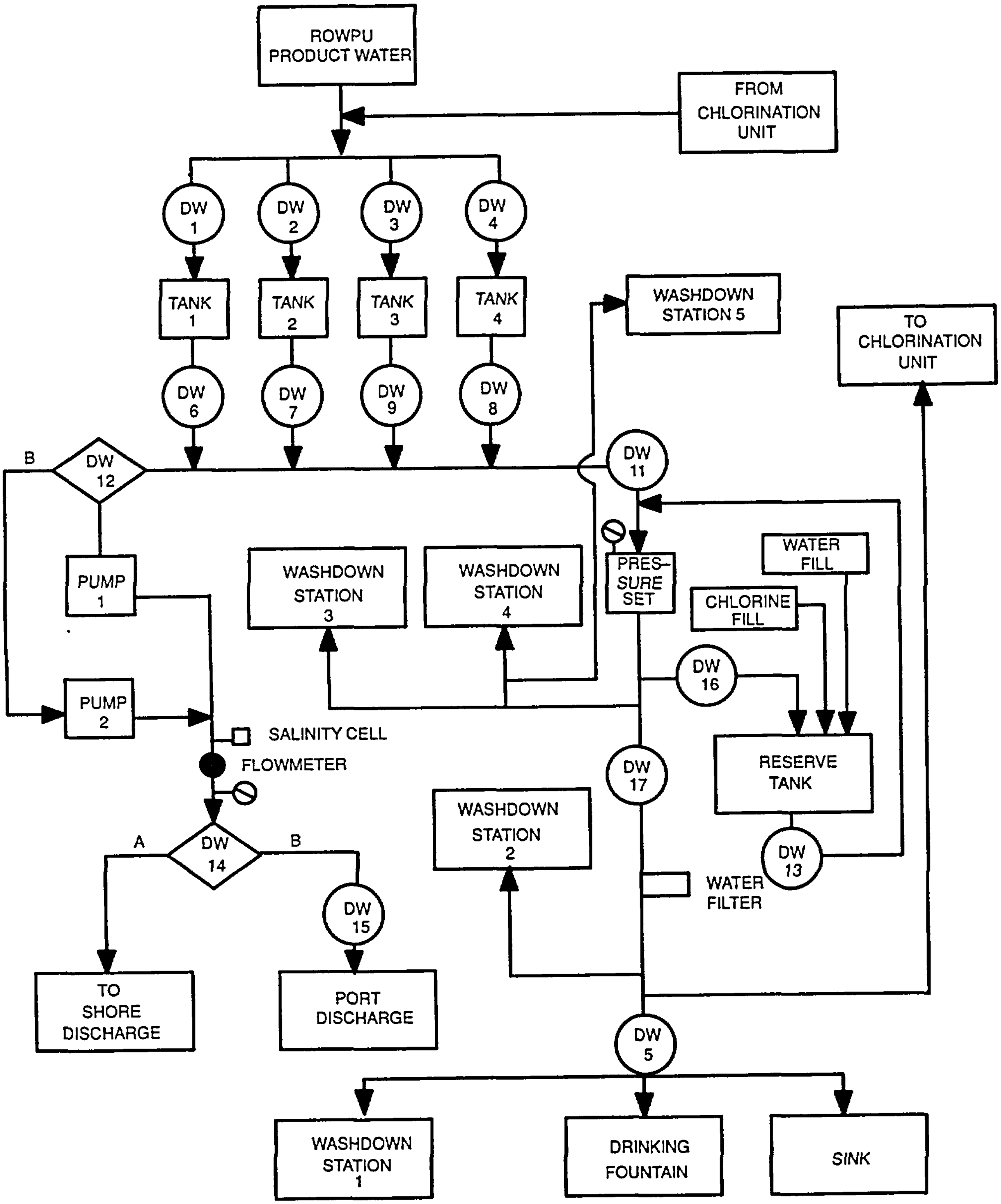


Figure 14-3. Drinking Water System Block Diagram (Barge 1)

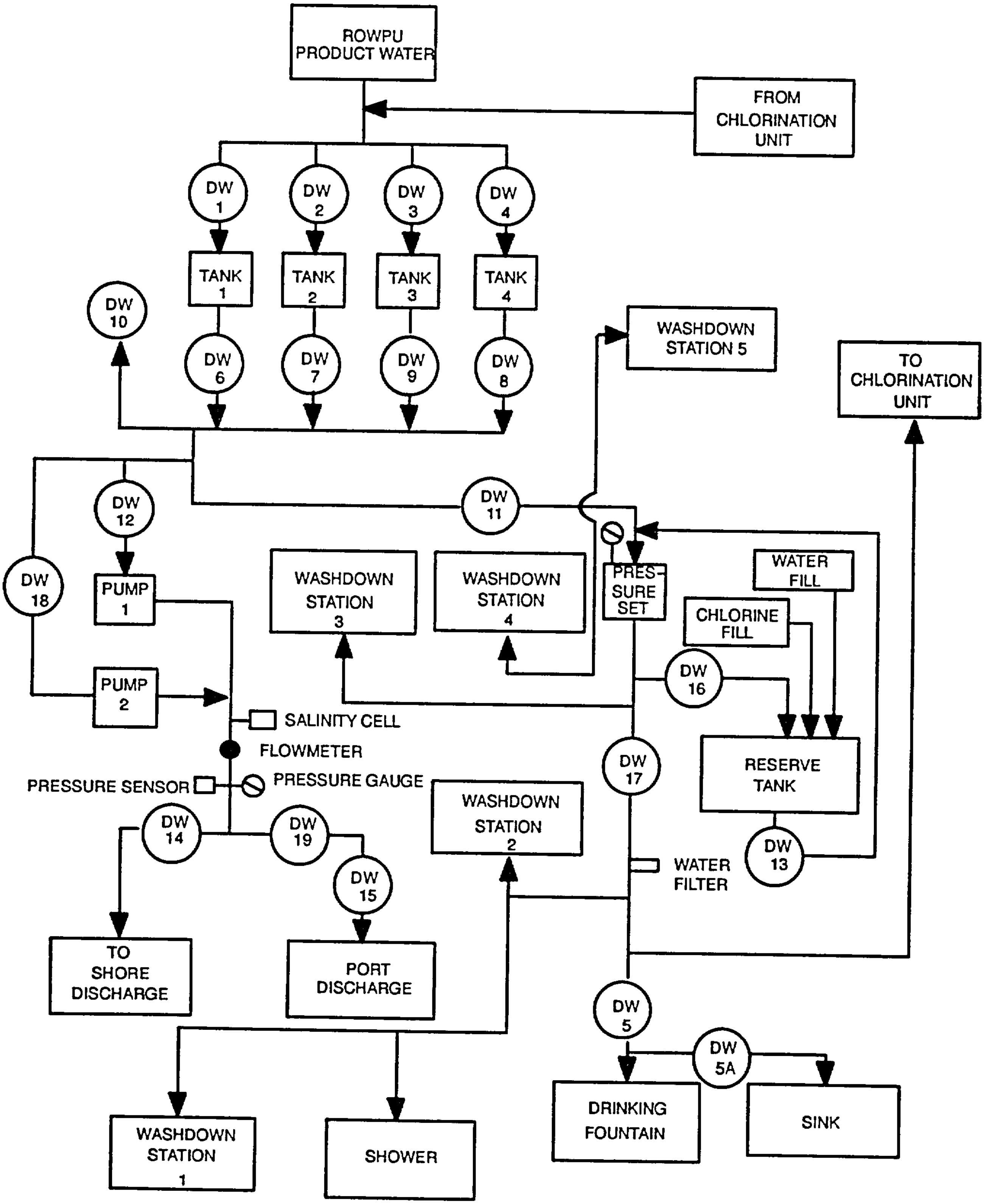


Figure 14-4. Drinking Water System Block Diagram (Barges 2 and 3)

14-8 Drinking water for onboard use. Drinking water for use onboard flows from the storage tanks to the pressure set. The pressure set pumps water to the drinking fountain and sink in the dayroom, shower on the forward weatherdeck, and washdown stations in the ROWPU space and deckhouse top. The pressure set also supplies water to the chlorination system. As a reserve backup, the pressure set pumps water from the reserve tank, if water is not available from the storage tanks. This tank also can be filled with water from another vessel or shore supply through a fill pipe located on the weatherdeck near the port discharge valve.

Section III. Operating instructions

14-9 Operating controls and indicators. Information about the drinking water system's operating controls and indicators is in Table 14-2. These controls and indicators are shown in Figures 14-3 thru 14-8. Information about system valves (Figures 14-1 and 14-2) is in Table 14-3.

14-10 Prestart procedures

14-10.1 Before performing any drinking water system operation, be sure to check system for damage and perform following the before operation checks:

a. Wipe components clean, especially gauges and control panels.
b. Check for leaks, paying special attention to all joints, valves, fittings and piping. Report leaks to shift leader for correction.
c. Check for damage, especially to pressure gauges, filters, and control panels.
d. Check for loose or missing securements and fasteners. Tighten or replace as necessary.
e. Check wiring for loose connections and frayed cables. Secure as necessary. Repair or replace damaged cables.
f. Check water filter cartridge. Replace as necessary.

NOTE

EMS monitors water level in each storage tank and discharge water pressure, flow rate, salinity and total water discharged.

14-10.2 Make sure EMS is operating. If not, start up by following procedures in Chapter 8.

14-11 Operating procedures

14-11.1 General. Normal operating procedures for operating this system are in the following paragraphs:

a. Filling drinking water storage tanks paragraph 14-11.2.
b. Discharging drinking water to shore paragraph 14-11.3.
c. Discharging drinking water through port discharge valve paragraph 14-11.4.
d. Supplying storage tank drinking water to pressure set for use onboard barge paragraph 14-11.5.
e. Filling drinking water reserve tank paragraph 14-11.6.
f. Supplying drinking water onboard barge from reserve tank paragraph 14-11.7.
g. Supplying drinking water to dayroom, washdown stations, chlorination unit, and shower paragraph 14-11.8.

Table 14-2. Operating Controls and Indicators

Component	Figure	Location
Discharge pump 1 and 2 motor controllers	14-5	Void 3 port - aft bulkhead
Discharge pump 1 and 2 remote START/STOP switches	14-5	ROWPU space -forward bulkhead near workshop door
Drinking water pump and tank selector switch	14-5	Void 3 port - aft bulkhead
Pressure set motor controller	14-5	Void 3 port - forward bulkhead
Tank liquid level indicator	14-6	Void 3 port - one each on storage tanks 1 and 3 and reserve tank. Void 3 starboard - one each on storage tanks 2 and 4
Discharge pressure gauge	14-7	Void 3 port - aft bulkhead
Discharge pressure sensor	14-7	Void 3 port - aft bulkhead
Discharge flow rate meter	14-7	Void 3 port - aft bulkhead
EMS SYSTEM STATUS display page shows discharge pressure, flow rate, and total water discharged	14-7	ROWPU space - forward bulkhead outboard of workshop door
Discharge salinity cell	14-8	Void 3 port - aft bulkhead
EMS SALINITY display page on video monitor	14-8	ROWPU space - forward bulkhead outboard of workshop door
EMS POTABLE WATER TANKS display page on EMS video monitor	14-9	ROWPU space - forward bulkhead outboard of workshop door
Pressure set pressure gauge	14-10	Void 3 port - on pressure set

h. During these operations, perform the following during operation checks as appropriate:

(1) Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report leaks to shift leader so corrective action can be taken.

(2) Check for loose or missing securements and fasteners. Tighten or replace as necessary.

(3) Check wiring for loose connections and frayed cables. Secure as necessary. Repair or replace damaged cables.

(4) Be alert to unusual noises or overheating, which might indicate malfunctions.

(5) Make sure discharge pressure gauge, flow sensor and salinity sensor are operating normally by observing that normal readings are indicated on this equipment and EMS video monitor displays.

(6) Make sure pressure set is operating normally by observing that pressure gauge indicates normal reading.

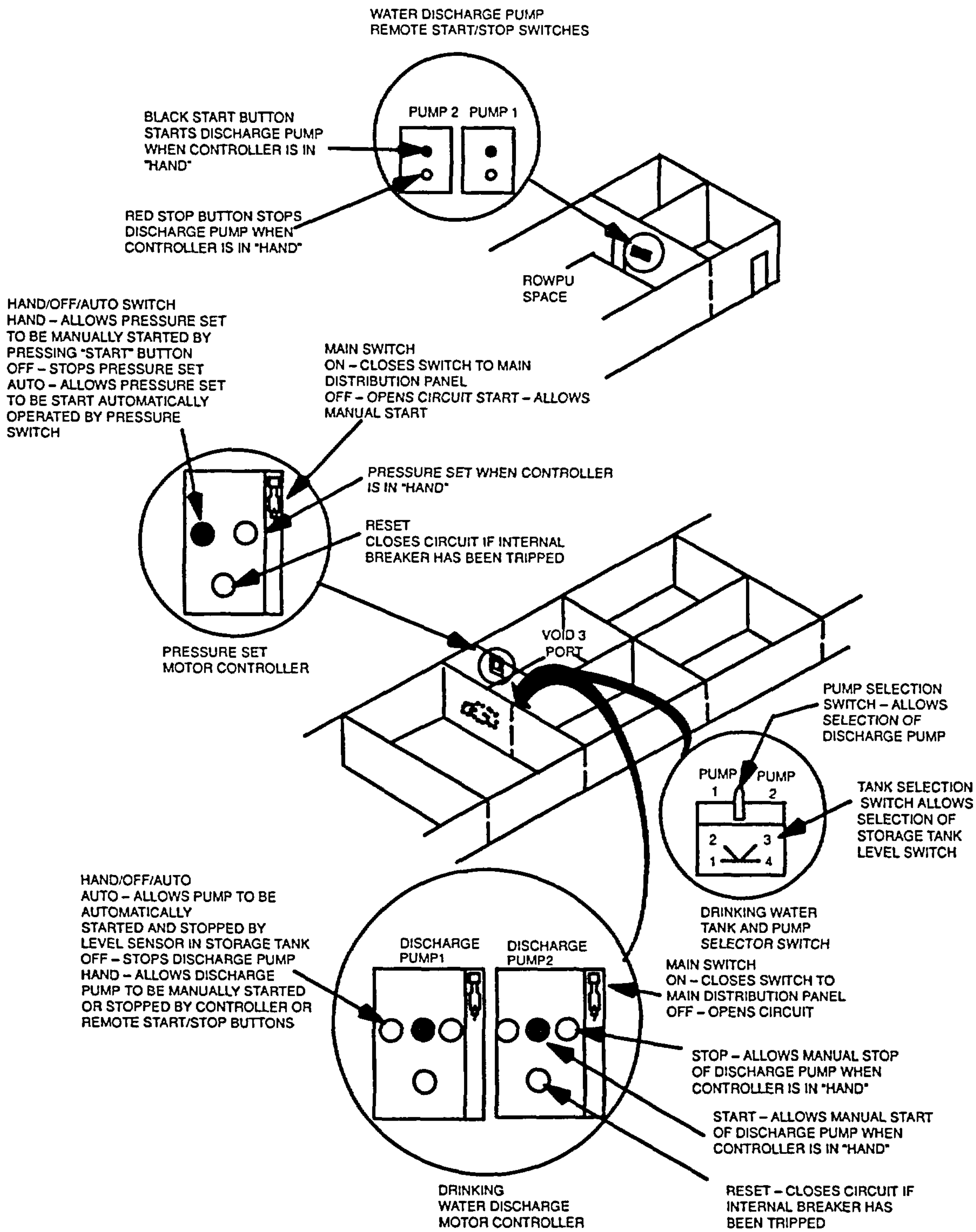


Figure 14-5. Drinking Water System Electrical Controls

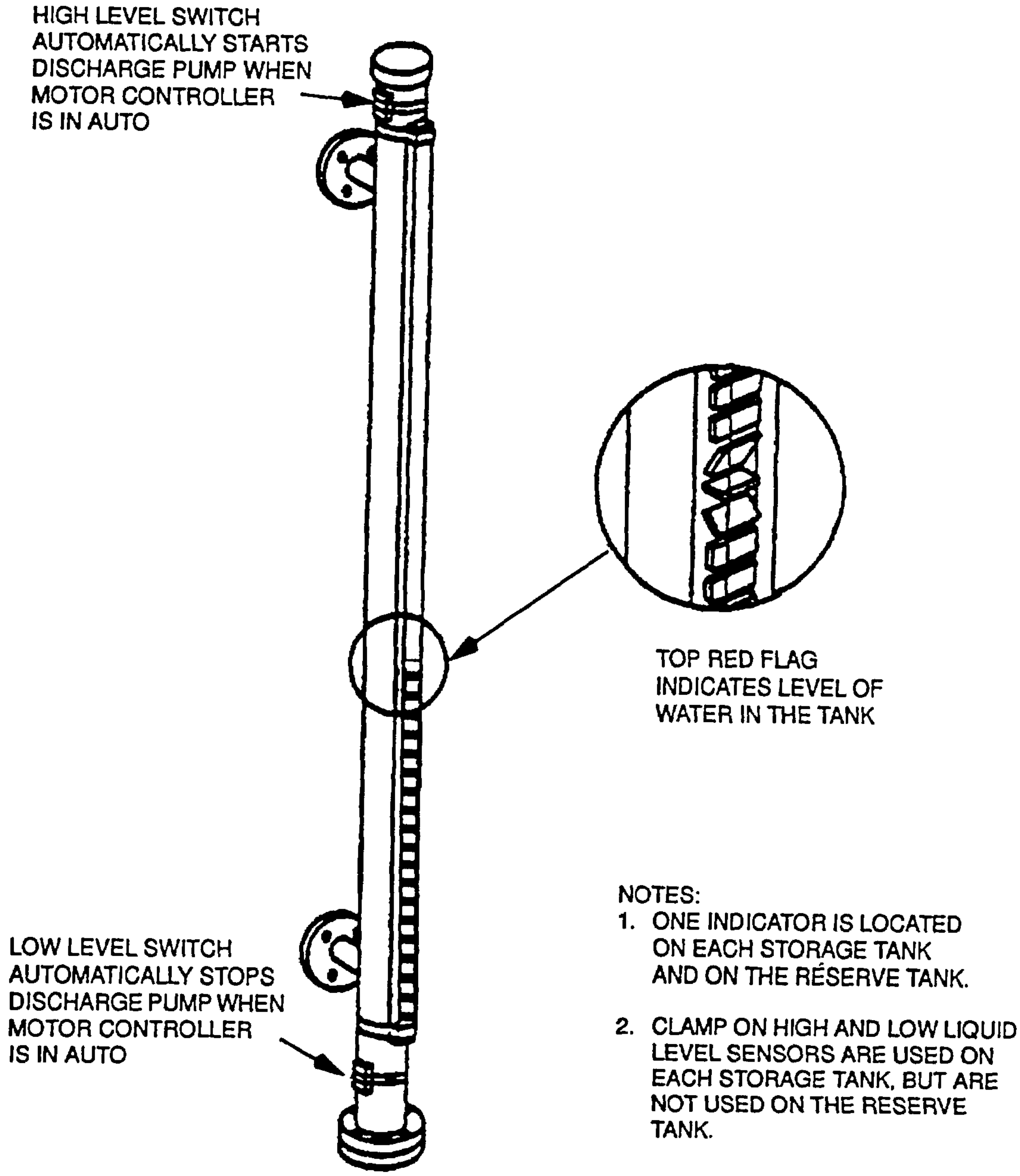
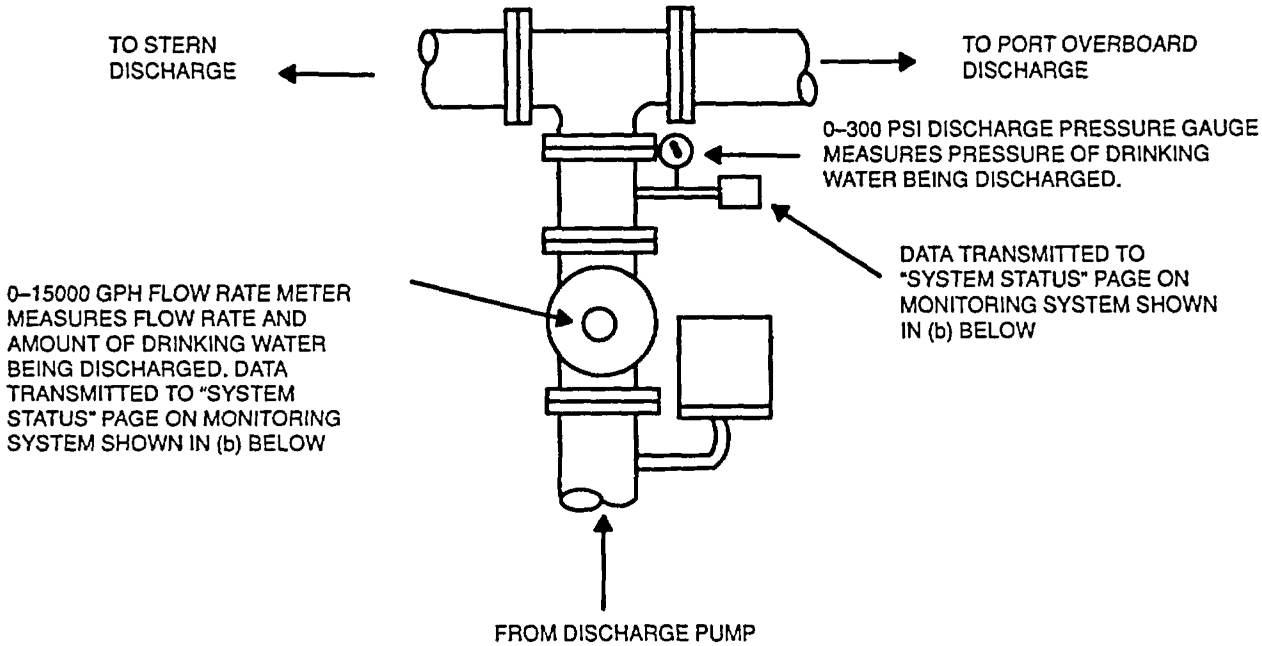
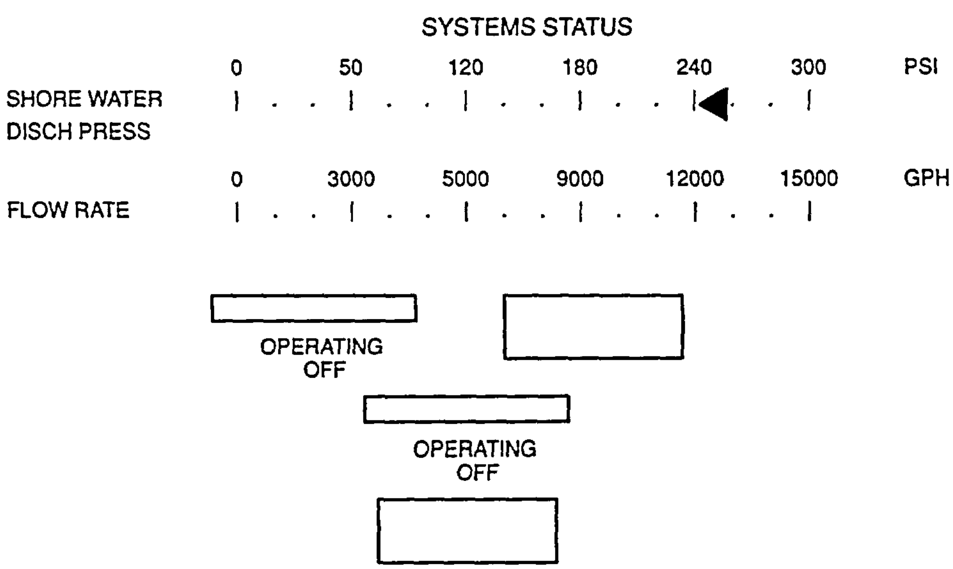


Figure 14-6. Tank Liquid Level Indicator

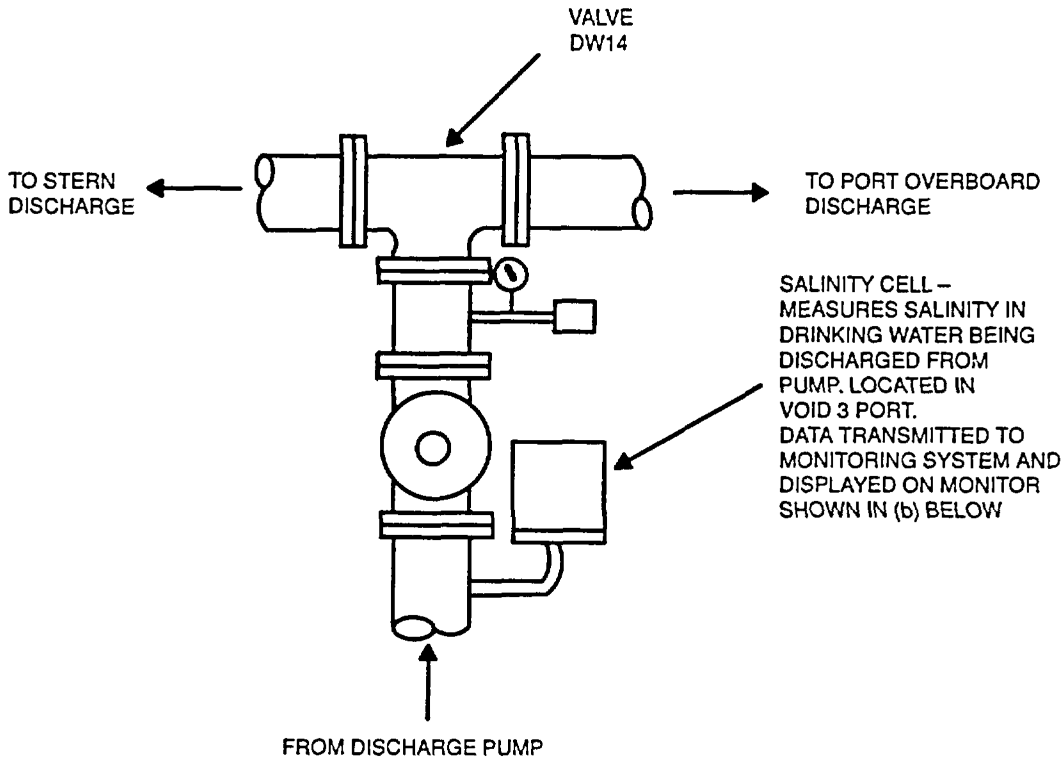


(a) DISCHARGE PRESSURE AND FLOW RATE INDICATORS

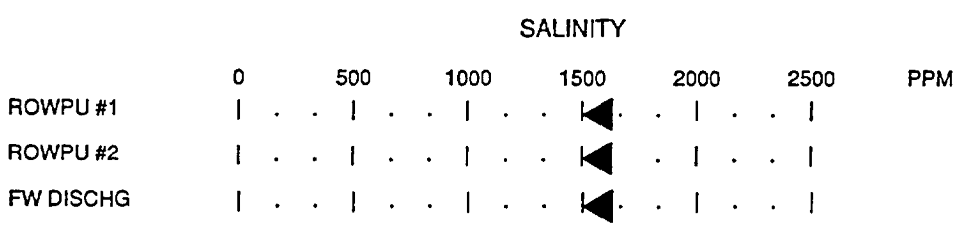


(b) MONITORING SYSTEM DISCHARGE PRESSURE DISPLAY FLOW RATE AND TOTAL WATER DISCHARGE

Figure 14-7. Drinking Water Discharge Pressure Gauge, Flow Rate Meter, and Associated Monitoring System Display



(a) SALINITY CELL



NOTE: FW DISCHG = DRINKING WATER DISCHARGE SALINITY MEASURED BY SALINITY CELL IN PUMP DISCHARGE LINE SHOWN IN (a) ABOVE.

(b) SALINITY DISPLAY ON MONITORING SYSTEM

Figure 14-8. Drinking Water Salinity Sensor and Monitoring System Display

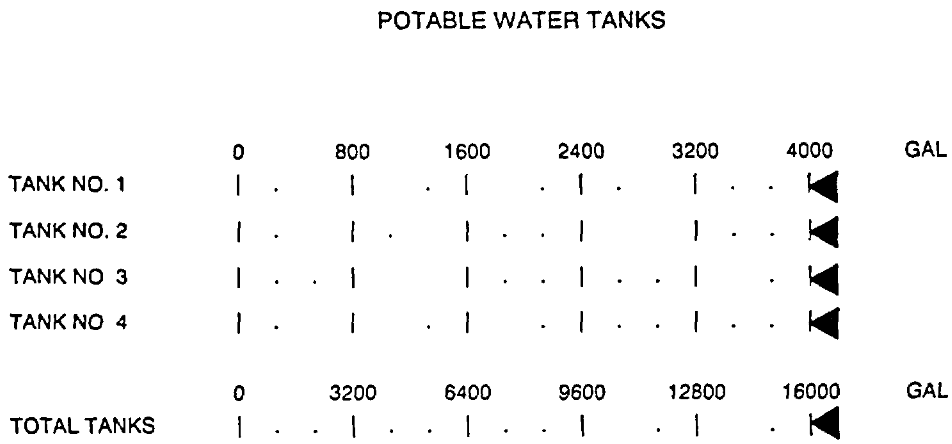


Figure 14-9. Potable Water Tanks Monitoring System Display

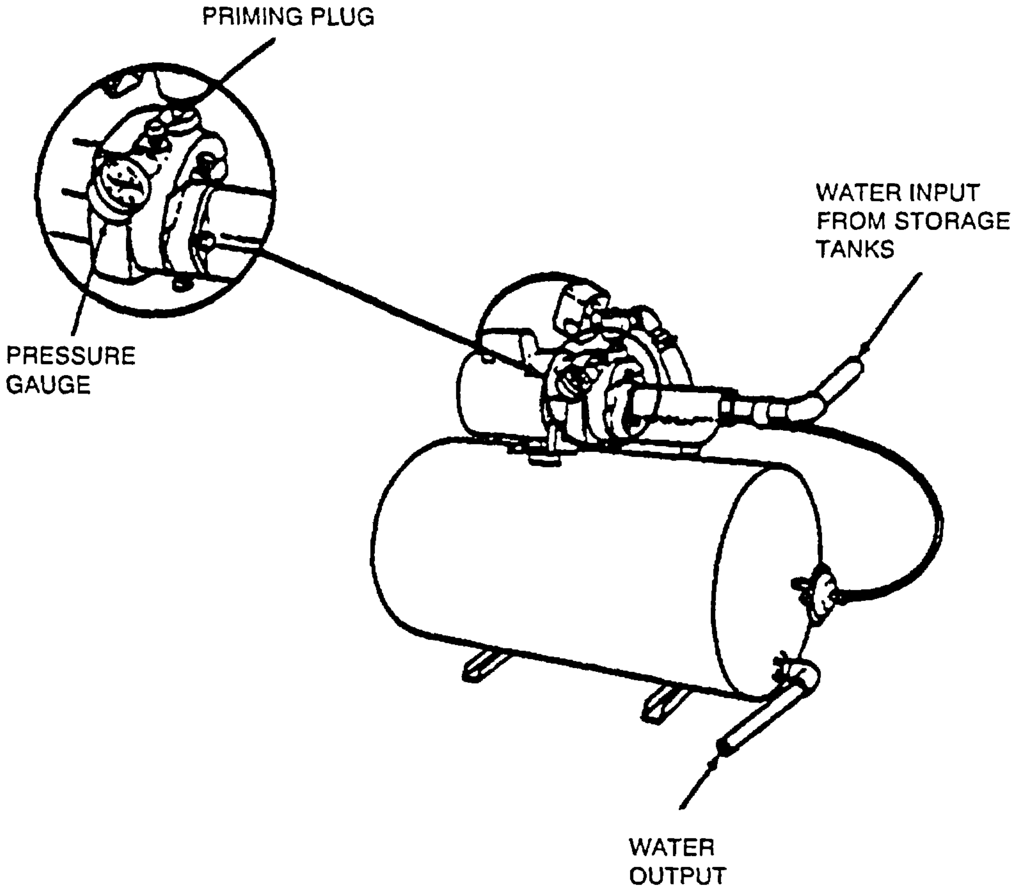


Figure 14-10. Drinking Water Pressure Set Pressure Gauge

Table 14-3 Drinking Water System Valve Label Identification

Type	Figures 14-2 & 14-3 Callout	Location	Label Identification and Valve Function
3-in globe valve	DW1	Void 3 port (Barge 1) starboard (Barges 2 & 3) - in storage tank 1 fill line on top of tank	STORAGE TANK 1 FILL: Allows chlorine treated product water from ROWPU's to flow into tank 1 and isolates tank
3-in globe valve	DW2	Void 3 starboard (Barge 1) port (Barges 2 & 3) - in storage tank 2 fill line on top of tank	STORAGE TANK 2 FILL: Allows chlorine treated product water from ROWPU's to flow into tank 2 and isolates tank
3-in globe valve	DW3	Void 3 port (Barge 1) starboard (Barges 2 & 3) - in storage tank 3 fill line on top of tank	STORAGE TANK 3 FILL: Allows chlorine treated product water from ROWPU's to flow into tank 3 and isolates tank
3-in globe valve	DW4	Void 3 starboard (Barge 1) port (Barges 2 & 3) - in storage tank 4 fill line on top of tank	STORAGE TANK 4 FILL: Allows chlorine treated product water from ROWPU's to flow into tank 4 and isolates tank
1/2-in globe valve	DW5	Dayroom - in water line between pressure set and drinking fountain	DAYROOM SUPPLY: Allows drinking water to flow to and isolates drinking fountain and sink
3/8-in. globe valve (Barges 2 and 3 only)	DW5A	Dayroom - in water line to fountain	DRINKING FOUNTAIN SUPPLY: Allows drinking water to flow to and isolates drinking fountain
4-in gate valve	DW6	Void 3 port (Barge 1) starboard (Barges 2 & 3) - in storage tank 1 drain line near tank	STORAGE TANK 1 DRAIN: Allows drinking water to drain from tank 1 and isolates tank
4-in gate valve	DW7	Void 3 starboard (Barge 1) port (Barges 2 & 3) - in storage tank 2 drain line near tank	STORAGE TANK 2 DRAIN: Allows drinking water to drain from tank 2 and isolates tank
4-in gate valve	DW8	Void 3 port (Barge 1) starboard (Barges 2 & 3) - in storage tank 3 drain line near tank	STORAGE TANK 3 DRAIN: Allows drinking water to drain from tank 3 and isolates tank
4-in valve port	DW9	Void 3 starboard (Barge 1) (Barges 2 & 3) - in storage tank 4 drain line near tank	STORAGE TANK 4 DRAIN: Allows drinking water to drain from tank 4 and isolates tank
2-in globe valve (Barges 2 and 3 only)	DW10	Void 3 starboard - under deck in storage tank drain line near fuel pump	STORAGE TANK DRAIN TO BILGE: Allows drainage of drinking water from storage tank(s) to bilge
1-1/4 in gate valve	DW11	Void 3 port - in pressure set inlet line between main drinking water supply line and pressure set	PRESSURE SET SUPPLY: Allows drinking water to flow to pressure set and isolates pressure set

Table 14-3. Drinking Water System Valves Label Identification (continued)

Type	Figures 14-2 & 14-3 Callout	Location	Label Identification and Valve Function
4-in ball valve (3-way)	DW12	Void 3 port - in discharge pump suction line near pump 1	DISCHARGE PUMP 1 SUPPLY: Allows pump to drain drinking water from storage tank(s)
1-1/4-in gate valve	DW13	Void 3 port - in reserve tank drain line	RESERVE TANK DRAIN: Allows drinking water to drain from reserve tank
3-in globe valve	DW14	Void 3 port - in pump shore discharge line	STERN OR PORT DISCHARGE: Allows drinking water to flow to stem shore discharge hose
2 1/2-in globe valve	DW15	Weatherdeck - port-side near stem	PORT OVERBOARD DISCHARGE: Allows drinking water to be discharged overboard or to vessel tied alongside
1/2-in globe valve	DW16	Void 3 port - in reserve tank fill line	RESERVE TANK SUPPLY: Allows drinking water from pressure set to flow into reserve tank and isolates tank
1/2-in globe valve	DW17	Void 3 port - in dayroom supply line near pressure set	PRESSURE SET DISCHARGE: Allows drinking water to flow from water pressure set to dayroom and chlorination unit
4-in gate valve (Barges 2 and 3 only)	DW18	Void 3 port - in discharge pump suction line near pump 2	DISCHARGE PUMP 2 SUPPLY: Allows pump to drain drinking water from storage tank(s)
3-in globe valve (Barges 2 and 3 only)	DW19	Void 3 port - in pump overboard discharge line	DISCHARGE PUMP TO PORT OVERBOARD: Allows drinking water to flow to port overboard discharge valve
3/8-in spigot	--- ---	In void no. 2 port	To wash down chlorination unit and void no. 2 port deck plates
Washdown hose bib		ROWPU space - on each of 4 washdown stations, deckhouse top-2 washdown stations	For connection of washdown station hoses
Washdown adjustment nozzle		On washdown hose	For washdown station hose
Drain cock starboard		Void 3 port and	Sample valve on each storage tank and reserve tank

14-11.2 Filling drinking water storage tanks

a. Open appropriate drinking water valves as shown in table below. Make sure valves of tank(s) not to be filled are closed.

To fill drinking water storage tank	Open valves
1	DW1, DW6
2	DW2, DW7
3	DW3, DW8
4	DW4, DW9

b. Close drinking water valves DW11, DW12, and DW18 (Barges 2 and 3 only) and make sure drinking water valves DW10 and DW13 are closed.

NOTE

Storage tanks are now ready to be filled with water from ROWPU's.

c. Make sure chlorine is being added to the ROWPU product water before water enters storage tanks. If chlorination system is not operating, start up by following procedures in TM 55-1930-209-14&P-4.

NOTE

EMS monitors and indicates water level in each storage tank (Figure 14-9) and amount of chlorine in water entering tanks.

d. Make sure EMS is operating and monitoring water level in each tank and amount of chlorine in water entering tanks. If not, start up by following procedures in TM 55-1930-209-14&P-11.

NOTE

Water level in each tank is also shown on each tank's liquid level Indicator.

e. As tanks are being filled, periodically check EMS video monitor POTABLE WATER TANKS display page for water levels and CHLORINE STATUS display page to make sure chlorine input is 2 to 5 ppm.

NOTE

If water level rises above full level in tank(s) as shown on EMS video monitor, horn and strobe light In ROWPU space are activated and buzzer in dayroom sounds. In addition, EMS keyboard alarm sounds and video monitor automatically switches to ALARM page which shows full tank level alarm condition in flashing double Intensity. POTABLE WATER TANKS key on keyboard flashes red.

f. When alarms are energized, stop filling tanks.

g. Press red flashing POTABLE WATER TANKS key on keyboard to change ALARMS display page back to POTABLE WATER TANKS alarm display page.

NOTE

Display stays double Intensity until abnormal condition is corrected.

h. Press ACK key on keyboard to stop alarms and automatically change red flashing POTABLE WATER TANKS key to white and flashing display on video monitor POTABLE WATER TANKS page to double intensity.

14-11.3 Discharging drinking water to shore

a. Make sure discharge hose is properly deployed, valves are properly set, and shore facility is ready to receive drinking water.
b. Make sure storage tanks are being filled per instructions in paragraph 14-11.2.

NOTE
EMS monitors water level in each storage tank and amount of chlorine in water entering tanks. It also monitors salinity, flow rate, pressure, and total amount of drinking water being discharged.

c. Make sure EMS is operating. If not, start up by following procedures in TM 55-1930-209-14&P-11.
d. Position drinking (DW) water valves as follows:

o = open x = closed

Discharge pump used	Valve No. DW12	DW14	DW18 *	DW19 *
1	o	o	x	x
2	x	o	o	x

*On Barges 2 and 3 only.

e. Open drain valve(s) of storage tank(s) to be drained as shown in table below. Make sure valves of tank(s) not being drained are dosed.

Tank no.:	1	2	3	4
Valve no.:	DW12	DW14	DW8	DW9

CAUTION
To prevent operating shore discharge pump when dry, make sure that drain valve (DW6, DW7, DW8, or DW9) of tank selected on selector switch Is open.

f. On drinking water tank and shore discharge pump selector switch (Figure 14-5), position switches as follows:
(1) Set pump selector switch to pump 1 or pump 2.

CAUTION
Normally, all four tanks are filled and drained at same time. In this case, tank selector switch can be positioned to any of the four tank numbers (1, 2, 3, or

4) However, when all four tanks are not being drained, tank selector switch must be positioned to a tank number of any of tanks being drained.
(2) Position tank selector switch (Figure 14-5) to number 1, 2, 3, or 4 tank to be drained. High and low level switches on liquid level indicator (Figure 14-6) of tank selected then automatically start and stop pump selected in step 1.
(3) Close switchboard circuit breaker P9 for shore discharge pump 1, or circuit breaker P15 for shore discharge pump 2.

NOTE
When high level switch senses a full tank, discharge pump starts automatically if motor controller HAND/OFF/AUTO switch is on AUTO. When low level switch senses tank Is empty, pump stops automatically.

g. On discharge pump motor controller of pump selected in step f (1), close main switch (Figure 14-5) to ON. Then position HAND/OFF/AUTO switch to AUTO.

NOTE

Tank(s) are manually drained when motor controller HAND/OFF/AUTO switch is on HAND. Discharge pump Is started or stopped by pushing START or STOP button on motor controller or pushing START or STOP button on ROWPU space remote START/STOP switch (Figure 14-5) on ROWPU space forward bulkhead.

NOTE

As tank(s) Is/are being filled and drinking water is being discharged to shore, EMS continuously monitors water level in tanks, discharge flow rate, water discharge pressure, and salinity.

h. As drinking water is being discharged to shore, periodically check the following:

(1) On EMS video monitor, check following indications:

Page	Indication
POTABLE WATER TANKS	Level in each tank Total level in all four tanks.
CHLORINE STATUS	Chlorine content between 2 and 5 ppm.
SALINITY	Salinity of drinking water being discharged not greater than 1500 ppm.
SYSTEM STATUS	Water pressure for shore discharge flow is not greater than 140 psi, flow rate is 250 gpm (15,000 gph) and total amount discharged is being indicated.

(2) If EMS indications are not within these tolerances, take corrective action. Periodically, manually check chlorine content and salinity according to TM 55-6630-215-12. Obtain sample at storage tank sample valve. If readings do not agree with EMS reading, take corrective action.

(3) On tank liquid level indicator, compare level in each tank to EMS reading. If not in agreement, take corrective action.

(4) On flow meter in void 3 port, check flow rate and total water discharged and compare to EMS reading. If not in agreement, take corrective action.

NOTE

The water level in each tank is monitored by a liquid level sensor. When water rises or falls above or below the level that starts or stops the discharge pump, EMS visual alarms flash and audible alarms sound. Alarms are also activated when discharge pressure or salinity falls outside acceptable values. EMS video monitor automatically changes to ALARM page which displays problem condition In flashing double Intensity. In addition, POTABLE WATER TANKS key flashes red and sounds an alarm. These alarms warn crew that appropriate corrective action must be taken.

i. If alarms are activated, perform procedures 1, 2, 3, 4, or 5 as appropriate.

(1) If alarms are activated by tank high liquid level switch due to a full tanks), while shore discharge pumps are operating normally, perform the following:

(a) Stop discharge pump by moving HAND/OFF/AUTO switch on motor controller to OFF.

(b) Press red flashing POTABLE WATER TANKS key on EMS keyboard to change EMS video monitor ALARM display page back to POTABLE WATER TANKS display page.

(c) Press EMS keyboard ACK key to stop alarms and automatically change red flashing POTABLE WATER TANKS key to white and stop flashing display on video monitor POTABLE WATER TANKS display page This display (tank no. 1, 2, 3, or 4) continues to show In double Intensity until problem is solved

(d) Check video monitor POTABLE WATER TANKS display page to find the overflowing tank(s)

(e) Isolate overflowing tank(s) by closing drinking water valves as follows-
Tank 1 - close DW 1 and DW 6,
Tank 2 - close DW 2 and DW 7,
Tank 3 - close DW 3 and DW 8,
Tank 4 - close DW 4 and DW 9.

(f) Continue discharging drinking water from remaining tanks by starting discharge pump by turning HAND/OFF/AUTO switch on motor controller to AUTO.

(g) Drain off enough water from isolated tank(s) through sampling valve(s) until water level reaches normal high level as indicated on liquid level indicator.

(h) Troubleshoot as provided In TM 55-1930-209-14 & P-5, Table 4-1, problem 13

(i) Upon completion of troubleshooting, open valves closed in step (e) when remaining tanks are as full as isolated tank(s).

(2) If alarms are activated by tank high liquid level switch due to a malfunctioning pump, perform the following:

(a) Stop discharge pump by moving HAND/OFF/AUTO switch on motor controller to OFF.

(b) Press red flashing POTABLE WATER TANKS key on EMS keyboard to change EMS video monitor ALARM display page back to POTABLE WATER TANKS display page.

(c) Press EMS keyboard ACK key to stop alarms and automatically change red flashing POTABLE WATER TANKS key to white and stop flashing display on video monitor POTABLE WATER TANKS display page This display (tank 1, 2, 3, or 4) will continue to show in double intensity until problem is solved

(d) On Barge 1, position valve DW12 for discharge pump 1 or 2. On Barges 2 and 3, position valve DW12 for pump 1 or valve DW18 for pump 2 to allow water to bypass nonfunctioning pump.

(e) Reposition pump selection switch (Figure 14-5).

(f) On discharge pump motor controller of pump selected in step (e) above, close main switch to ON Then position HAND/OFF/AUTO switch to AUTO. Discharge pump starts and stops automatically.

(g) Troubleshoot as provided in TM 55-1930-209-14&P-5, Table 4-1, problem 7.

(3) If alarms are energized by tank low liquid level switch, while shore discharge pumps are operating normally, perform the following:

(a) Stop discharge pump by moving HAND/OFF/AUTO switch on motor controller to OFF.

(b) Press red flashing POTABLE WATER TANKS key on EMS keyboard to change EMS video monitor ALARM display page back to POTABLE WATER TANKS display page.

(c) Press ACK key on EMS keyboard to stop alarms and automatically change red flashing POTABLE WATER TANKS key to white and stop flashing display on video monitor POTABLE WATER TANKS display page This display (tank 1, 2, 3 or 4) continues to show in double intensity until problem is solved.

(d) Troubleshoot as provided in TM 55-1930-209-14&P-5, Table 4-1, problem 14.

(e) When drinking water is to be discharged again, start shore discharge pump by positioning HAND/OFF/AUTO switch on motor controller to AUTO.

(4) If alarms are energized by salinity sensor, perform the following:

(a) Stop discharge pump by moving HAND/OFF/AUTO switch on motor controller to OFF.

(b) Press red flashing SALINITY key on EMS keyboard to change EMS video monitor ALARM display page back to SALINITY display page.

(c) Press ACK key on EMS keyboard to stop alarms and automatically change red flashing SALINITY key to white and stop flashing display on video monitor SALINITY display page. This FW DISCHG display continues to show in double intensity until problem is solved.

(d) Troubleshoot as provided in TM 55-1930-209-14&P-5, Table 4-1, problem 3.

(e) When drinking water is to be discharged again, start shore discharge pump by positioning HAND/OFF/AUTO switch on motor controller to AUTO.

(5) If alarms are energized by pressure sensor, perform following steps:

(a) Stop discharge pump by moving HAND/OFF/AUTO switch on motor controller to OFF.

(b) Press red flashing SYSTEM STATUS key on EMS keyboard to change EMS video monitor ALARM display page back to SYSTEM STATUS display page.

(c) Press ACK key on EMS keyboard to stop alarms and automatically change red flashing SYSTEM STATUS key to white and stop flashing display on video monitor SYSTEM STATUS display page. This DISCH PRESS display continues to show in double intensity until problem is solved.

(d) Troubleshoot as provided in TM 55-1930-209-14&P-5, Table 4-1, problem 4.

(e) When drinking water is to be discharged again, start shore discharge pump by positioning HAND/OFF/AUTO switch on motor controller to AUTO.

j. When discharge pump operation is to be stopped, set HAND/OFF/AUTO switch to OFF.

14-11.4 Discharging drinking water through port discharge valve

14-11.4.1 Discharging drinking water to another vessel

a. Perform steps b and c in paragraph 14-11.3.

b. Close valve DW14 (Barges 2 and 3 only).

c. Perform step f in paragraph 14-11.3.

d. Remove protective cap from discharge line at valve DW15.

e. Open valve DW19 on Barges 2 and 3. On Barge 1, position valve DW14 to port discharge.

f. Connect hose from other vessel to valve line.

g. Open valve DW15.

NOTE

If drinking water Is to be supplied through valve DW15 to another vessel, and this valve outlet has not been used recently, flush system for several minutes before connecting discharge hose. After this has been completed, hook up discharge hose from other vessel.

h. On Barge 1, position valve DW12 for discharge pump 1 or 2. On Barges 2 and 3, open valve DW12 and close DW18 to use discharge pump 1. Open valve DW18 and close DW12 to use discharge pump 2.
i. Start discharging drinking water and monitor water being discharged as given in steps g thru i in paragraph 14-11.3.
j. Stop discharge pump operation as necessary, by setting HAND/OFF/AUTO switch to OFF.
k Close valve DW15.
l. Disconnect fill hose.
m. Reinstall cap.
n. Close valve DW19 (Barges 2 and 3 only).

14-11.4.2 Emptying storage tanks by discharging overboard

a. Open appropriate valve(s) of storage tank(s) to be drained, as shown in table below:

Tank no.:	1	2	3	4
Valve no.:	DW12	DW14	DW8	DW9

b. Close valve DW14 (Barges 2 and 3 only)
c. Remove protective cap from discharge line at valve DW15 and open valve.
d. Set shore discharge pump selector switch (Figure 14-5) to pump 1 or 2.
e. Open valve DW19 on Barges 2 and 3. On Barge 1, position valve DW14 to port discharge.

NOTE

To prevent low level alarm from sounding and flashing while tank is being emptied, ALARM RELAY circuit breaker 4P14 on 24 Vdc power panel must be open (OFF).

f. On Barge 1, position valve DW12 for discharge pump 1 or 2. On Barges 2 and 3, open valve DW12 and close DW18 to use discharge pump 1. Open valve DW18 and close DW12 to use discharge pump 2.
g. Close switchboard circuit breaker P9 for shore discharge pump 1 or circuit breaker P15 for shore discharge pump 2.
h. In void 3 port, on shore discharge pump motor controller for pump selected in d, start pump by setting HAND/OFF/AUTO switch to HAND.

i. Start discharge pump by pushing START button on motor controller.

CAUTION

While emptying storage tank(s), with alarm circuitry turned oft, liquid level Indicator on tank(s) must be observed to prevent running pump dry.

j. When tank is dry, set HAND/OFF/AUTO switch on motor controller to OFF.
k. Close valves DW15 (all barges) and DW19 (Barges 2 and 3 only).
l. Reinstall cap on overboard discharge outlet.

14-11.5 Supplying storage tank drinking water to pressure set for use on barge

a. If drinking water is not being discharged from storage tanks, perform steps 1 and 2. If drinking water is being discharged from the storage tanks, go to step b.
   (1) Check liquid level indicator to be sure storage tank(s) contains water.
   (2) Open appropriate valve(s) of storage tank(s) to be drained, as shown in table below:

Tank no.:	1	2	3	4
Valve no.:	DW12	DW14	DW8	DW9

b. Open valve DW11.
c. Close reserve tank valve DW13.
d. Close power panel 1 circuit breaker 11P5 to provide power to drinking water pressure set motor controller.
e. Prime water pressure set as follows, if necessary:
   (1) Position HAND/OFF/AUTO switch on pressure set motor controller to HAND.
   (2) Start pressure set by pushing START button on motor controller.
   (3) Close valve DW16.
   (4) Open priming port petcock on pressure set.
   (5) Close petcock when steady flow appears.
f. Open drinking water valves DW5, DW5A (Barges 2 and 3 only), and DW17.
g. Position pressure set motor controller HAND/OFF/AUTO to AUTO.

NOTE

Pressure set automatically supplies, on demand, drinking water to dayroom fountain and sink, washdown stations In ROWPU space and on deckhouse top, shower on forward weatherdeck, and void 2 port chlorination unit.

14-11.6 Filling drinking water reserve tank

NOTE

Drinking water in reserve tank is for onboard use when drinking water is not available from storage tanks.

14-11.6.1 Filling drinking water reserve tank from storage tanks

CAUTIONS

Water level In reserve tank must be checked daily by monitoring liquid level Indicator. Add water if necessary. Chlorine content must also be checked daily.

Obtain sample at reserve tank sample valve and check chlorine content according to TM 55-6630-215-12. Add chlorine through chlorine fill on top of reserve tank If chlorine content is not between 2 and 5 ppm.

a. Check liquid level indicator on storage tank (s) to make sure tank(s) contains drinking water.
b. Make sure pressure set motor controller HAND/OFF/AUTO switch is OFF.
c. Close valves DW13 and DW17.
d. Open valves DW11 and DW16.

NOTE
Pressure set automatically fills reserve tank.

e. Close power panel 1 circuit breaker 11P5 to provide power to pressure set motor controller.
f. Position HAND/OFF/AUTO switch on pressure set controller to AUTO and pressure set automatically fills reserve tank.
g. When reserve tank is full, as shown on liquid level indicator, close DW16.
h. When drinking water storage tanks are full, open drinking water valves DW11 and DW17. Pressure set supplies onboard drinking water directly from storage tanks and bypasses pressure set reserve tank

14-11.6.2 Filling drinking water reserve tank from other vessel or shore supply

NOTE
If drinking water is not available from storage tanks, reserve tank can be filled from other available drinking water supplies.

a. Remove cap from water fill pipe located near port discharge valve DW15 on weatherdeck.
b. Attach or insert hose from drinking water supply.
c. Close valves DW13 and DW16.

NOTE
Use telephone headsets for communications between weatherdeck and void 3 port

d. When reserve tank is full, as indicated by reserve tank liquid level indicator, stop filling tank.
e. Reinstall cap on water fill pipe.

14-11.7 Supplying drinking water on barge from reserve tank

NOTE
Drinking water In reserve tank Is for use onboard barge when water is not available from storage tank(s).

a. Obtain sample of drinking water from reserve tank at sample valve. Check chlorine content according to TM 5-6630-215-12. Add chlorine through chlorine fill on top of reserve tank if chlorine content is not between 2 and 5 ppm.
b. Make sure filter cartridge is clean. Replace if necessary.
c. Close valves DW11 and DW16.
d. Open drinking water valves DW5, DW5A (on Barges 2 and 3 only), DW13, and DW17.

NOTE
Pressure set automatically supplies, on demand, drinking water to dayroom, washdown stations, chlorination unit, and shower.

e. Close power panel 1 circuit breaker 11P5 to provide power to pressure set motor controller.

NOTE

Pressure set automatically stops when reserve tank is empty. Before It becomes empty, refill by following procedures In paragraph 14-11.6.

f. Set HAND/OFF/AUTO switch on pressure set motor controller to AUTO.
g. Make sure pressure set is operating normally.

14-11.8 Supplying drinking water to dayroom, washdown stations, chlorination unit, and shower

a. Make sure drinking water is in storage tanks or reserve tank
b. Perform steps a thru g in paragraph 14-11.5 to supply drinking water from storage tank(s). Perform steps a thru g in paragraph 14-11.7 to supply drinking water from reserve tank.
c. Supply drinking water as follows:
   (1) At dayroom sink, open valve DW5 and open faucet
   (2) At dayroom fountain, open valves DW5 and DW5A (on Barges 2 and 3 only) and operate fountain.
   (3) At ROWPU and deckhouse top washdown stations, open bib at each station.
   (4) At shower on bow weatherdeck, open valve on showerhead.
   (5) At chlorination unit, open valve as directed by procedures in TM 55-1930-209-14&P-4.

14-12 Shutdown procedures

14-12.1 Normal shutdown

a. If system will be shut down for less than 12 hours and personnel remain onboard;
   (1) Stop ROWPU systems according to procedures in TM 55-1930-209-14&P-3 to stop drinking water from flowing into storage tanks.
   (2) Stop shore discharge pumps by positioning motor controller HAND/OFF/AUTO switch to OFF.
   (3) When an onboard water supply is not required, stop pressure set by positioning its motor controller HAND/OFF/AUTO switch to OFF.
b. If system will be shut down for more than 12 hours but less than 7 days and personnel will not be onboard:
   (1) Perform steps 1 thru 3 in step a.
   (2) Open switchboard circuit breakers P9 (shore discharge pump 1) and P15 (shore discharge pump 2).
   (3) Open power panel 1 circuit breaker 11P5.
c. After shutdown, perform the following after operation checks:
   (1) Wipe components clean, especially gauges and control panels.
   (2) Check for damaged or missing items, loose wires, connections and securements. Repair, replace and/or tighten as necessary.
   (3) Remove rust and corrosion. Touch up paint in accordance with TB 43-0144 as necessary. Do not paint threads or labels.

14-12.2 Emergency shutdown

14-12.2.1 General. The barge has two emergency shutdown modes (Chapter 3). One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Seven red system shutdown buttons are located on the ROWPU space starboard bulkhead just aft of the personnel door. These seven emergency system shutoff buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel high pressure pump, ROWPU 2 diesel HP pump, SAG, SSG1, and SSG2.

Six red total shutdown buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system emergency shutoff buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck.
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck
- Inside dayroom door to weatherdeck

14-12.2.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.

b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

CHAPTER 15 SHORE DISCHARGE SYSTEM

Section I. General

15-1 General. The shore discharge system discharges drinking water from barge drinking water storage tanks via a flexible steel and rubber-coated hose to a storage area ashore, as shown in Figure 15-1.

15-2 Description. System transports drinking water from barge storage tanks to holding/storage facilities ashore Major system components are listed In Table 15-1. Equipment specifications, maintenance Information and manufacturer's service manuals are contained In TM 55-1930-209-14&P-6.

15-3 Capabilities. This system, under optimum conditions, moves 300,000 gallons of drinking water per day from barge drinking water storage tanks to shore storage facilities.

15-4 Special limitations. The shore discharge system has been designed to operate in a condition not exceeding sea state 3

15-5 Performance characteristics:

Maximum operating pressure	150 psi
Flow rate capacity	300,000 gal/day
Flexible hose length	2500 ft
Ambient operating temperature	32° to 120°F
Electrical power requirement	440 Vac, 3 ph, 60 Hz

Section II. Description and data

15-6 Shore winch installation. To set up the shore discharge system to pump drinking water ashore, an LCM-8 or vessel with same capability, is positioned across the bow of the ROWPU barge When the 20-ton capacity shore winch (weighing 5.5 tons) has been readied for deployment (TM 55-1930-209-14&P-21), the bow crane lifts it off the barge and sets it in the LCM-8. Operation, maintenance, and use of the bow crane is described In TM 55-1930-209-14&P-13. When the LCM-8 has run ashore and lowered its ramp, the shore unit uses a forklift to unload the winch The winch is then positioned on the beach and stabilized by stakes driven in by an air compressor-powered jackhammer. The free end of the messenger line, which has been brought ashore, is then fastened to the winch drum. At the barge, the bitter end of the messenger line and lines from floating buoys are tied to the hose end cap.

15-7 Hose deployment. A supervisor coordinates hose deployment from the hose reel to the shore winch takeup. Operator uses winch control lever and levelwind control lever to match barge reel winch deployment speed with shore winch retrieval speed As the hose is deployed, marker buoys are attached to the hose These buoys, along with status lights (nighttime) or status markers on the deckhouse top, warn vessels that an underwater hose Is deployed.

15-8 Pumping water to shore. When hose is connected to shore connection, flexible discharge hose deployment is complete. Drinking water Is then pumped ashore until water-making operations at this location are stopped and discharge hose is retrieved.

15-9 Hose retrieval. Retrieval begins when the flexible hose is disconnected from the water connection ashore and the PIG catcher is attached to the hose end. The PIG, propelled by compressed air, travels from the barge end of the discharge hose to the shore, and pushes the water out of the hose to make it easier to retrieve. When this procedure is complete, the PIG catcher on the end of the discharge hose is replaced with the hose end cap and floating buoys. The barge winch operator then operates both the hose reel winch control lever and levelwind control lever to rewind the hose on the winch reel.

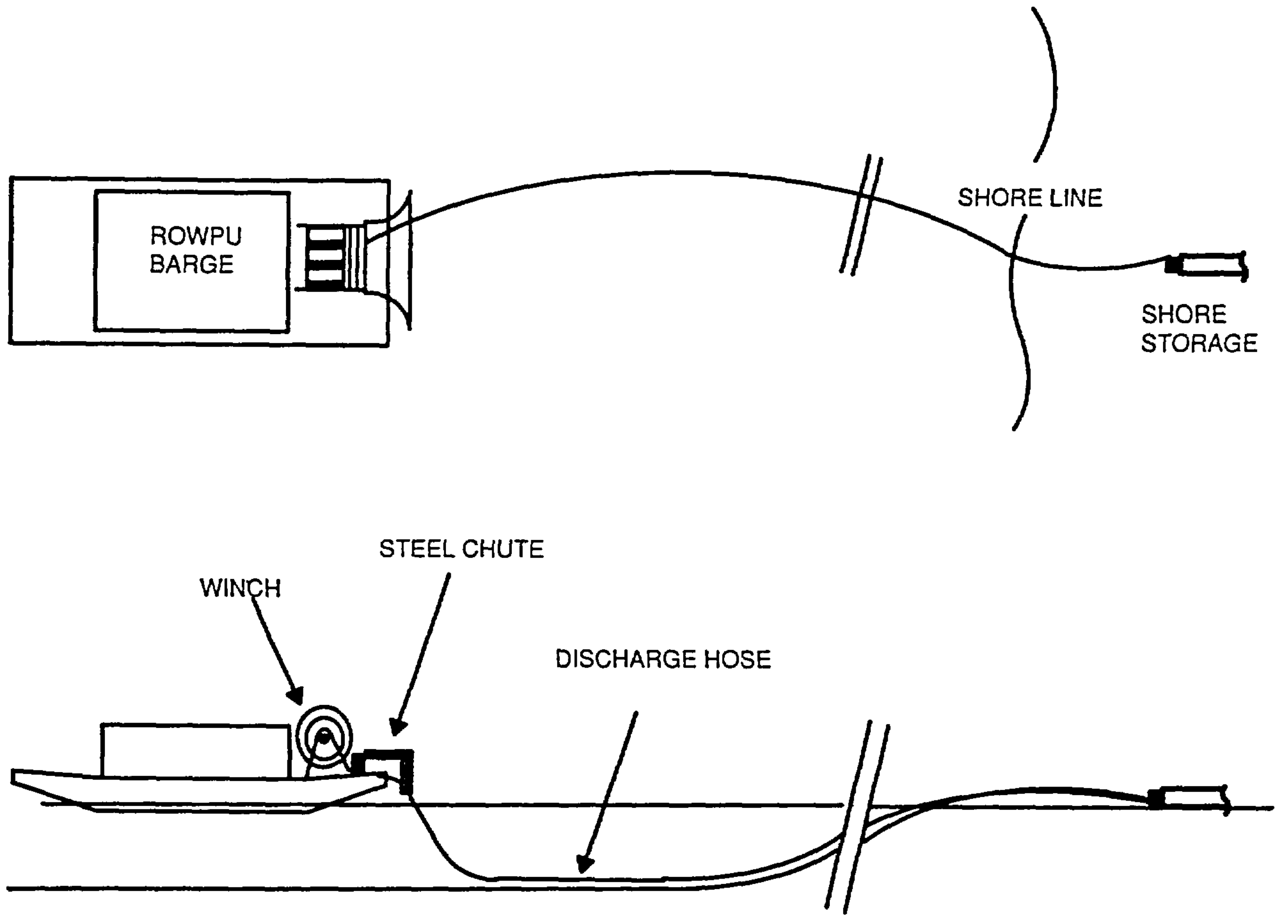


Figure 15-1. Shore Discharge System Installation

Table 15-1. Components of Shore Discharge System

Component	Function	Location
Hose reel winch	Deploys and retrieves hose	Centerline of barge at stern
Hydraulic power unit	Provides power to winch and levelwind	Void 5
Levelwind	Guides hose onto reel during hose retrieval	Aft of winch
Chute	Supports hose when deployed	Aft of levelwind
PIG	Forces water out of hose	Stored when not in use
PIG insertion point	Inserts PIG into flexible hose	Stern portside in shore discharge water pipe connection to hose
PIG receiver	Catches PIG on shore	On shore end of discharge hose
Flexible discharge hose	Carries water from barge to shore when deployed	On winch when retrieved
Hose reel winch hydraulic unit START/ STOP switch	Starts and stops hydraulic power unit	Aft deckhouse bulkhead control panel portside on weatherdeck
Hose end cap	Attachment point for messenger line when pulling flexible hose ashore with shore winch	Screws on end of hose or stored In workshop stowage area
Floating buoys	Keeps hose end cap from catching on sea bottom	Attached to hose end cap during deployment Stored in ROWPU space aft stowage area
Messenger line	Attaches to hose end cap on end of hose to allow shore winch to pull hose to shore	On dispensing reel on aft of workboat
Shore winch	Pulls discharge hose to shore	Stored on bow forward of bow crane. Remains on shore when barge is deployed

Section III. Operating Instructions

15-10 Operating controls and Indicators. Information about shore discharge system operating controls and indicators is contained in Table 15-2 and shown in Figures 15-2 thru 15-10. Operating valves are shown in Figures 15-7 thru 15-10 and are listed in Table 15-3.

15-11 Prestart procedures. Before operating shore discharge system operation, be sure to check system for damage and perform the following before operation checks:

a. Wipe components dean, especially gauges and control panels.
b. Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report leaks to shift leader so corrective action can be taken.
c. Check for damage, especially to pressure gauges, filters, and control panels.
d. Check for loose or missing securements and fasteners. Tighten or replace as necessary.
e. Check wiring for loose connections and frayed cables. Secure as necessary. Repair or replace damaged cables.
f. Check hydraulic power unit reservoir sight gauge to make sure reservoir is full of oil. Add oil if necessary.
g. Make sure steel chute surfaces are smooth and free of gouges, damage, or roughness that could damage the hose. Repair as necessary.

15-12 Operating procedures. During operating procedures, perform the following during operation checks:

a. Check for leaks, paying special attention to all joints, valves, fittings, and piping. Report leaks to shift leader so corrective action can be taken.
b. Check for loose or missing securements and fasteners. Tighten or replace as necessary.
c. Check wiring for loose connections. Tighten as necessary.
d. Be alert to unusual noises or overheating that might indicate a pending malfunction. Report these occurrences to the shift leader for possible troubleshooting and corrective action.
e. Make sure all components operate normally.
f. Make sure readings on hydraulic power unit piston pump low (return) pressure gauge and piston pump high (discharge) pressure gauge are the same. Adjust bias settings if readings differ.
g. Check hydraulic power unit filter pressure gauges. If pressure gauges indicate a requirement for filter element replacement, notify shift leader so this can be done after operation is completed.

15-12.1 Discharge hose deployment

WARNING

Make sure good communications between barge and shore facility have been established to coordinate discharge hose deployment.

15-12.1.1 Predeployment procedures. Before deploying the discharge hose, make sure the predeployment operations in paragraphs 15-12.1.1 thru 15-12.1.1.3 have been performed.

WARNING

Shore winch must be positioned and securely anchored before It pulls discharge hose to shore.

15-12.1.1.1 Shore winch Installation. Make sure the shore winch (20-ton capacity) has been properly positioned and secured according to procedures in TM 55-1930-209-14&P-21.

Table 15-2. Operating Controls and Indicators

Component	Figure	Location
Winch hose control lever	15-2 (Barge 1) 15-3 (Barges 2 and 3)	Portside of winch
Winch pressure gauge	15-2 (Barge 1) 15-3 (Barges 2 and 3)	Portside of winch near winch control lever
Winch disc brake lever	15-3 (Barges 2 and 3)	Portside of winch near winch control lever
Levelwind control lever	15-2 (Barge 1) 15-3 (Barges 2 and 3)	Portside of winch
Levelwind pressure gauge	15-2 (Barge 1) 15-3 (Barges 2 and 3)	Portside of winch near levelwind control lever
Hydraulic power unit control panel	15-4	Void 5 or hydraulic power unit
Hydraulic unit remote control switch	15-4	On deckhouse aft bulkhead portside on stern
Zero adjustment screw	15-5	Void 5 on hydraulic power unit
Piston pump high (supply) pressure gauge	15-5 (Barge 1) 15-6 (Barges 2 and 3 -A PRESSURE)	Void 5 on hydraulic power unit
Piston pump low (return) pressure gauge	15-5 (Barge 1) 15-6 (Barges 2 and 3 -B PRESSURE)	Void 5 on hydraulic power unit
Charge pressure gauge 15-6 (Barges 2 and 3	15-5 (Barge 1) -CHARGE PRESSURE)	Void 5 on hydraulic power unit
Levelwind pump pressure gauge	15-5 (Barge 1) 15-6 (Barges 2 and 3 -LEVELWIND PRESSURE)	Void 5 on hydraulic power unit
Supply filter pressure gauge	15-5 (Barge 1) 15-6 (Barges 2 and 3 -SUCTION FILTER)	Void 5 on hydraulic power unit
Return filter pressure gauge	15-5 (Barge 1) 15-6 (Barges 2 and 3 -RETURN FILTER)	Void 5 on hydraulic power unit
Level gauge	15-5	Void 5 on hydraulic power unit

Table 15-2. Operating Controls and Indicators (continued)

Component	Figure	Location
Temperature gauge	15-5	Void 5 on hydraulic unit
PIG launcher controls		
PIG insertion point	15-7	Portside of winch
Compressed air hose connection	15-7	Portside of winch
Valve SD1	15-7	Portside of winch
Valve SD2	15-7	Portside of winch
Winch hydraulic disc brake release controls		
Disc brake release pump handle	15-8	Portside of winch
Hose reel winch disc brake	15-8	Portside of winch
Hose reel winch disc valve SD4	15-8	Portside of winch
Hose winch band brake		
Band brake pump handle	15-9	Starboardside of winch
Band brake valve SD3	15-9	Starboardside of winch
Levelwind valve SD5 (Barges 2 and 3)	15-10	Portside of winch

15-12.1.1.2 Preparation of discharge hose

a. Free pulling head tiedown. Check that pulling head is secured to coupling.

b. Attach three 500-pound buoyancy floats to pulling head. This prevents hose end from getting stuck in seabottom.

15-12.1.1.3 Preparation of shore discharge hose, reel winch, and hydraulic power system

a. Make sure that hydraulic lines are properly connected to hydraulic power package and to winch and levelwind. Make sure that electrical connections are tight and in order.

b. Check sight gauge on hydraulic reservoir to ensure proper level of hydraulic oil (Figure 15-5).

c. If temperature gauge reads 45°F or less, turn heater ON/OFF switch to ON (Figure 15-4).

NOTE

Hose reel winch has two braking systems: 1) a hand-pumped band brake located on starboard side of winch and 2) a spring-loaded, normally on hydraulic disc brake, located on the winch port side.

On Barge 1, during operation, disc brake is released (OFF) when the winch control lever (Figure 15-2) Is in the DEPLOY or RETRIEVE position and set (ON) when In the NEUTRAL position.

On Barges 2 and 3, disc brake Is set or released when the winch disc brake lever (Figure 15-3) is positioned ON (set) or OFF (released). Manual release Is accomplished by using the hose reel winch hydraulic brake release hand pump.

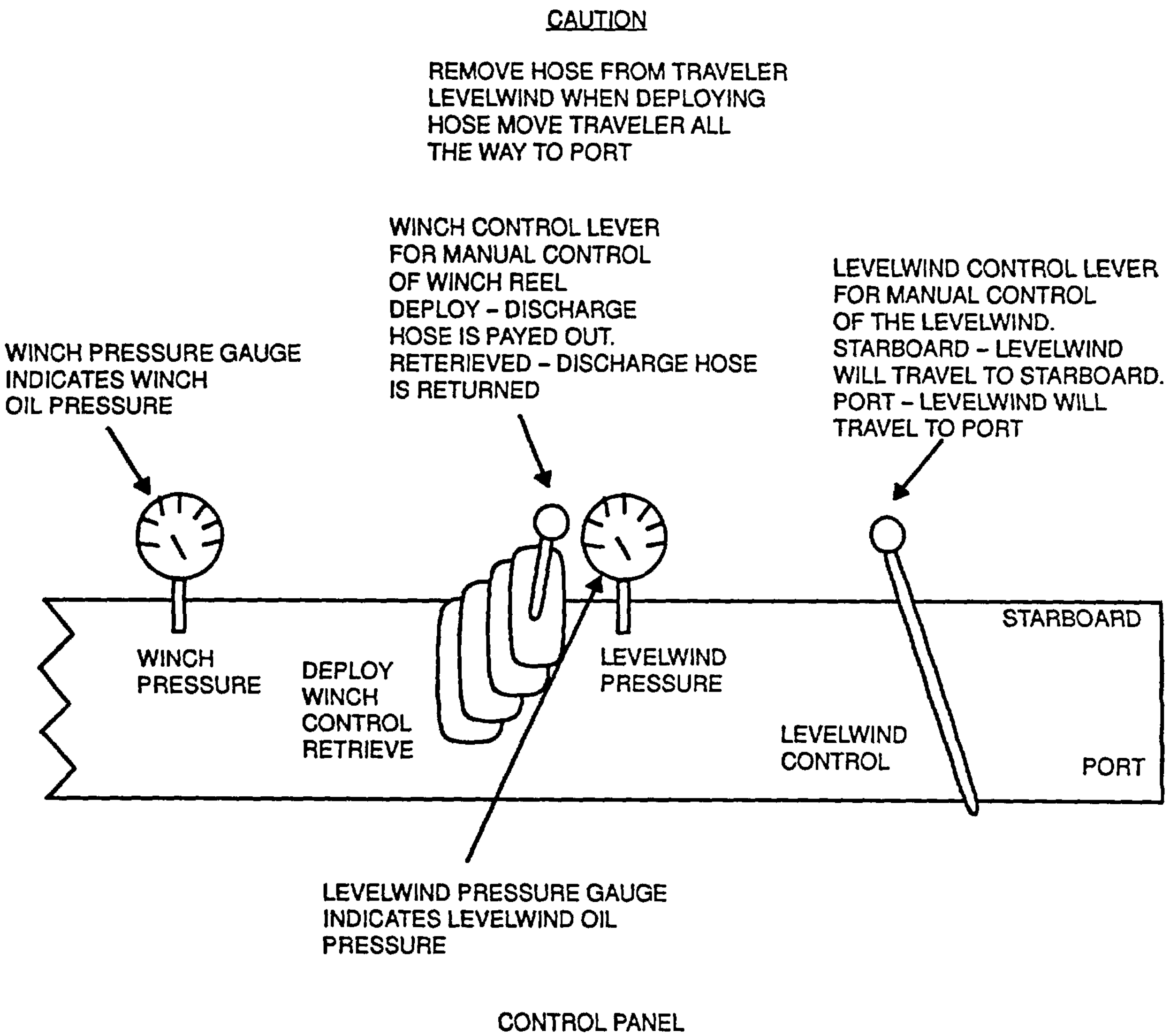
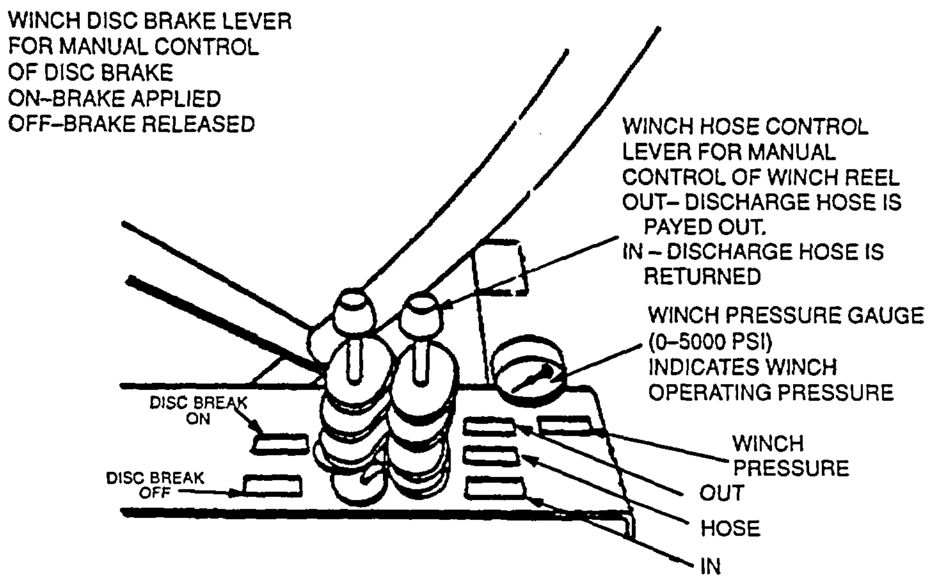
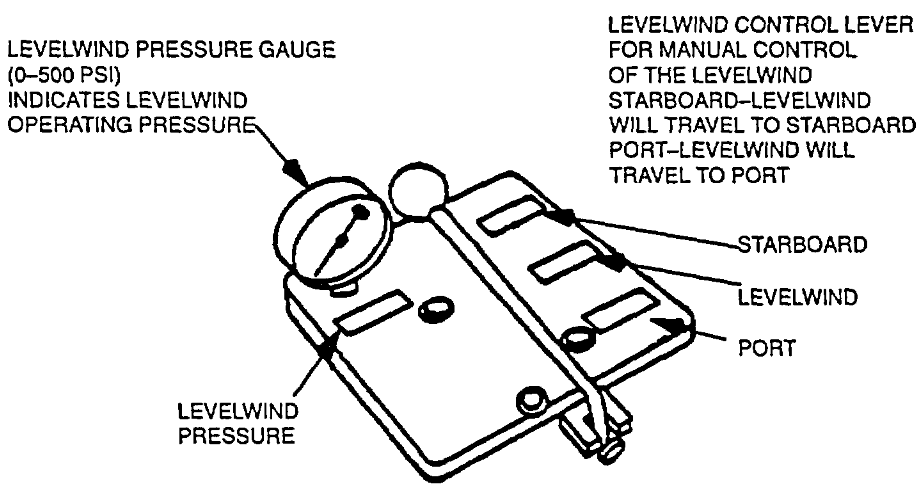


Figure 15-2. Shore Discharge System Winch Controls and Indicators (Barge 1)



LEVELWIND CONTROL AND INDICATOR
LOCATION: PORTSIDE OF WINCH ON STERN



WINCH HOSE CONTROLS AND INDICATOR
LOCATION: PORTSIDE OF WINCH ON STERN

Figure 15-3. Shore Discharge System Winch Controls and Indicators (Barges 2 and 3)

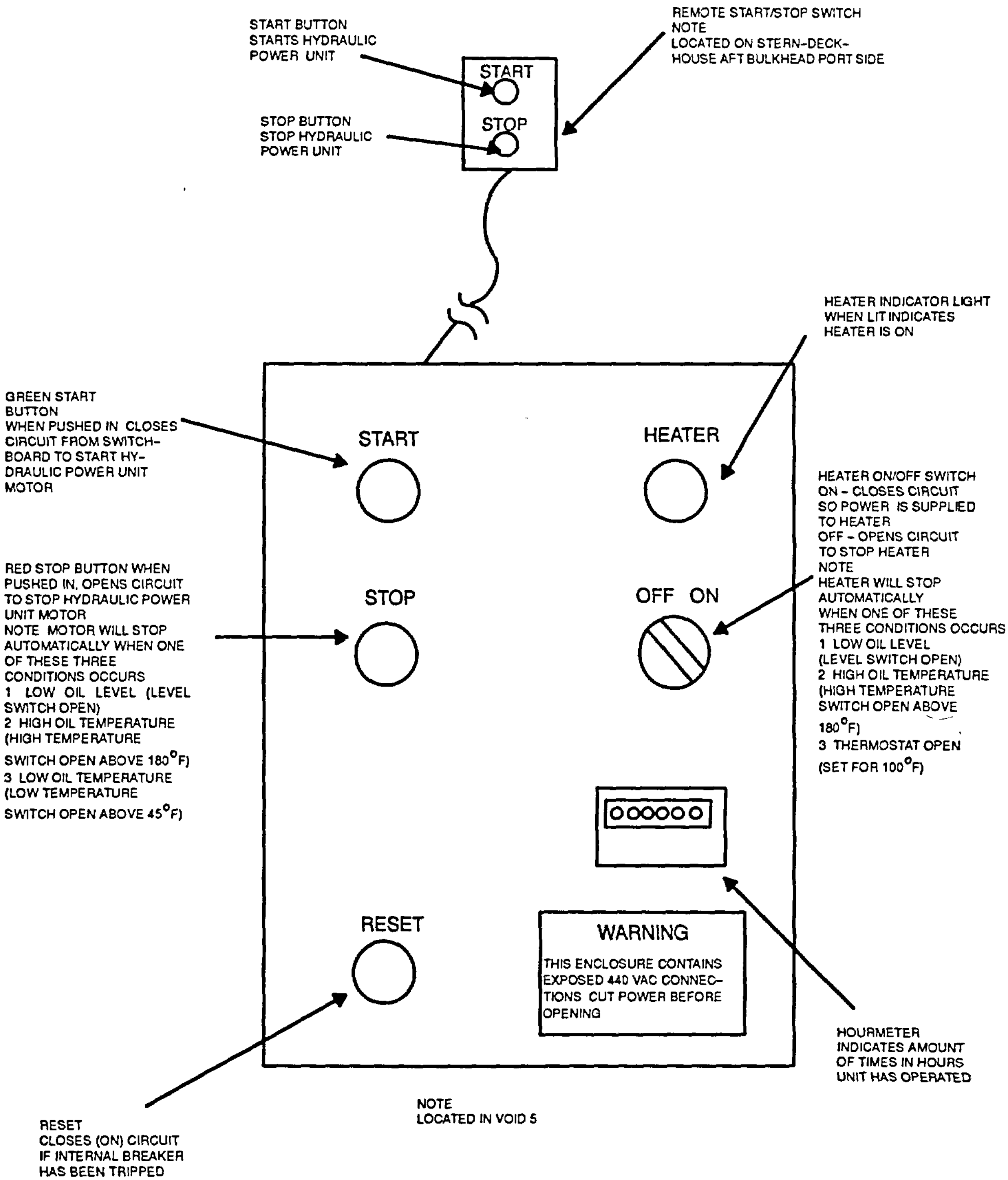
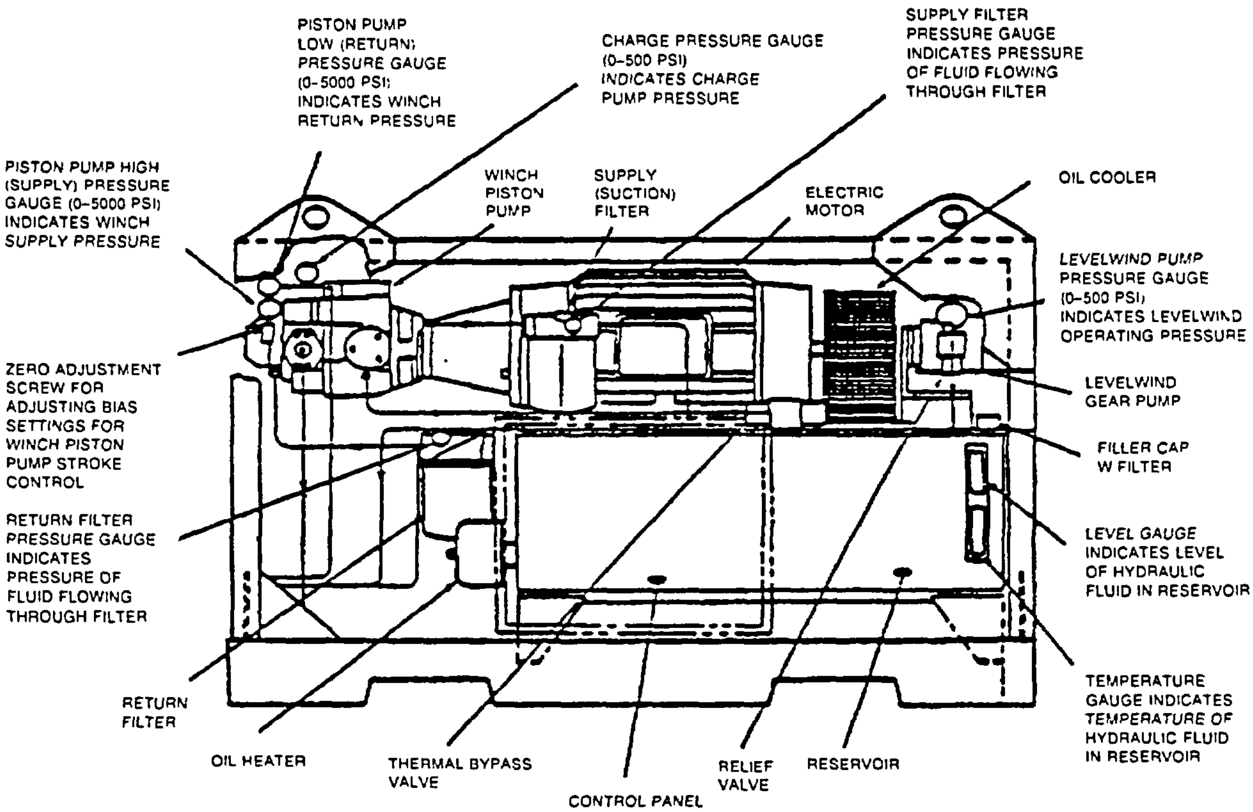


Figure 15-4. Hydraulic Power Unit Control Panel and Remote Start/Stop Switch



ON BARGE 1, PRESSURE GAUGES ARE ON HYDRAULIC POWER UNIT AS SHOWN ON BARGES 2&3, PRESSURE GAUGES ARE ON CONTROL PANEL

LOCATION: VOID 5

Figure 15-5. Hose Winch Hydraulic Power Unit

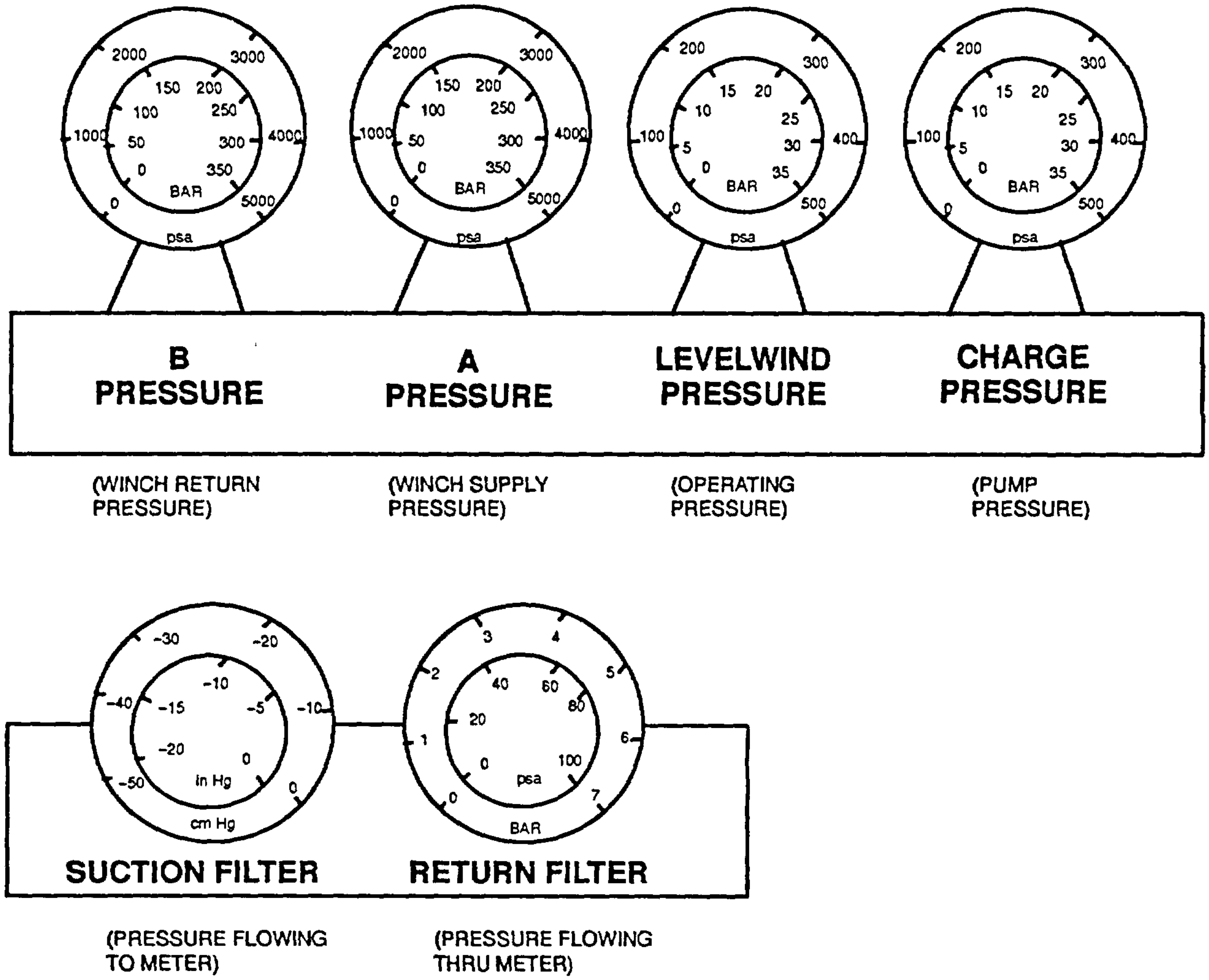


Figure 15-6. Hydraulic Power Unit Gauges (Barges 2 and 3)

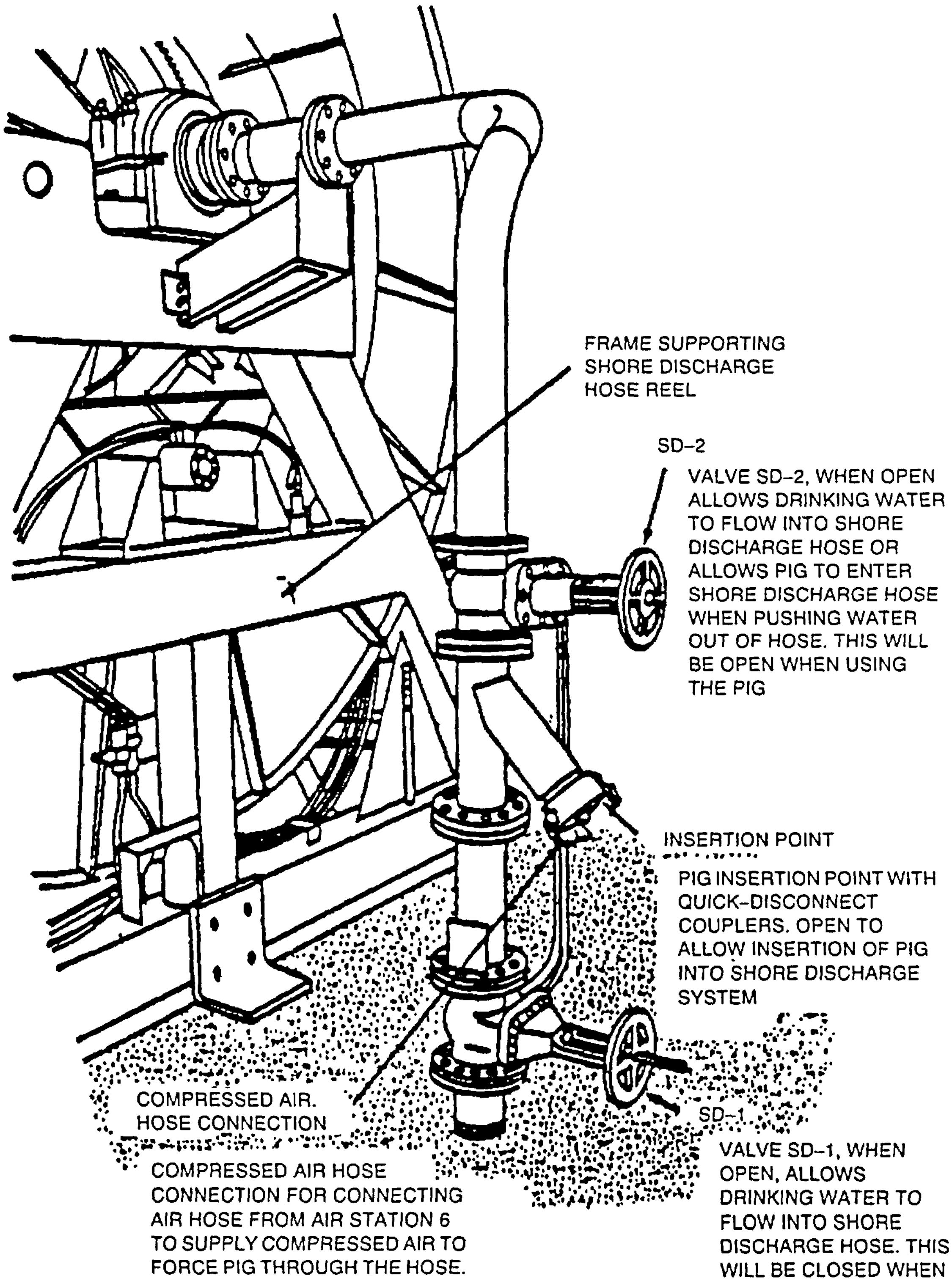


Figure 15-7. Valves and PIG Launcher Controls

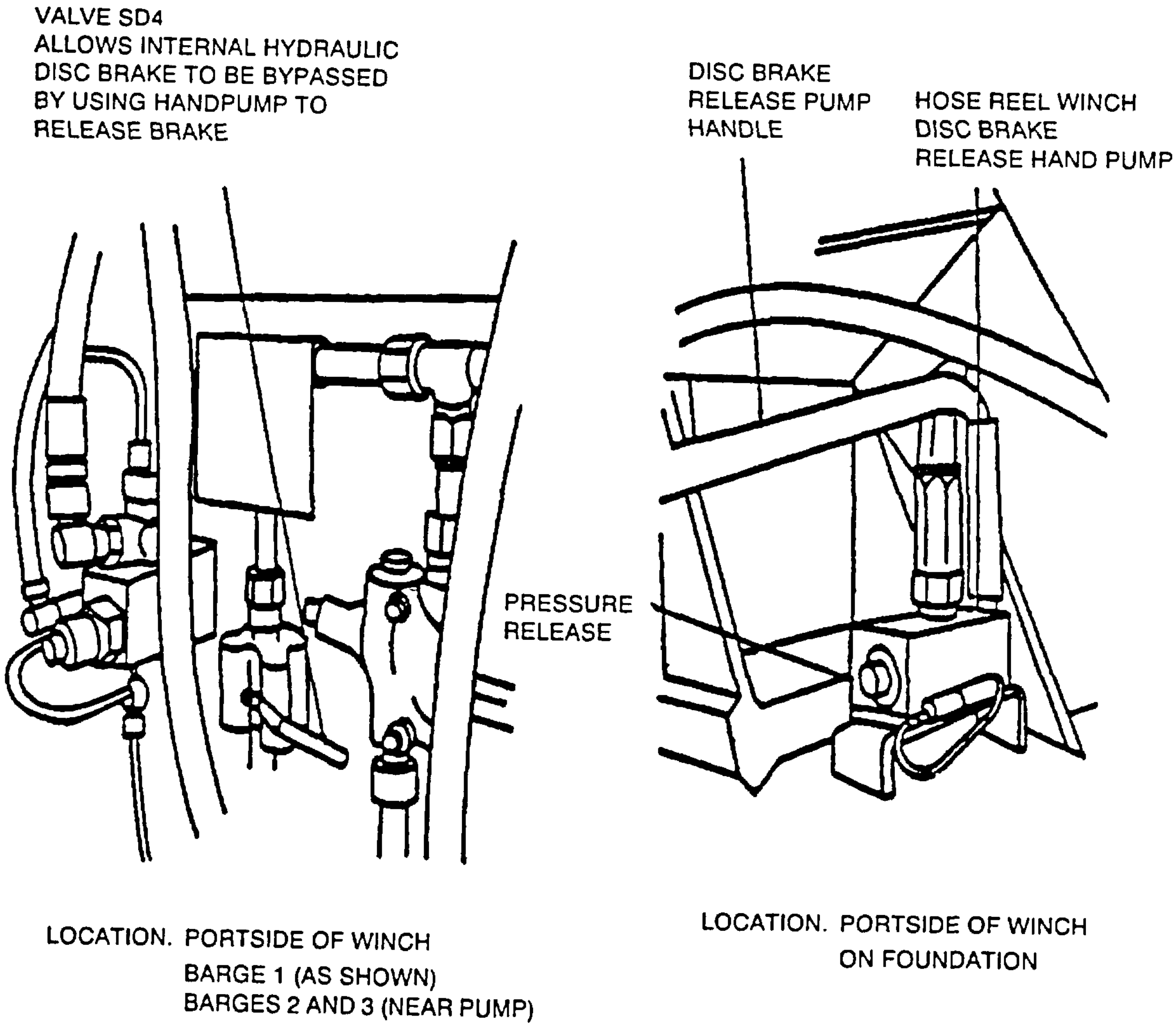


Figure 15-8. Hydraulic Disc Brake Release Controls

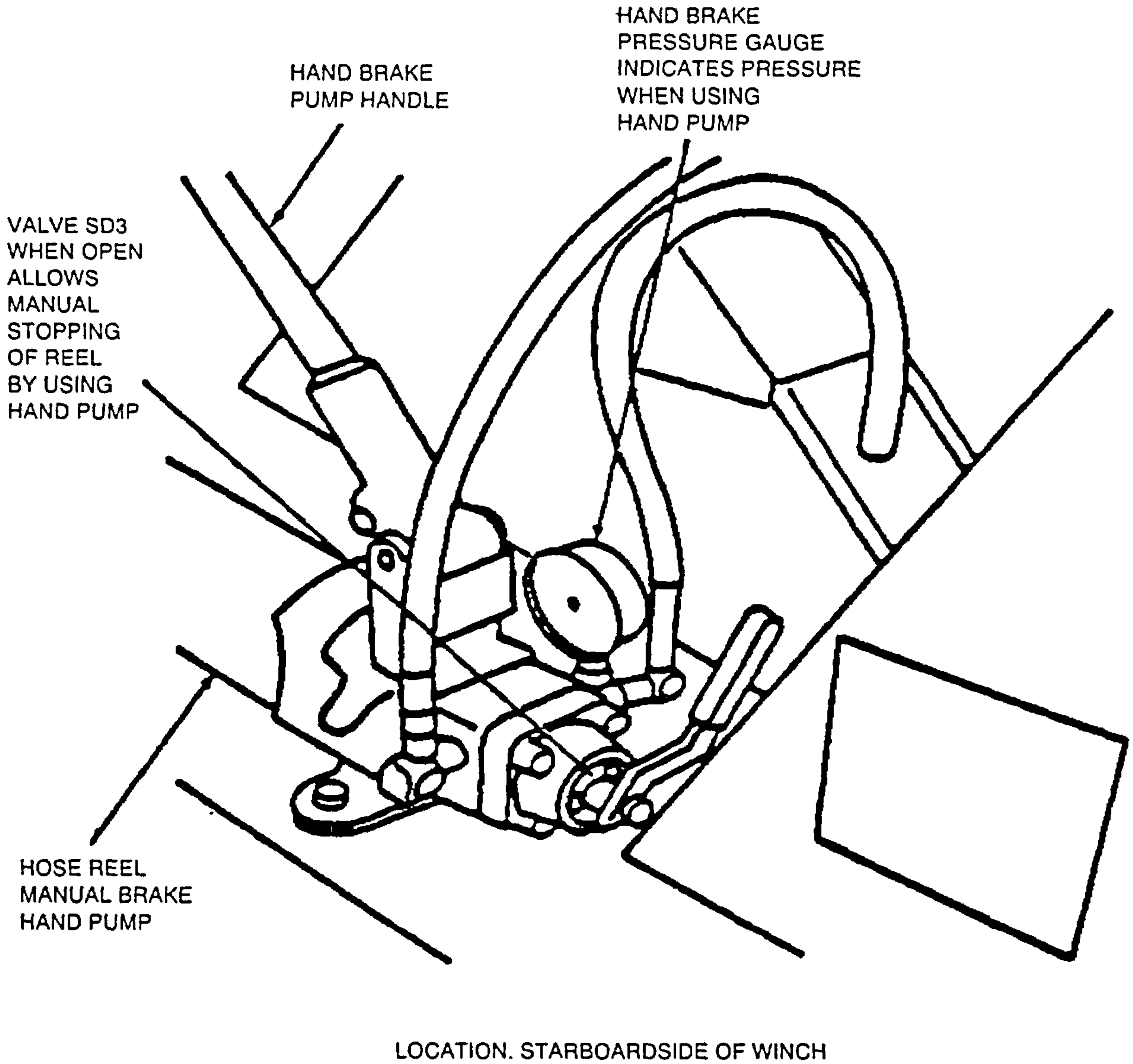
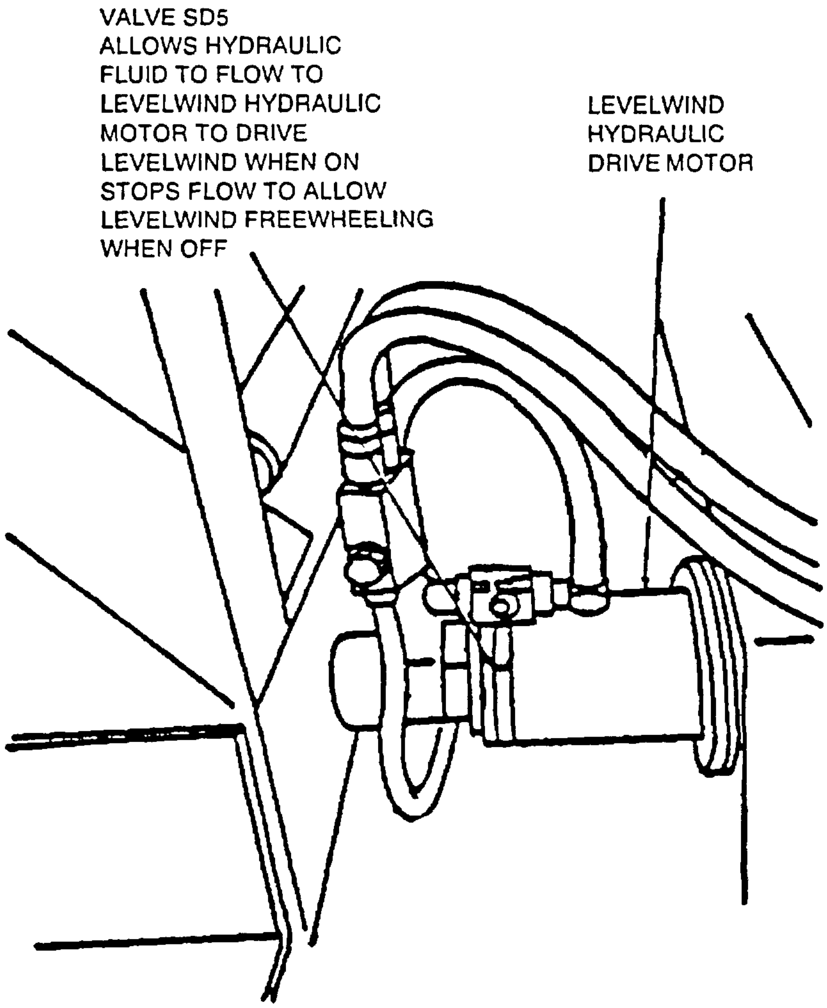


Figure 15-9. Band Brake Hand Pump Controls and Indicators



LOCATION PORTSIDE IN FRONT OF WINCH
LEVELWIND CONTROLS (BARGES 2 AND 3)

Figure 15-10. Levelwind Controls (Barges 2 and 3)

Table 15-3. Shore Discharge System Valves

Type	Figures 15-7 thru 15-10 Callout	Location	Label Identification and Valve Function
4-in. gate	SD1	In supply line to shore discharge winch reel	DRINKING WATER SUPPLY: Allows drinking water to flow to valve SD2
4-in. gate	SD2	In supply line to shore discharge winch reel	PIG LAUNCHER: Allows drinking water to flow to discharge hose when valve SD1 is open. Allows PIG to move to discharge hose when valve SD1 is dosed and compressed air moves PIG
Ball valve	SD3	On starboard side of winch reel	HOSE REEL WINCH HAND BRAKE: Allows reel to be manually stopped by using handpump to engage band brake
Ball valve	SD4	On port side of winch reel	HOSE REEL WINCH HAND ROTATION: Allows internal disc brake to be bypassed by using handpump to release brake
Ball valve	SD5 (Barges 2 and 3)	On levelwind hydraulic motor	LEVELWIND: Controls hydraulic fluid to levelwind drive motor to allow levelwind to operate under hydraulic power or freewheel

d. Make sure winch band brake on starboard side of winch is set. If not, set as follows:

(1) Open valve SD3 (Figure 15-9).

(2) Obtain band brake pump handle from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE.

(3) Pump until band brake piston enters cylinder and band is tight on the brake drum.

(4) Position valve SD3 in neutral position (midway between OPEN and CLOSE position) to lock the cylinder in the set position.

(5) Remove pump handle and return to stowed position.

e. Perform the following as appropriate:

(1) On Barge 1:

(a) Make sure valve SD4 (Figure 15-8) is in ON position.

(b) Make sure that winch control and levelwind control levers (Figure 15-2) are in middle (neutral) position.

(2) On Barges 2 and 3:
   (a) Make sure valve SD4 (Figure 15-8) is in ON position.
   (b) Make sure valve SD5 (Figure 15-10) is in OFF position to allow freewheeling of levelwind hydraulic drive motor.
   (c) Make sure that winch control and levelwind control levers are in neutral position.
   (d) Make sure disc brake lever is in ON position.

f. Close (ON) switchboard reel circuit breaker P12 supplying power to hydraulic unit, electrical motor, and controls.

NOTE

Hydraulic power unit can also be started by pressing START push button on hydraulic unit remote START/STOP switch located on deckhouse aft bulkhead, portside.

g. Push green START button on hydraulic power unit control panel located in void 5 (Figure 15-4). If motor does not start, troubleshoot as given in paragraph 4-10.1 TM 55-1930-209-14&P-6.

h. If initial startup, check pump rotation as shown on identification plate.

i. If initial startup, or if system has not been operated for several days:

   Barge 1 - Allow pumps to run with winch control and levelwind control levers in neutral position for not less than 5 minutes. This allows hydraulic oil to circulate at low pressure to remove entrapped air.

   Barges 2 and 3 - Allow pumps to run with disc brake control in OFF position and winch and levelwind controls in neutral position for not less than 5 minutes.

j. Check for oil leaks and tighten fittings if necessary.

k. Make sure charge pressure gauge (Barge 1 - Figure 15-5; Barges 2 and 3 - Figure 15-6) on hydraulic power unit reads 250 psi. This is the minimum pressure needed for proper stroke control and make-up flow for winch circuit.

l. Check bias settings for piston pump stroke control. With winch control lever in neutral position on Barge 1 (Figure 15-2) or OFF position on Barge 2 and 3 (Figure 15-3), compare readings between piston pump low pressure gauge and high pressure gauge on hydraulic power unit (Figure 15-5). These gauges indicate pressure on two sides of winch circuit. If the two readings differ, bias should be zeroed by adjusting zero adjustment screen (socket-head screw) on end of stroke control on piston pump. This ensures that pump is fully destroked when winch hose control lever is in neutral position.

m. If winch drum is secured, release winch drum tiedown.

15-12.1.1.4 Deployment of messenger (tow) line

a. Using workboat, carry end of messenger line to shore and, with enough slack, attach to shore winch.

b. Deploy line from workboat reel while moving toward barge.

c. Attach messenger line bitter end to discharge hose pulling head assembly with shackle and shackle pin. Make sure shackle pin has been secured with wire or cotter pin to prevent loss during deployment to shore.

15-12.1.2 Deployment of discharge hose (hose out)

WARNING

Make sure that nobody stands in front of or behind hose reel.

a. Make sure steel chute surface is smooth and free of any irregularities that could damage hose.

NOTE

If hydraulic power unit is shut down or no electric power is available, deploy discharge hose manually as given in paragraph 15-12.1.1.4.

b. Release band brake on winch as follows:
   (1) Close valve SD3 (Figure 15-9).
   (2) Obtain band brake pump handle from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on band brake pressure gauge.

   (3) Pump until band brake piston comes out of cylinder and there is a slight clearance between band brake material and brake drum.
   (4) Remove pump handle and return to stowed position.

c. Screw on hose end cap.

d. Deploy hose as follows:
   (1) On Barge 1 (Figure 15-2):

WARNING

During deployment on Barge 1, levelwind control lever must be operated. Use care to regulate speed of levelwind movement with hose movement.

      (a) Use winch control lever to deploy hose end cap while using levelwind control lever to control movement of levelwind.
      (b) Make sure hose end cap is pulled away from barge anchor lines to prevent entanglement.

   (2) On Barges 2 and 3 (Figure 15-3):

WARNING

During deployment on Barges 2 and 3, levelwind control lever must not be operated. Make sure valve SD5 (Figure 15-10) on levelwind hydraulic drive motor is OFF and levelwind moves freely.

      (a) Push winch disc brake lever (Figure 15-3) to OFF to release disc brake.
      (b) Use winch control lever to deploy pulling head assembly.
      (c) Make sure hose end cap assembly is launched away from barge anchor lines to prevent entanglement.

WARNING

Barge winch deployment speeds and shore winch takeup speed must be the same but no faster than 30 feet per minute. Deploying 2000 feet of hose normally takes 70-90 minutes.

(d) Deploy hose at same speed that shore winch takes it in, but no faster than 30 feet per minute. Operate shore winch according to TM 55-1930-209-14&P-21. If a winch runaway situation starts to develop, perform procedures in 15-12.1.3. Otherwise, go to step e.

e. As hose is deployed, attach marker buoys with line to identify undersea discharge hose location. First marker must be 150 feet from shore, and all other markers must be spaced every hundred feet for remainder of hose deployed. If tactical situation permits and area near barge has considerable boat traffic, these marker buoys should be lighted at night to protect the undersea hose from damage.

Deployment of Marker Buoys:

Marker	Color	Location
First	White	150 feet plus distance of shore facility connection from beach
Second	Red	100 feet from first marker
Third	White	100 feet from second marker
Fourth, etc.	Alternate color	100 feet from previous marker

NOTE

Watch pulling head assembly floats to ensure that floats are visible at all times during discharge hose deployment.

f. Deploy discharge hose until flange is at desired location (near shore hose connection) on shore. Anchor with sandbags and stakes at least 70 feet of hose resting on shore to make sure it does not shift. While deploying hose, perform during operation checks in paragraph 15-12.

g. Deploy additional length of hose onto seabed to protect hose and barge winch. Then, on:

Barge 1 return winch control and levelwind control levers to neutral.

Barges 2 and 3 return winch control lever to neutral and disc brake lever to ON.

NOTE

Barge crewmen must connect hose flange to shore facility flange.

h. Remove hose end cap, floats, and messenger line and attach hose flange to flange of shore connection.

i. Return hose end cap, floats, and messenger line to barge and stow.

j. Set band brake on barge winch as follows:

(1) Open valve SD3 (Figure 15-9).

(2) Obtain BAND BRAKE PUMP HANDLE from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE

(3) Pump until band brake piston enters cylinder and band is tight on the brake drum.

(4) Position valve SD3 in neutral position (midway between OPEN and CLOSE position) to lock the cylinder in the set position.

(5) Remove pump handle and return to stowed position.

k. Turn off hose winch hydraulic power unit by pushing red STOP button on control panel.
l. Open switchboard circuit breaker P12 to cut power to hose reel hydraulic unit and winch.
m. Shutdown shore winch according to procedures in TM 55-1930-209-14&P-21.
n. Display international rules of the road day shapes or night lights on mast above topdeck to warn that barge has a discharge hose deployed on the seabed.

Time	Top Signal	Middle Signal	Bottom Signal
Daytime	Black Ball	Black Diamond	Black Ball
Nighttime	White Light	Red Light	White Light

15-12.1.3 Controlling a **runaway discharge hose.** If a winch runaway situation develops, control runaway as follows:

a. Barge 1 - Position winch control lever in NEUTRAL.
b. Barges 2 and 3 - Push disc brake lever to ON.
c. If this fails to stop runaway, apply band brake as follows:
   (1) Open valve SD3.
   (2) Obtain BAND BRAKE PUMP HANDLE from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE gauge.

   (3) Pump until band brake piston enters cylinder, band is tight on the brake drum and stops rotation.
   (4) Position valve to neutral position (midway between OPEN and CLOSE position) to lock the cylinder in the set position.
   (5) If band brake begins to smoke, spray it with salt or fresh water to cool brake.
   (6) After band brake cools, close valve SD3.
   (7) Pump until band brake piston comes out of the cylinder and there is a slight clearance between the band brake material and brake drum.
   (8) Remove pump handle and return to stowed position.

15-12.1.4 Unpowered discharge hose deployment. If hydraulic power is not operating or electrical power is not available, deploy discharge hose as follows:

a. Position valve SD4 (Figure 15-8) to OFF to allow winch hydraulic drive motor to freewheel.
b. Disconnect hydraulic disc brake hose from disc brake valve and connect to hose reel winch hydraulic brake release handpump.
c. Obtain disc brake release pump handle from stowed position and insert into pump extension.
d. Open pump pressure release valve, located beneath pump handle, by turning it counterclockwise.
e. Pump until disc brake is released.
f. Close pump pressure release valve by turning it clockwise.

NOTE

While external source is pulling hose from winch reel, use band brake as necessary to control deployment rate.

g. Prepare band brake to control winch drum rotation as follows:
   (1) Open valve SD3 (Figure 15-9).
   (2) Obtain BAND BRAKE PUMP HANDLE from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE.

h. As winch drum rotates, operate pump handle to control drum rotation.
i. When hose is deployed or power becomes available, return winch to normal powered operation as follows:

WARNING

For normal powered operation of winch, valve SD4 must be fully closed (ON), disc brake pressure release valve must be closed (ON), and brake hose must be connected to brake valve.

   (1) Release brake line pressure by turning pressure release screw on hose reel winch hydraulic brake release handpump counterclockwise. Disc brake will be automatically set.
   (2) Position valve SD4 to ON (Figure 15-8).
   (3) Disconnect hydraulic disc brake hose from hose reel winch hydraulic brake release handpump and connect hose to disc brake valve.
   (4) Return disc brake release pump handle to stowed position.
   (5) Set band brake as follows:
      (a) Open valve SD3 (Figure 15-9).

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE.

j. Pump until band brake piston enters cylinder and band brake is tight on the brake drum.
k. Position valve SD3 in neutral position (midway between OPEN and CLOSE position) to lock the cylinder in the set position.
l. Remove pump handle and return to stowed position.

15-12.2 Discharging drinking water to shore. When discharge hose has been deployed and shore receiving station is ready to receive drinking water, perform the following:

a. Open valve at shore receiving facility.
b. Open shore discharge valve SD1 and SD2 (Figure 15-7).
c. Make sure drinking water system is ready to discharge drinking water to shore, then start drinking water discharge pump.
d. While drinking water is being discharged to shore, perform during operation checks in paragraph 15-12.

15-13 Shutdown procedures. When shutting down shore discharge operation, coordinate hose retrieval with shore receiving station. First, blow out drinking water from hose (paragraph 15-13.1). Then, retrieve hose and secure winch (paragraph 15-13.2).

WARNING

Make sure good communications between barge and shore facility have been established to coordinate discharge hose retrieval.

15-13.1 Discharge hose pigging (hose blowout)

NOTE

Discharge hose must be emptied of its water before retrieving hose. Removing water reduces weight of hose, making it easier to retrieve.

a. On barge, close valves SD1 and SD2 (Figure 15-7).

b. On shore, perform the following:
   - (1) Close valve at shore facility.
   - (2) Disconnect hose flange from shore facility flange.
   - (3) Connect PIG receiver to hose flange.

c. On barge, perform the following:
   - (1) Open PIG insertion point (Figure 15-7), insert PIG, and reinstall cap.
   - (2) Connect 25-foot air hose between Compressed Air Station 6 and PIG insertion point air connection.
   - (3) Open valve SD2.
   - (4) Make sure compressed air system is operating. Start up and charge receiver if necessary.
   - (5) When shore end of discharge hose has been disconnected and PIG receiver on shore is ready to receive PIG, open Compressed Air Station 6 supply valve.
   - (6) When PIG arrives in PIG receiver on shore, close Compressed Air Station 6 supply valve and valve SD2.
   - (7) On shore, remove PIG receiver and remove PIG. Return PIG to barge if reusable (not badly worn or damaged).

NOTE

Pigging time is about 15 minutes. About 1,500 gallons of water will be discharged on shore.

   - (8) On shore, connect hose end cap to hose flange. Make sure cap is tight to provide watertight connection. Return PIG receiver to barge and stow.

15-13.2 Discharge hose retrieval (hose in)

WARNING

Make sure that nobody stands in front of or behind hose reel. Make sure steel chute is smooth and free of any dents or cuts that could damage hose.

a. Attach floats to discharge hose end cap.

b. Make sure winch band brake on starboard side of winch is set. If not, set as follows:
   (1) Open valve SD3 (Figure 15-9).
   (2) Obtain BAND BRAKE PUMP HANDLE from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE.

   (3) Pump until band brake piston enters cylinder and band is tight on the brake drum.
   (4) Position valve SD3 in neutral position (midway between OPEN and CLOSE position) to lock the cylinder in the set position.
   (5) Remove pump handle and return to stowed position.

c. Make sure switchboard circuit breaker P12 is closed (ON).

d. Perform the following, as appropriate:
   (1) On Barge 1:
      (a) Make sure valve SD4 is ON (Figure 15-8).
      (b) Make sure that Winch Control and Levelwind Control levers are in middle (neutral) position.
   (2) On Barges 2 and 3:
      (a) Make sure valve SD4 is ON (Figure 15-8).
      (b) Make sure DISC BRAKE lever is ON.

e. Start up winch as follows:

NOTE

Hydraulic power unit can also be started by pressing START button on hydraulic unit remote control switch located on stern weatherdeck bulkhead portside.

   (1) Push green START button on hydraulic power unit control panel or on hydraulic unit remote control switch (Figure 15-4). If motor does not start, troubleshoot as given in paragraph 4-10.1, TM 55-1930-209-14 & P-6.
   (2) If system has not been operated for several days, allow hydraulic oil to circulate at low pressure to remove entrapped air.

   Barge 1 - Allow pumps to run with winch control and levelwind control levers in neutral position.

   Barges 2 and 3 - Allow pumps to run with disc brake control OFF and winch and levelwind control in neutral.

   (3) Check for oil leaks and tighten fittings if necessary.
   (4) Make sure charge pump pressure gauge on hydraulic power unit reads 250 psi.

NOTE

On Barge 1, levelwind is used during deployment and retrieval. On Barges 2 and 3, levelwind is allowed to freewheel during deployment.

f. On Barges 2 and 3, turn valve SD5 ON (Figure 15-10).

g. Release band brake as follows:
   (1) Close valve SD3 (Figure 15-9).
   (2) Obtain BAND BRAKE PUMP HANDLE from stowed position and insert in pump extension.

CAUTION

While pumping, do not exceed 4,000 psi as shown on BAND BRAKE PRESSURE GAUGE.

   (3) Pump until band brake piston comes out of the cylinder and there is a slight clearance between the band brake lining and brake drum.
   (4) Remove pump handle and return to stowed position.

h. Connect washdown hose to washdown connection on deckhouse top. While retrieving discharge hose, wash mud and other foreign materials from hose.
i. As hose is retrieved, remove marker buoys and lines and stow in ROWPU space aft stowage area.

CAUTION

As each layer of hose comes on the reel, make sure transition to the next layer is smooth. If necessary, operate LEVELWIND control lever to gently form the first coil of the next layer.

j. Start retrieving hose by using winch control lever. Operate Levelwind control lever to form first layer of hose on drum. If necessary, operate Levelwind control lever to gently form the first coil of the second layer. Then operate lever as needed to form remaining layers. On Barges 2 and 3, also operate disc brake lever when needed.
k. When the discharge hose is completely retrieved, tie hose end cap to barge.
l. Push red STOP button on hydraulic power unit to stop unit, or on hydraulic unit remote control switch.
m. Open switchboard circuit breaker P12.

15-13.3 Emergency shutdown

15-13.3.1 General. The barge has two emergency shutdown modes. One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdowns, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Seven red system shutdown buttons are located on the ROWPU space starboard bulkhead just aft of the personnel door. These emergency system shutdown buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG1, and SSG2.

Six red total shutdown buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system shutdown buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

15-13.3.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.

b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

CHAPTER 16 BARGE DEPLOYMENT

Section I. General

16-1 General. The barge is normally maintained in administrative or long-term storage in a rear area. Prior to deployment to a forward area, all barge systems must be removed from storage configuration and operated to make sure an operational barge is being deployed. When the barge is determined to be fully operational, it is deployed to a working site. Detailed information about anchoring, mooring, and towing equipment (including equipment specifications, maintenance information and manufacturer's service manuals) is contained in TM 55-1930-209-14&P-14.

Section II. Considerations in docking

16-2 General

16-2.1 The bridge crane jib rail extension and starboardside sliding door are primarily for loading supplies. If supplies are to be loaded from the dock, barge must be moored, starboard to dockside. If loading from another vessel alongside, portside should be to dockside.

16-2.2 In confined and congested water ways, such as harbors and ports, barge is normally maneuvered by a tug with barge "on its hip" (Figure 16-1). While space permits, before approaching the dock, tug may have to switch barge from one hip to another to permit bringing barge alongside dock with appropriate side free for docking. Tug will then bring barge alongside dock and keep it on the hip until barge is moored to the dock.

16-2.3 The barge is normally moored to the dock with four lines using both bitts and cleats.

16-2.4 When tying up to another vessel, a tug usually maneuvers the barge into position alongside the other vessel. The tugmaster is in command while his boat is moving and maneuvering the barge. Lashings will be as directed by the tugmaster.

Section III. Towing procedures

16-3 General. Towing equipment is used primarily for long open-water tows by either commercial or military tugs. For shorter moves and within congested areas or in close waters, the barge is normally moved by a tug with the barge on the hip.

16-4 Preparation for towing

a. Secure the following,
   - (1) Workboat, if being transported on barge.
   - (2) All deck hatches and soft patches.
   - (3) All deckhouse hatches, port lights, and doors.
   - (4) All doors between voids.
   - (5) All deck equipment/machinery, including shore discharge hose reel, bridge crane outside extension (jib rail), anchors, and winches.
   - (6) All interior equipment/machinery, including bridge crane, and void 4 trolley hoists.
   - (7) All loose equipment and repair parts.

b. Trim barge in conjunction with tugmaster and according to his recommendations. Normal barge trim for towing is to raise bow about 9 inches above stern. See Chapter 11 for use of ballast system.

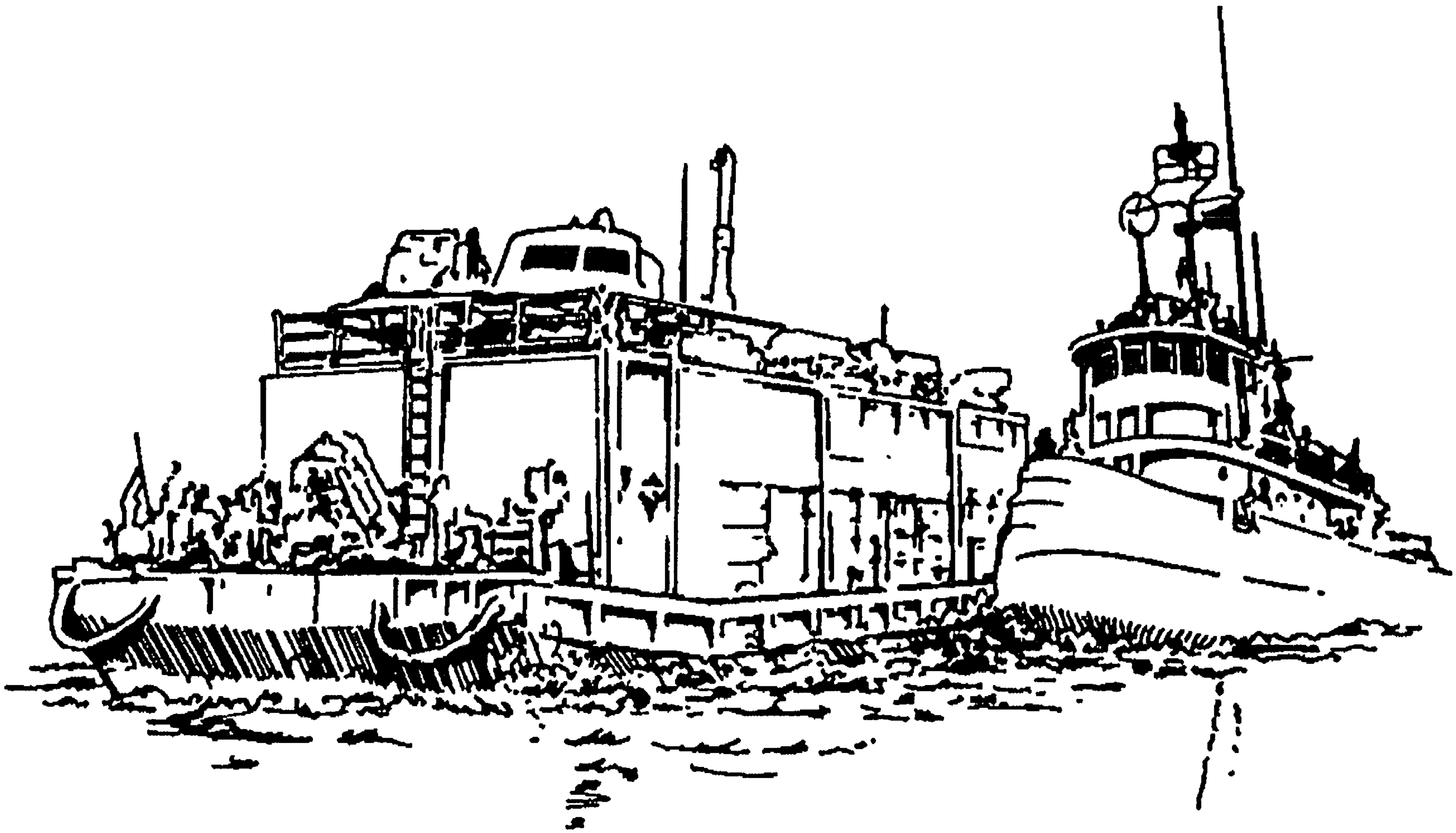


Figure 16-1. Tug with Barge "on the Hip"

16-5 Towing bridle installation

a. Remove towing bridle (Figure 16-2) from forward storage in void 1.
 (1) Activate bow crane by following procedures in Chapter 10.
 (2) Open void 1 towing bridle access hatch.
 (3) Hook bow crane cable hook into flounder plate of towing bridle in void 1 storage area

CAUTION

Make sure flounder plate dears sides of access hatch.

 (4) Make sure long dimension of flounder plate is vertical so plate will dear void 1 access hatch. Lift flounder plate out of void 1 storage.
 (5) Continue lifting until towing bridle shackles are free of access hatch.
 (6) Lay towing bridle on deck and remove crane cable hook from flounder plate.

b. Attach towing bridle shackles to barge tow padeyes.
 (1) Use nut and bolt to attach shackles to padeyes on port and starboard corners of forward weatherdeck. Make sure each nut is tight.
 (2) Secure nut with a cotter pin inserted in bolt hole. Bend it 90^o to make sure it cannot slip out.

c. Reattach bow crane cable hook to flounder plate. Raise and hold plate at working level while attaching tow line, or pass flounder plate to tug to attach tow line. Remove crane cable hook.

WARNING

Make sure installed towing bridle clears all deck equipment and anchors prior to tug taking a pull on the bridle.

d. Close void 1 towing bridle access hatch.

e. Place bow crane in stowed position by following procedures in Chapter 10.

16-6 Towing operations. In towing operations, tugmaster is towmaster and has final decision and responsibility for:

a. Methods of towing and lashing.

b. Lighting and marking the barge.

c. Number of personnel, if any, on barge during tow. Such personnel are under control of towmaster.

16-7 Towing bridle storage. When tow is complete and the barge is secured, store towing bridle as follows:

a. Activate bow crane by following procedures in Chapter 10.

b. Attach crane cable hook to flounder plate. Use bow crane to bring plate to forward weatherdeck

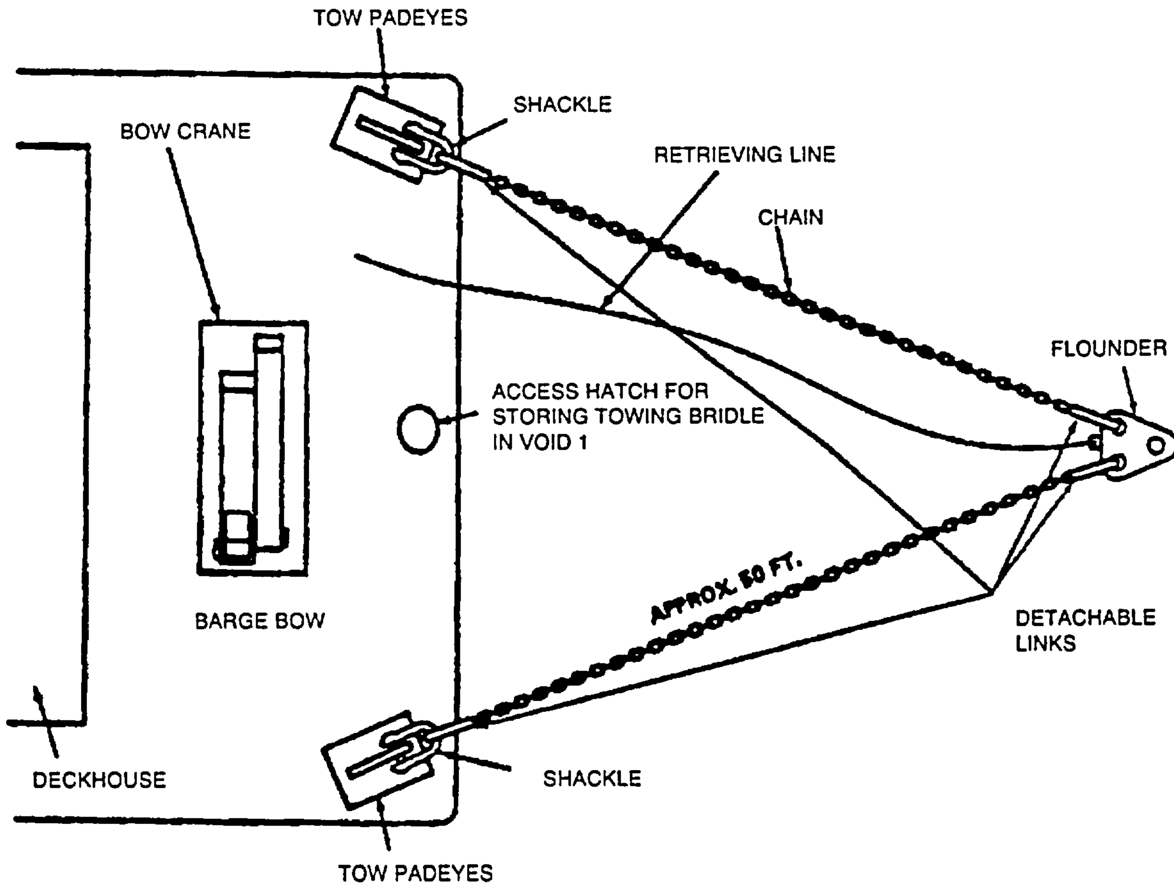
c. If tug personnel have not done so, remove tug towline and hardware from flounder plate.

d. Remove rivet or cotter pin on each shackle nut and bolt, remove nut and bolt, and remove shackles from tow padeyes.

e. Replace nut, bolt, and cotter pin/rivet in each shackle and tighten. Always use a new cotter pin.

f. Remove void 1 storage area access plate.

g. Inspect towing bridle as follows:



NOT TO SCALE

Figure 16-2. Towing Equipment Installation

(1) Using bow crane to hold flounder plate at eye level, inspect plate and attaching hardware for twists, cracks, or other damage or weaknesses.

(2) Lift towing bridle and inspect chains for cracks, twisted links, or other damage or weaknesses.

(3) Inspect shackles for cracks or twisted or bent metal.

h. If towing bridle is damaged or shows signs of possible weakness, red tag bridle to show that it is not serviceable. Notify intermediate support maintenance unit of requirement for repairing towing bridle.

i. Inspect towpads for cracks, excessive wear, broken welds, and twisted or bent metal. If either towpad shows signs of damage or possible weakness, notify intermediate support maintenance unit of requirement for repairing a towpad.

j. Using bow crane, suspend towing bridle over void 1 towing bridle access hatch and apply multipurpose, water-resistant grease (MIL-G-24139A) to shackles, chains, and plate.

k. Lower towing bridle into void 1 storage area.

l. Make sure long dimension of flounder plate is vertical so plate will clear access hatch. Lower flounder plate into storage area. Unhook bow crane cable hook.

m. Secure towing bridle access hatch.

n. Place bow crane in stowed position by following procedures in Chapter 10.

Section IV. Anchoring site selection considerations

16-8 Barge requirements

16-8.1 Barge is designed to operate in sea conditions not exceeding Sea State 3. This is a condition not exceeding a combination of winds up to 16 knots, waves to a height of 6 feet, and currents up to 3 knots. Therefore, barge must be operated in protected waters or be within range of reaching protected waters prior to arrival of major storm activity.

16-8.2 Depending on sea conditions, barge may be operated in areas with a minimum low tide depth of 8 feet. Operating at depths of less than 15 feet requires use of the starboardside water suction pipe rather than bottom mounted seachest.

CAUTION

Most tugs used to position and recover the barge, due to their draft and propeller clearance requirements, will not enter water with an operating depth of less than 20-30 feet.

16-8.3 Optimum depth for normal barge operation is between 25 and 35 feet.

16-8.4 The barge must be anchored within 2000 feet of the high water shoreline so the 2500 feet of shore discharge water hose can reach the shore connection.

16-8.5 In depths greater than 50 feet, anchors may not hold. At these depths, the angle between the seabottom and the anchor/anchor cable becomes so great the anchor flukes may not be able to rotate enough to dig into the bottom and hold the anchor in position.

16-8.6 The barge must be anchored with its stem facing the beach and in direct line with the shore facility hookup point.

16-9 Beach and shore requirements

16-9.1 Area must provide sufficient level space for establishing a water distribution facility with road access to the shore facility.

16-9.2 Area must provide sufficient smooth, hard ground for location and anchoring of beach winch for pulling in barge water shore discharge hose. This winch weighs about 6 tons, and area must provide access for rough terrain forklift to enter a beached LCM, pick up the winch, move to the designated site for the winch and position it. Area must also provide suitable method for anchoring beach winch. This is normally done by driving six to ten 5-foot stakes into the ground and securing the winch to the stakes.

16-9.3 Area must provide sufficient smooth hard ground for establishing connection point between shore facility and barge water discharge hose. Area must have sufficient slope to encourage drainage of excess water.

16-9.4 Area must provide smooth, gradually decreasing grade from connection point to shore high water line and then underwater to barge location.

16-10 Oceanographic requirements

16-10.1 Optimum site has minimum current, sea action, and natural harbor to provide protection from adverse weather. Sea direction is generally set by prevailing winds. Even when current is fairly strong (up to 3 knots), wind direction normally establishes sea direction. Therefore, prevailing winds must be determined before selecting a site.

16-10.2 Sea bottom conditions must provide a very high probability that anchor will set and hold. Mud and sand bottoms normally provide this. Rock and/or coral may be more difficult.

16-10.3 A gradually decreasing seabottom grade from shore high water line to proposed barge location provides less wave action at the beach, fewer natural obstructions and a better nesting area for the barge's bottom-laid shore discharge hose.

16-10.4 An area with few, if any, underwater obstructions or obstacles, reduces the probability that the barge, its anchors and cables, or water discharge hose could be damaged.

16-11 Support requirements

16-11.1 Barge site must be within easy range of personnel support facilities. Crewmembers require messing, billeting, and associated support activities either ashore or on another vessel. The workboat is normally used to change crews onboard the barge once or twice in every 24 hours. It has a range of less than 50 miles and a cruising speed of less than 30 mph.

16-11.2 Barge consumes large quantities of POL and must be replenished every 5 to 8 days.

16-12 Anchoring site selection

16-12.1 Obtain navigational chart of areas for proposed anchoring sites. Use above requirements to select potential sites based on chart data.

16-12.2 Survey sites by helicopter or barge workboat. If possible, have divers examine tentative sites for underwater hazards or obstructions.

16-12.3 Select site and mark it with anchoring floats. Mark chart showing approximate deployment location for barge and each anchor.

16-12.4 Provide chart to tugmaster prior to moving barge to location.

Section V. Anchoring methods

16-13 General. Each barge is equipped with four anchors and winches and may be anchored with four, two, or one anchors as the situation requires. Normally, the barge is anchored with four anchors. If information on the selected anchoring site area indicates that anchors hold well and sea, wind, and current forces are minimal, two anchors may be used. The barge may ride easier with only two anchors deployed. If sea direction is directly towards the shore, bottom conditions provide for secure anchoring, and wind and currents are minimal, one bow anchor may be used. In this case, the water discharge hose acts as a stem anchor.

16-14 Anchoring with four anchors

a. Barge is towed in close to designated anchoring site and tug casts off the tow.
b. Based on wind and sea conditions, tug then positions barge on its hip (Figure 16-1) so tug is on downcurrent side as tug moves barge towards shore (Figure 16-3).
c. If waterdepth permits, tug moves barge over position for upcurrent stem anchor (Figure 16-4). If waterdepth does NOT permit tug to move in this close to shore, see modified anchoring procedures in paragraph 16-15.

NOTE

Anchors are stowed against barge fore and aft bolsters and held in place with the flukes under the bolsters and anchor winches maintaining a tight cable to hold them in place. When anchoring barge, winches are turned on and anchors are powered down from their stowed position. For detailed procedures on anchor winch operation, see Section VII, anchor winch procedures.

d. Attach a marker line and buoy to anchor swivel. This not only marks anchor location but also helps retrieve the anchor.

e. Using powered anchor winch, lower the stern anchor to the seabottom. Do not "free fall" the anchor because the anchor cable will tangle.
f. Tug maneuvers barge downcurrent to anchoring position for downcurrent stern anchor, as barge pays out anchor cable.
g. When tug has placed barge in position for downcurrent stern anchor, and barge has payed out about 550 feet of cable on upcurrent stern anchor, barge lowers downcurrent stern anchor to seabottom.
h. With both stern anchors positioned, tug moves barge out to desired final anchored position. Barge pays out cable on downcurrent stern anchor and pulls in cable on upcurrent stern anchor.
i. When tug has barge in desired final anchored position, it holds barge in this position. The barge, using its bow crane, passes bow upcurrent anchor to auxiliary vessel. The auxiliary vessel, as barge pays out anchor cable, takes upcurrent bow anchor out to its anchor position and drops it.
k. Using anchor winches, barge crewmembers set these three anchors. When these anchors are set and holding, tug casts off, moves away from barge, and stands by.
l. The barge, using bow crane, passes downcurrent bow anchor to auxiliary vessel and as barge pays out anchor cable, auxiliary vessel carries anchor to its anchor position and drops it. Barge uses anchor winch to set this anchor.
m. When all anchors are set, bargemaster takes bearings on several landmarks and checks that anchors are holding.
n. When bargemaster determines that anchors are holding, the winches are turned off, the electric brakes are automatically set, and the mechanical brakes are set to backup electrical brake.
o. Tug is released from its standby position.

16-15 Modified anchoring with four anchors. If water is too shallow for tug, with barge on its hip, to move in close to shore to position barge for dropping stern anchors, the normal anchoring method is reversed. In this method, tug positions barge for dropping bow anchors first and uses an auxiliary vessel to position inshore anchors.

a. First two steps are the same as in normal anchoring
b. If water depth does NOT permit tug to move in close to shore, it moves barge over position for upcurrent bow anchor. Barge lowers (using power, not a free fall) bow anchor to the seabottom. As tug maneuvers barge downcurrent to anchoring position for bow downcurrent anchor, barge pays out anchor cable.
c. When tug places barge over position for downcurrent bow anchor, barge lowers that anchor to seabottom.
d. With both offshore anchors positioned, tug moves barge to its desired final position and holds barge in this position.
e. The barge passes stern upcurrent anchor to auxiliary vessel. The auxiliary vessel, as barge pays out anchor cable, takes upcurrent stern anchor to its desired position and drops it.
f. Using anchor winches, barge crewmembers set these three anchors. When these anchors are set, tug casts off, moves away from barge, and stands by.
g. Barge passes downcurrent stern anchor to auxiliary vessel, and, while barge pays out anchor cable, vessel carries anchor to its desired position and drops it. Barge uses anchor winch to set this anchor.
h. When all anchors are set, bargemaster takes bearings on several landmarks and checks that anchors are holding.
i. When bargemaster determines that anchors are holding, winches are turned off, electric brakes automatically set, and mechanical brakes are set to backup electrical brake.
j. Tug is released from its standby position.

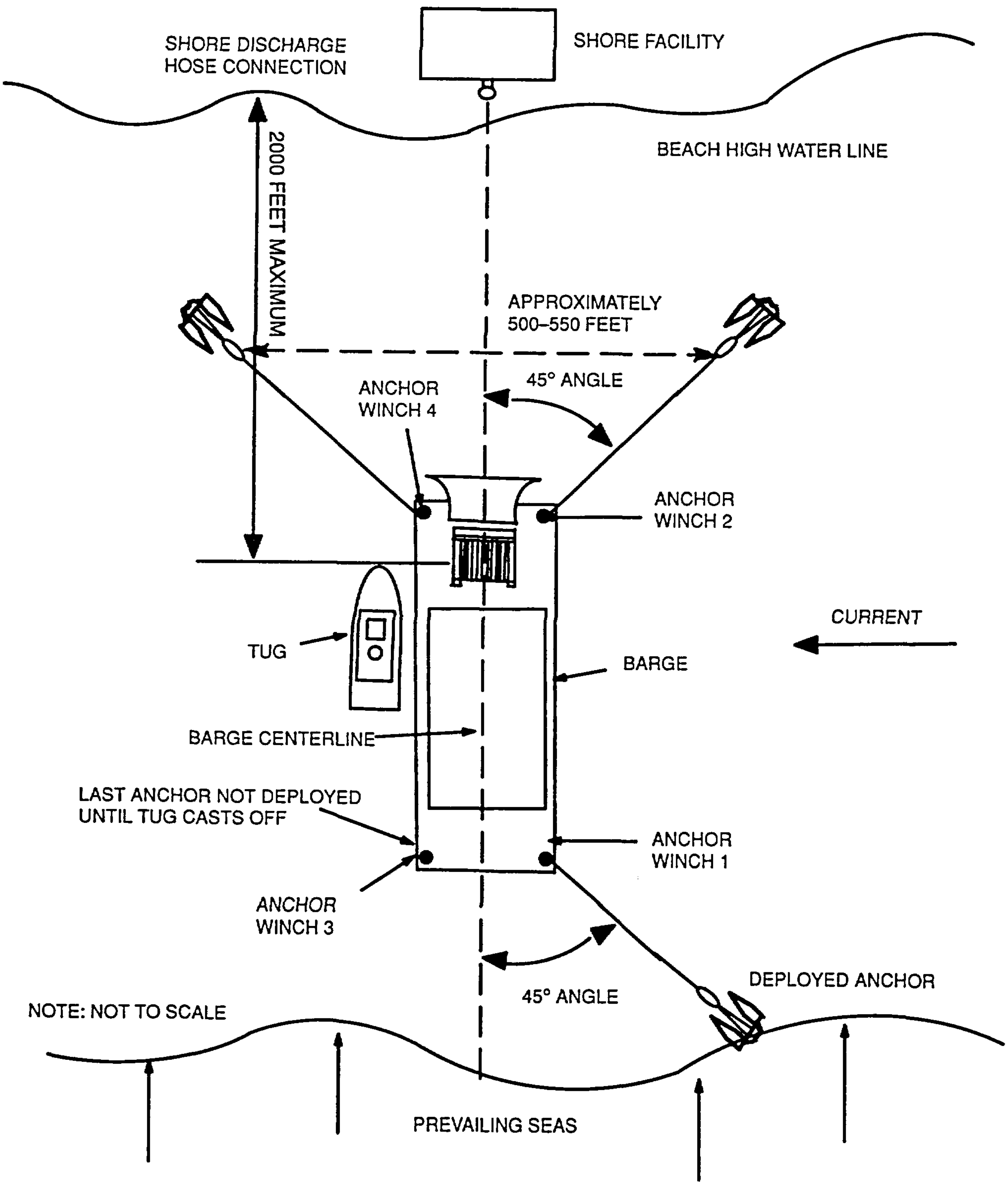


Figure 16-3. Positions of Tug, Barge, Shore Facility, and Anchors

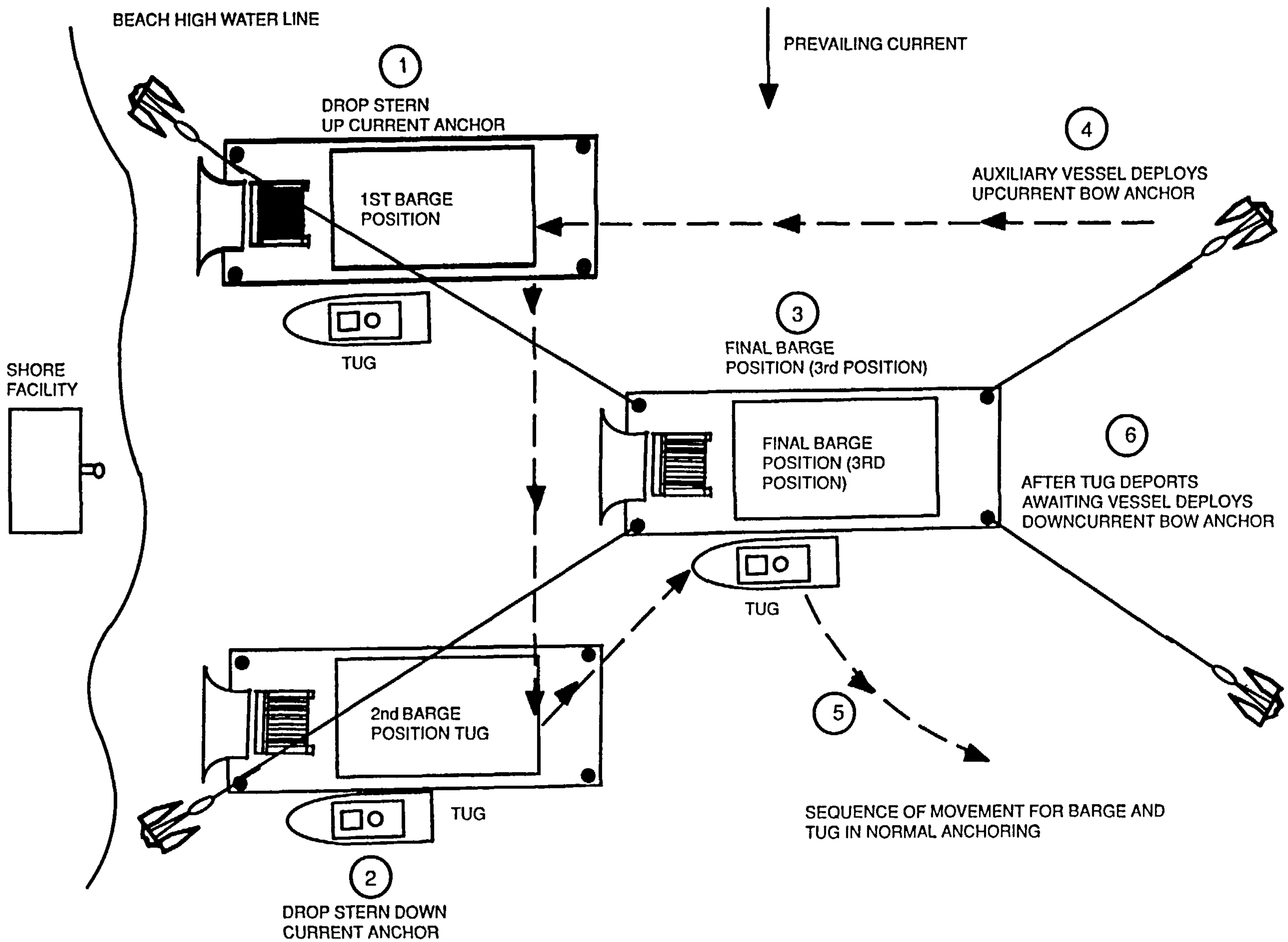


Figure 16-4. Sequence of Movements for Barge and Tug in Normal Anchoring

16-16 Anchoring with two anchors. Wind, sea, and current direction and force must be known and carefully considered in selecting which two anchors will be used. When anchors have been selected and water depth allows tug sufficient maneuvering, the best method is a modification of the method provided in paragraph 16-15.

a. The barge is towed in close to designated anchoring site and tug casts off the tow.

b. Based on wind and sea conditions at the anchoring site, tug then positions the barge on its hip (Figure 16-1) so tug is on downcurrent side as tug moves barge towards shore. Tug will have its bow pointed toward the barge's stern.

c. Tug moves barge over position for first anchor. Barge lowers (using power, not a free fall) first anchor to the seabottom. As tug maneuvers barge towards anchoring position for second anchor, barge pays out anchor cable.

d. With first anchor positioned, tug moves barge to its final position and holds barge in this position.

e. The barge, using its bow crane, if appropriate, passes second anchor to auxiliary vessel. The auxiliary vessel, as barge pays out anchor cable, takes second anchor out to its anchor position, and drops it.

f. Using anchor winches, barge crewmembers set these two anchors. When these anchors are set, tug casts off, moves away from barges, and stands by.

g. Bargemaster takes bearings on several landmarks to check that anchors are holding.

h. When bargemaster determines that anchors are holding, the winches are turned off, the electric brakes are automatically set, and the mechanical brakes are set to backup electrical brake.

i. Tug is released from its standby position.

16-17 Anchoring with single anchor. As in anchoring with two anchors, knowledge of wind, sea and current direction and force, and seabottom conditions is critical. These factors must be considered not only in selecting which anchor to use, but also in selecting anchoring site in relation to shore facility (Figure 16-5).

a. The barge is towed in close to designated anchoring site and tug casts off the tow.

b. Based on wind and sea conditions at the anchoring site, tug then positions the barge on its hip (Figure 16-1) so tug is on downcurrent side as tug moves barge towards shore. The tug will have its bow pointed toward the barge's stern.

c. Tug moves barge over position for the anchor. Barge lowers (using power, not a free fall) selected anchor to the seabottom. As tug maneuvers barge to its final position, barge pays out anchor cable.

d. With anchor positioned, tug moves barge to its final position and holds barge in this position.

e. Using anchor winch, barge crewmembers set this anchor.

f. Tug casts off, moves away from barge, and stands by.

g. When anchor is set, bargemaster takes bearings on several landmarks to check that anchor is holding.

h. When bargemaster determines that anchor is holding, the winches are turned off, the electric brakes are automatically set, and the mechanical brake is set to back up electrical brake.

i. Barge is allowed to swing into a position according to the sea conditions. If barge anchoring has been properly planned, the barge's stern is pointing at the shore facility. The shore discharge hose, when deployed, should run straight to the shore facility from the center of the hose fenders.

j. If this is not possible, tug should take barge on its hip and retrieve the anchor. A new position should be selected for anchoring and anchoring procedures should start again with paragraph c above.

k. Tug is released from its standby position.

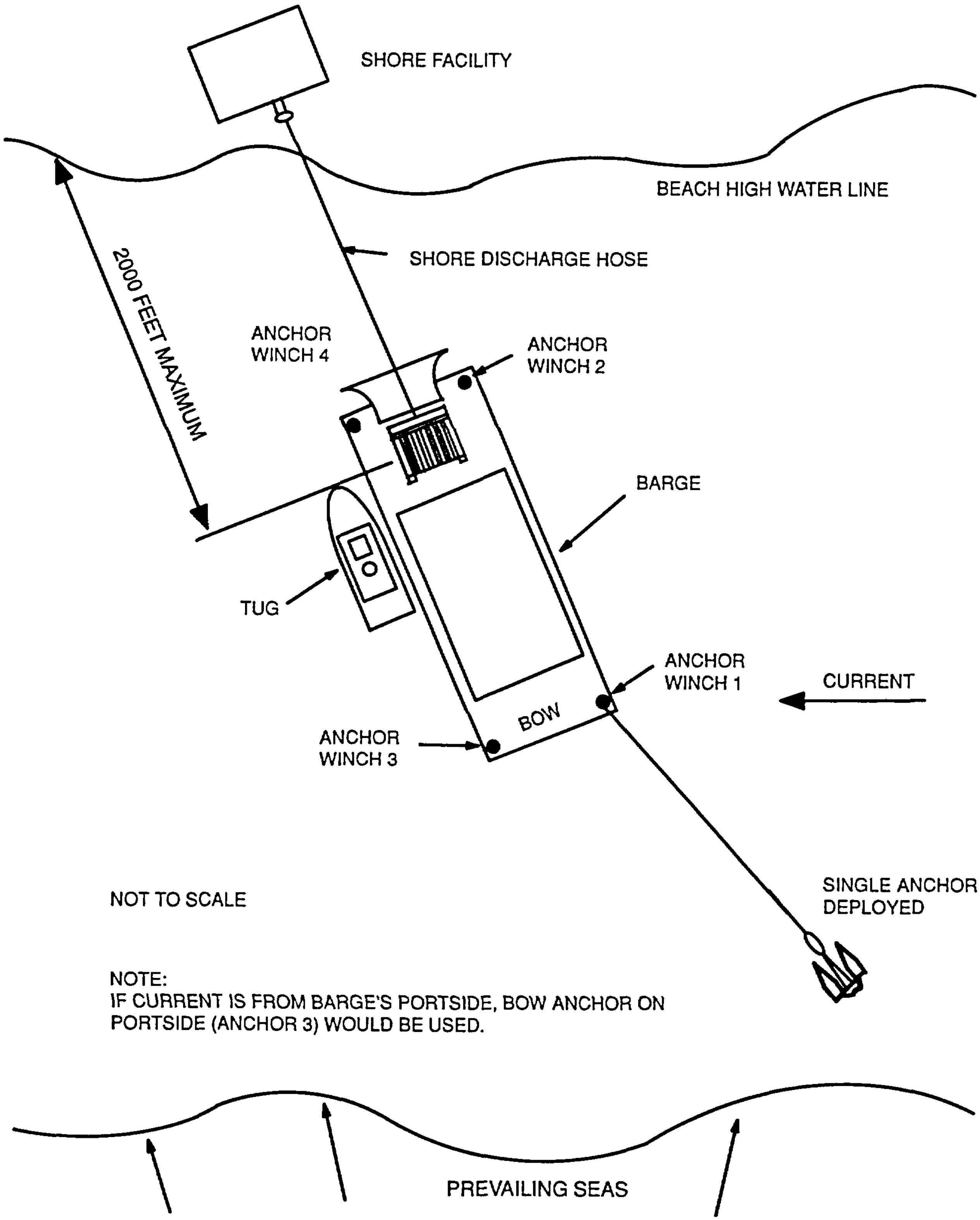


Figure 16-5. Position of Barge, Shore Facility, and Shore Discharge Hose when Using Only One Anchor

Section VI. Retrieving anchors

16-18 General. Anchors are retrieved in one of two methods; either the anchor is pulled upright on the seabottom and then dragged to the barge, or the barge is moved over the anchor and it is lifted directly upward to its position on the barge bolster. Generally, a combination of these two methods is used when preparing to move the barge from an anchored position. If four anchors are deployed, at least one offshore anchor must be retrieved to provide sufficient maneuvering area for the tug before it can come alongside the barge and take it on the hip.

16-18.1 Retrieving an anchor with assistance of auxiliary boat. In this method, the auxiliary boat, using the anchor buoy line, pulls anchor into upright position. This does not require the auxiliary boat to lift anchor off the seabottom but simply to pull it to an upright position. This pulls the flukes out of their set position in the seabottom and frees the anchor. While auxiliary boat holds anchor upright to keep flukes from digging into bottom, barge uses winch to reel in cable. This method normally has to be used for at least the first anchor retrieval so tug has sufficient maneuvering room to come alongside barge and take it on the hip.

16-18.2 Retrieving an anchor with assistance of tug. In this method, tug moves barge to the anchor and then barge lifts the anchor vertically from the seabottom and stows it on the barge bolster.

Section VII. Anchor winch procedures

16-19 Operating controls and indicators

a. Black ON/OFF switch. Located on top of winch control panel (see Figure 16-6). The ON position closes circuit for power to reach control panel from switchboard. OFF position opens circuit and stops power from reaching anchor winch control panel.

b. Black REVERSE (IN) button. Right-hand button on winch control panel (Barge 1) or button closest to deckhouse (Barges 2 and 3) (see Figure 16-6). When pushed in, winds anchor cable onto winch reel. Touch lightly for momentary retrieval or push firmly to lock in continuous retrieval position.

c. Black FORWARD (OUT) button. Left-hand button on winch control panel (Barge 1) or button closest to anchor (Barges 2 and 3) (see Figure 16-6). When pushed in, unwinds anchor cable from winch reel. Touch lightly for momentary extension or push firmly to lock in continuous payout position.

d. Red OFF button. Center button on winch control panel between black REVERSE (IN) and FORWARD (OUT) buttons (see Figure 16-6). When pushed in, stops anchor winch.

e. RESET button. Located near bottom left of winch control panel (see Figure 16-6).

f. Electric brake release. Located on end of electric motor/brake on top of winch (see Figure 16-7). Pull out to release electric brake. Push in to engage electric brake.

g. Winch manual/power clutch. Located on rear of winch housing (see Figure 16-7). Place winch in power operation by moving handle inboard (ENGAGE). An electric motor engages the winch through a gear system. Moving handle outboard (DISENGAGE), disengages electric motor and selects manual operation. By selecting DISENGAGE, anchor can be allowed to free fall with the manual brake proving the only control. This action is not recommended unless electrical power is unavailable during anchoring. See cautions in paragraph 16-22. Normal setting is ENGAGE.

h. Levelwind clutch. Located on inboard side of winch near center (see Figure 16-8). Pull handle out to turn levelwind OFF. Push handle in to turn levelwind ON. Normal position is ON (handle in).

i. Manual brake operating handle. Located on inboard side on winch above mechanical brake (see Figure 16-8). Operate by placing handle on top of ratchet. Turn clockwise (looking down on handle) to tighten brake. Reverse pawl and turn counterclockwise to release brake.

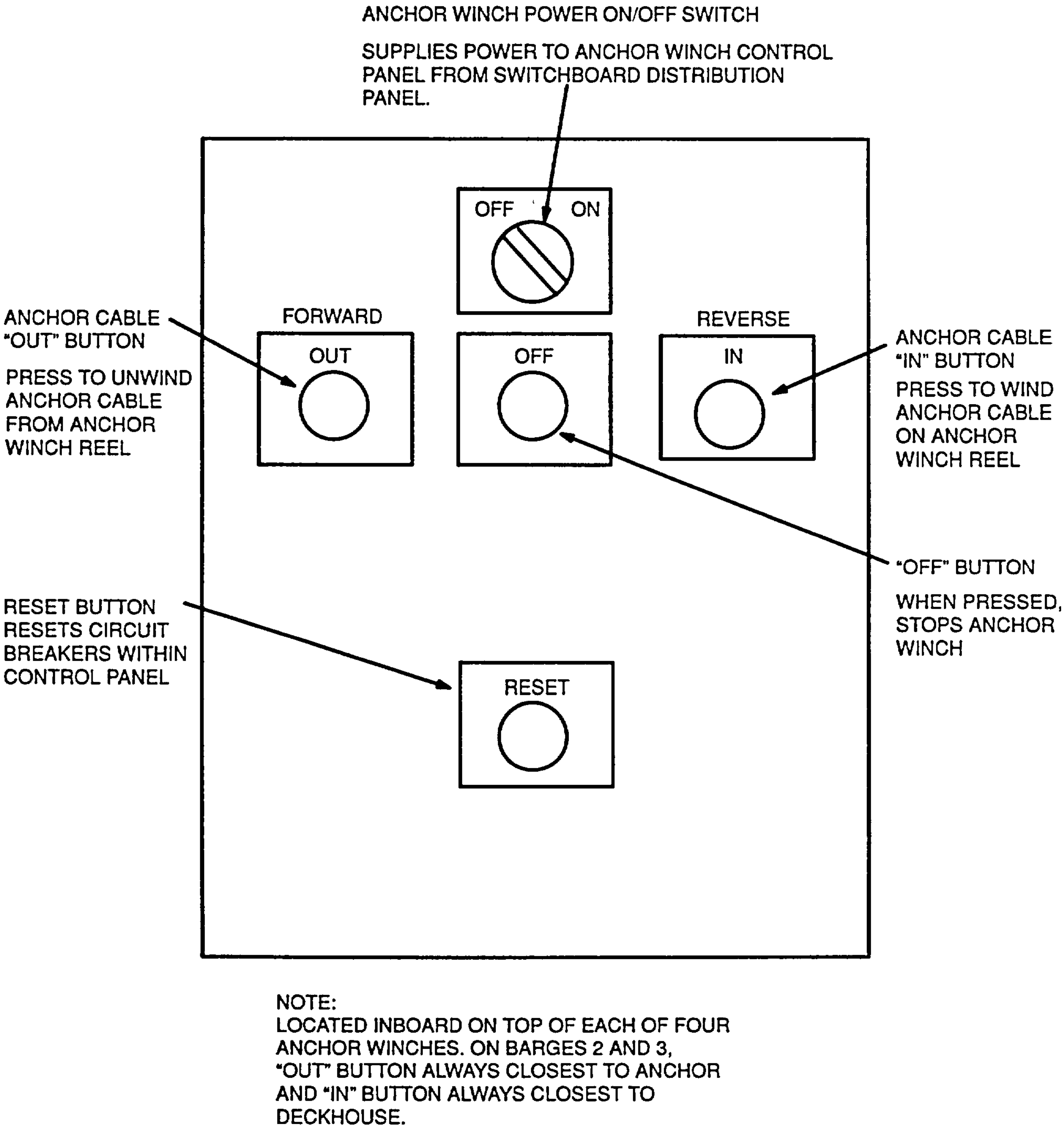


Figure 16-6. Anchor Winch Control Panel

16-20 Prestart procedures

a. At switchboard, start one of two ship service generators (155 kW) by following procedures in Chapter 3. Close generator circuit breaker to provide power to switchboard bus.

b. On switchboard, make sure circuit breaker P10 is dosed to provide power to anchor winches 1 and 2 and circuit breaker P11 is closed to provide power to anchor winches 3 and 4.

NOTE

Electric heaters in winch electric motors and brakes reduce humidity inside motor/brake housing and extend lives of these motors and brakes. Power is provided to these heaters from power panel 3 (120 Vac) circuit breaker 11P13.

c. Make sure power panel 3 circuit breaker 11P13 is dosed to provide power to winch heaters.

d. Visually check each anchor, exposed cable and connections, fairleader and anchor winch for damage. If damaged, notify intermediate support maintenance unit of repair requirements. If not operational, modify anchoring procedures to adjust for nonfunctioning anchor winch.

e. Using a grease gun with extender, lubricate each winch and fairleader as follows:

(1) Eight grease fittings on fairleader (two on each of four rollers).

(2) Eleven grease fittings on levelwind traveler (two on each of four rollers and three on top of Bare 1 traveler). On barges 2 and 3, traveler has four fittings on top instead of three.

(3) One grease fitting on gear case (outboard) side.

(4) Two grease fittings on brake (inboard) side (one on levelwind release mechanism, one on water end of cover on levelwind gears).

(5) Three fittings on inside shaft behind the manual/power selector.

(6) Levelwind compound helix shaft and guide bars.

f. Check oil level in gear motor reduction box (see Figure 16-9).

CAUTION

If unit has been in storage, gear motor reduction box may be full of oil and must be drained to operating level prior to operation.

(1) Remove breather and oil filler plug near top of gearbox.

(2) Remove gear oil check plug located 4 inches from bottom of gearbox on end of unit. Oil should be level with bottom of check hole.

(3) If overfull from storage requirements, allow excess oil (about 3 quarts) to run out of check hole into a container. When oil stops flowing, replace plug. Dispose excess oil into bilge system.

(4) If oil level is lower than bottom of check hole, add oil through breather and oil filler plug on side of gearbox until oil flows out of check hole. Use nontoxic rust-inhibiting worm gear oil, AGMA No. 7. Replace both plugs.

(5) Check breather plug on side near top of gear motor reduction box: Inner portion of plug must be screwed out to uncover breather holes. Make sure breather holes are not covered with post.

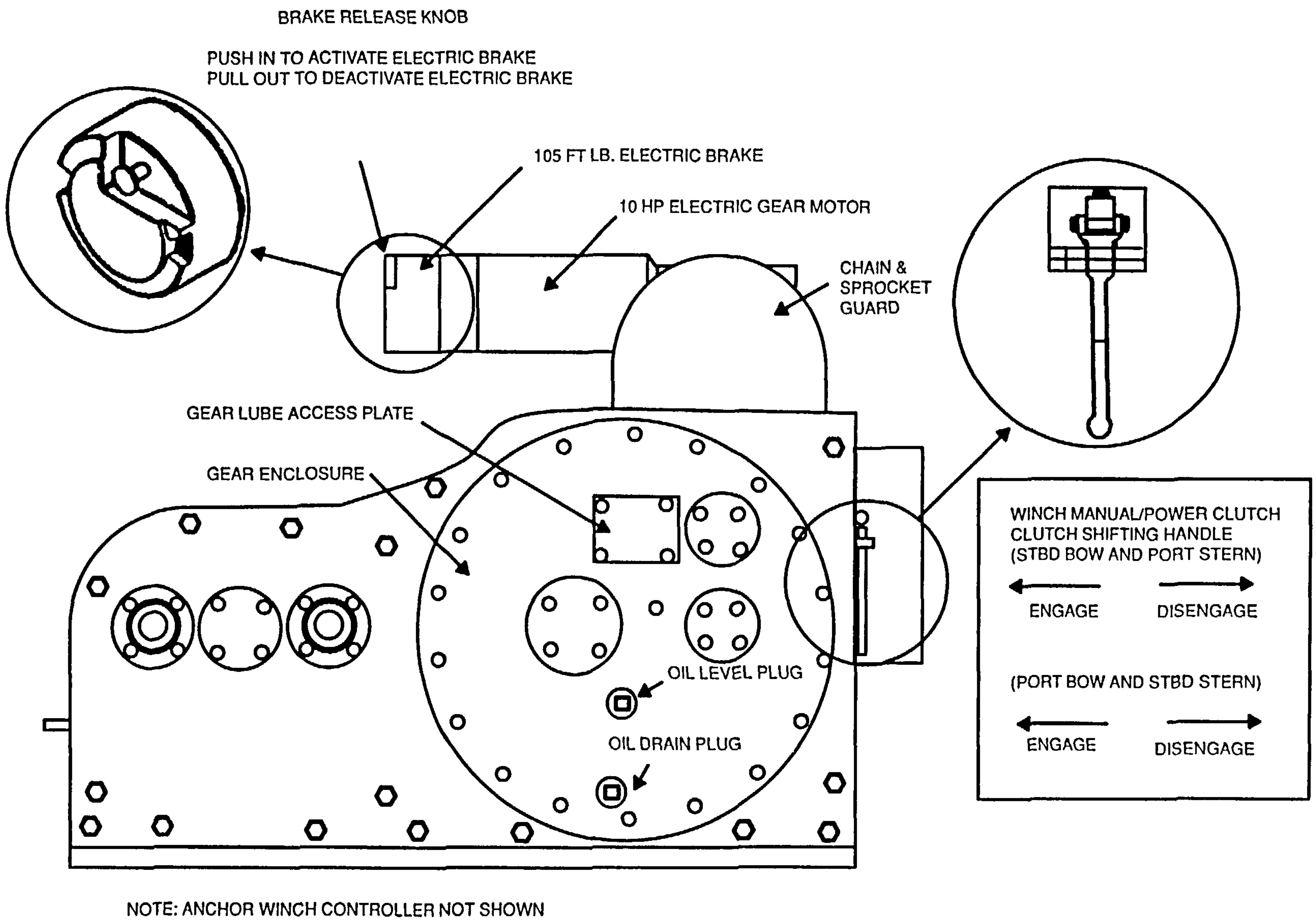


Figure 16-7. Outer Side of Anchor Winch

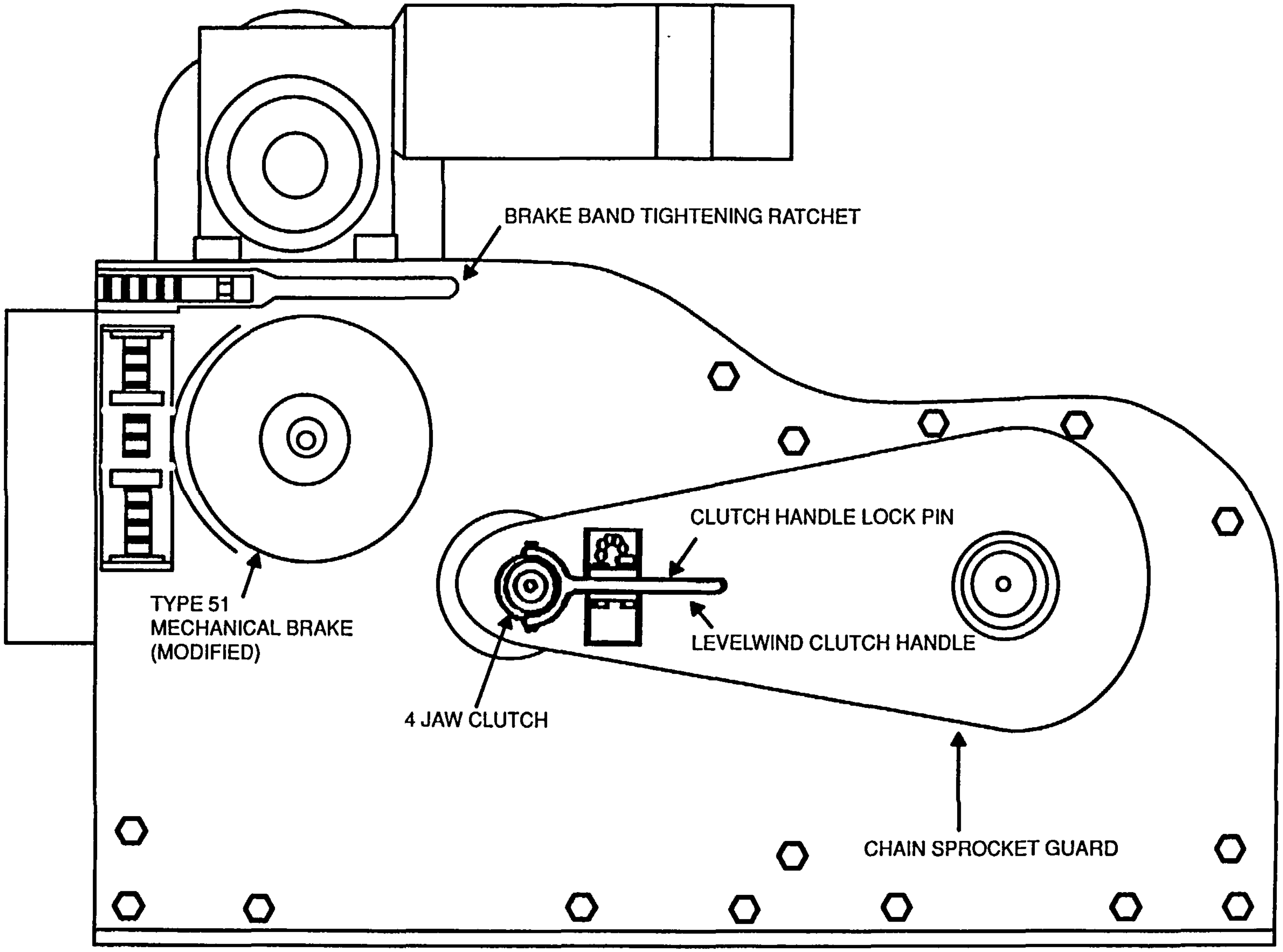


Figure 16-8. Inner Side of Anchor Winch (handle in)

g. Check oil level in gear case on outer side on winch (see Figure 16-9).
  (1) Unscrew oil level plug just below center line of gear case. Oil should be level with bottom of hole.
  (2) Remove gear lube access plate above oil level check hole.
  (3) Add 90 weight gear oil until it runs out of hole.
  (4) Replace oil level plug in hole.
  (5) Replace access plate.

CAUTION

Do not pay out anchor cable unless a weight (anchor) or force keeps cable tight. A block cable any become twisted, tangled, and unusable. This is called "birdcaging" because the twisted mass of cable resembles a birdcage. Severe birdcaging can only be corrected by cutting out twisted cable and replacing with new cable.

16-21 Operating procedures with power

a. On anchor winch control panel (Figure 16-6), turn black ON/OFF switch ON.
b. Apply multipurpose, water-resistant grease (MIL-G-24139A) on anchor cable fairleader rollers prior to anchor deployment.
c. Release mechanical brake (Figure 16-8).
d. Activate electric brake (Figure 16-7) by pushing selector knob in.
e. Push black FORWARD (OUT) button (Figure 16-6) to extend anchor cable. This releases internal electric disc brake, and electric motor turns drum to pay out cable.
f. Push red STOP button (Figure 16-6) to stop cable. This turns off electric motor and removes power from electric brake. Springs in electric brake automatically clamp disc brake on.

CAUTION

During anchor retrieval, if winch panel circuit breaker trips several times during operation, this may indicate a wrong recovery method. Continuing to operate winch under these conditions will damage the winch motor.

g. Push black IN button (Figure 16-6) to retrieve anchor cable. This release brake, and motor turns drum to pull in anchor cable.
h. As cable is pulled onto drum, check condition of cable. If seriously frayed, cut, or smashed, note location on drum and notify intermediate support maintenance unit of requirement for cable repair or replacement.
i. As cable is pulled onto drum, apply liberal coat of multipurpose, water-resistant grease (MIL-G-24139A) to cable.

16-22 Operating procedures without power. Anchor cables may be deployed without electrical power. However, anchor cables cannot be retrieved unless electrical power is available.

a. On inner side of winch, remove brake band tightening ratchet handle from holder and place on manual brake control ratchet (Figure 16-8). Using brake handle, tighten manual drum brake snug.

CAUTION

Do not operate motor with electric brake in manual release position. This overheats and damages friction disc in brake.

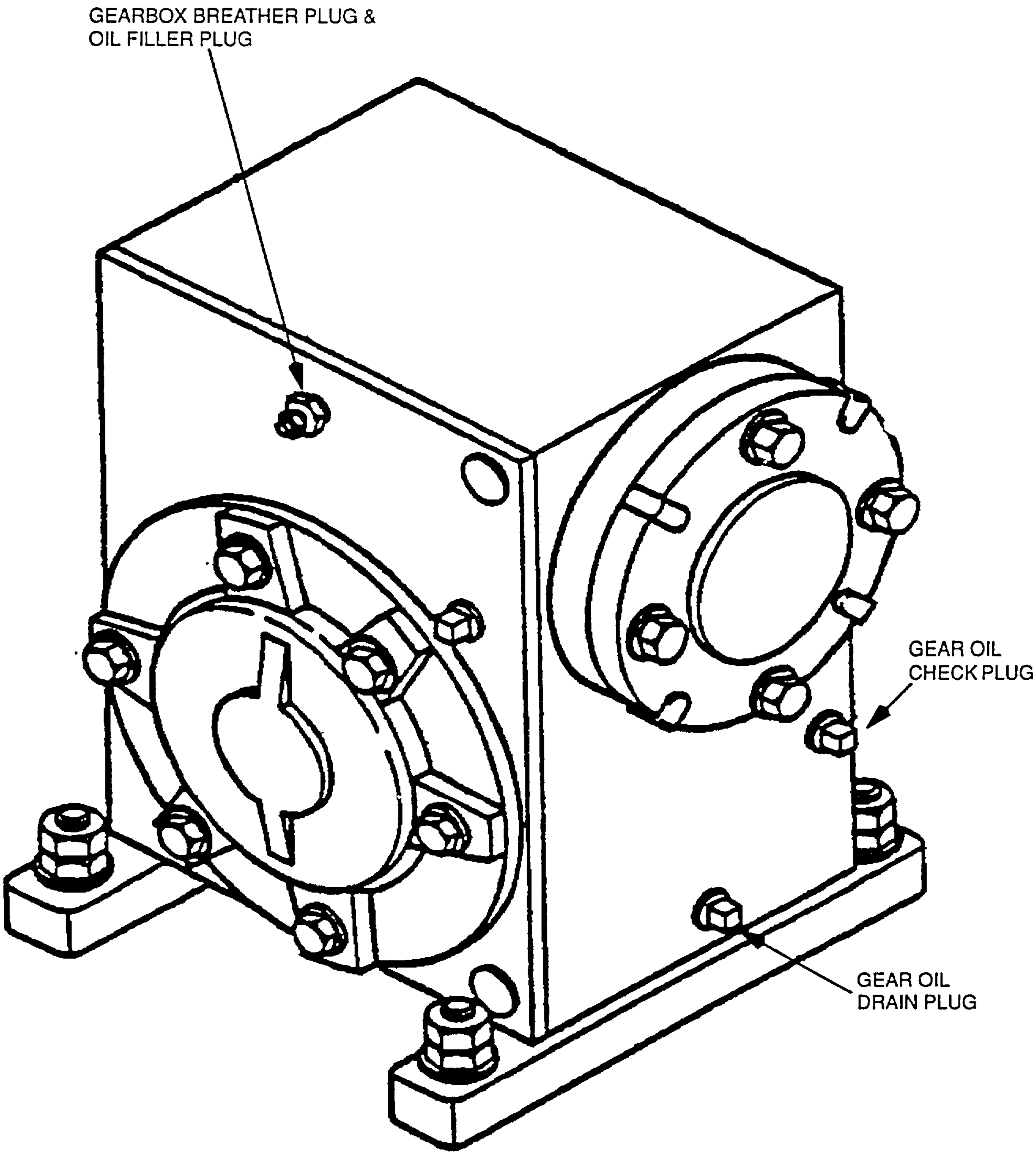


Figure 16-9. Servicing Points on Anchor Winch Gear Motor Reduction Box

b. On rear side on winch housing (Figure 16-7), move winch manual/power clutch to outside (DISENGAGE) position for normal operation.
c. On end of electric motor on top of winch, pull out BRAKE RELEASE knob (Figure 16-7). This releases spring that holds disc brake on when power is not applied.
d. Release anchor from anchor holding position on barge bolsters.

CAUTION

Free-falling an anchor with only manual braking control has a high probability of causing "birdcaging" unless crewmembers are extremely alert and quick to apply mechanical brake.

e. Using ratchet handle, loosen manual drum brake until anchor or other force pulls cable from winch drum.
f. Regulate and control pay out of cable by adjusting amount of drag that brake is applying to winch drum.
g. Stop anchor winch by tightening manual brake drum.
h. Push ELECTRIC BRAKE knob in. When power is available to the winch, the electric brake will be engaged.

16-23 Shutdown procedures

16-23.1 Anchors deployed. When winches are shut down while anchors are deployed, perform the following:

a. On anchor winch control panel (Figure 16-6), turn ON/OFF switch to OFF.
b. Make sure electric brake is engaged by pushing in on electric BRAKE RELEASE knob (Figure 16-7).
c. Set mechanical brake by turning ratchet handle (Figure 16-8) until brake drum is tight.
d. Make sure powerpanel 3 (120 Vac) circuit breaker 11 P13 is closed (ON) to provide heat to electric motors and brakes to combat moisture and corrosion.

16-23.2 Anchors retrieved. When anchor retrieval is complete, perform the following:

a. On anchor winch control panel (Figure 16-6), turn ON/OFF switch to OFF.
b. Apply liberal coat of multipurpose, water-resistant grease (MIL-G-24139A) to all exposed portions of cable and all exposed, nonpainted surfaces.
c. Clean and touch up all painted surfaces according to TB 43-0144.
d. Make sure power panel 3 (120 Vac) circuit breaker 11P13 is closed (ON) to provide heat to electric motors and brakes to combat moisture and corrosion.

16-24 Emergency shutdown

16-24.1 General. The barge has two emergency shutdown modes (Chapter 3). One mode shuts down individual systems such as the ventilation system or a diesel HP pump, and the other shuts down all barge operating systems.

Both modes are activated by pushing a red button protected by a metal guard. On individual system shutdown, either fuel or electrical power is shut off to that system only. On total shutdown, all fuel and electrical power is shut off to all operating systems.

Emergency system shutdown red buttons are on the ROWPU space starboard bulkhead just aft of the personnel door. These seven emergency system shutoff buttons (Figure 3-16) control shore power, ventilation systems, ROWPU 1 diesel HP pump, ROWPU 2 diesel HP pump, SAG, SSG 1, and SSG 2.

Emergency total shutdown red buttons are located as follows:

- On ROWPU space starboard bulkhead aft of personnel door, above and forward of system shutoff buttons.
- Outside ROWPU space starboard door on weatherdeck.
- Outside ROWPU space port door on weatherdeck.
- Inside ROWPU space port door to weatherdeck.
- Outside dayroom door to weatherdeck.
- Inside dayroom door to weatherdeck.

16-24.2 Emergency shutdown procedures

a. In an emergency, push the appropriate red button to shut down either a selected system or all operating systems.

b. When emergency situation has been corrected, reset emergency button by turning collar behind button one-quarter turn clockwise. Button will pop out and again be in the ready position.

c. After emergency button is reset, any systems turned off by that emergency button must be restarted with their individual controls.

APPENDIX A

REFERENCES

A-1 Drawings

13226E1924	Crane and Personnel Boat Foundations
13226E1925	Storage Area Installation
13226E1926	Deck House Ventilation System
13226E1927	Engine Exhaust System
13226E1928	Alarm/Casualty Monitoring System
13226E1929	Shore Discharge Hose Reel Installation
13226E1930	Dayroom and Workshop Arrangement
13226E1931	Heating and Air Conditioning, Dayroom and Workshop
13226E1932	Electrical Power Schematic Diagram
13226E1933	Communication System
13226E1935	Electrical Power System Layout
13226E1936	Void No 4 Ventilation System
13226E1937	Lighting System
13226E1938	Emergency Electrical Power/Lighting System
13226E1939	Motor Controllers Schematic and Wiring Diagram
13226E1940	Navigation/Exterior Lighting
13226E1941	Chlorination System Operational Instruction Placard
13226E1942	Ballast System
13226E1943	Battery Box
13226E1944	Equipment Shut Down System
13226E1945	ROWPU Modification
13226E1946	Removable Floor Covering
13226E1947	Smoke Detector System
13226E1948	Halon System
13226E1950	Fendering System
13226E1951	Caution, Warning, and Danger Signs
13226E1952	Multimedia Filter Assembly
13226E1953	Tank, Multimedia Filter
13226E1954	Plate, Information Multimedia Filter
13226E1955	Distributor Assy, Bottom, Multimedia Filter
13226E1956	Distributor Assy, Top, Multimedia Filter

13226E1957	ROWPU Barge, Type 231A, Radial Hub
13226E1958	ROWPU Barge. Type 231A, Lateral Slotted

A-2 Painting

TB 43-0144	Painting of Vessels

A-3 Cleaning

Fed Spec P-C-680	Metal Cleaning Solvent for Army Use
Mil Spec MIL-S-8660	Silicone Compound, NATO Code Number S-736

A-4 Rigging

TB 5-725	Rigging

A-5 Fire protection

TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved by Army Users

A-6 Demolition to Prevent Enemy Use

TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use

A-7 Maintenance

A 391-65	American Society of Testing and Material Specification
DA PAM 738-750	The Army Maintenance Management System (TAMMS)
NAVSEA S6225-EF-MMA-010/MODEL PE-250	Installation, Operation, Maintenance and Repair Instructions with Parts List, Portable Fire Fighting Service Gasoline Engine Driven Centrifugal Pump PE-250
TM 55-503	Marine Salvage and Hull Repair
TM 5-3835-210-14/9	Operator, Organizational, Direct and General Support Maintenance Manual Winch, Double Drum Diesel Engine Driven, 40,000 lb capacity CONMACO Model 270
TM 5-6630-215-12	Operator and Organizational Maintenance, Water Quality Analysis/Sets
TM 11-5820-401-10-1	Operator's Manual' Radio Sets AN/VRC Series
TM 11-6130-233-12	Operator's and Organizational Maintenance Manual: Power Supplies PP-2953/U, PP-2953A/U, PP-2963B/U, and PP-2953C/U (NSN 6130-00-985-7899)

A-8 Water Purification Barge Manuals

TM 55-1930-209-14 P-2	Seawater System
TM 55-1930-209-14 P-3	ROWPU System
TM 55-1930-209-14 P-4	Chlorination System
TM 55-1930-209-14 P-5	Drinking Water System
TM 55-1930-209-14 P-6	Shore Discharge System
TM 55-1930-209-14 P-7	Compressed Air System
TM 55-1930-209-14 P-8	Fuel Oil System
TM 55-1930-209-14 P-9	Electrical Power System
TM 55-1930-209-14 P-10	Lighting Systems
TM 55-1930-209-14 P-11	Equipment Monitoring System
TM 55-1930-209-14 P-12	Communication System
TM 55-1930-209-14 P-13	Handling Equipment
TM 55-1930-209-14 P-14	Anchoring, Mooring, and Towing Equipment
TM 55-1930-209-14 P-15	Miscellaneous Equipment
TM 55-1930-209-14 P-16	Ventilation, Heating and Air Conditioning Systems
TM 55-1930-209-14 P-17	Workboat, Lifesaving, and Firefighting Systems
TM 55-1930-209-14 P-18	Supporting Appendixes
TM 55-1930-209-14 P-19	Preventive Maintenance Checks and Services (PMCS)
TM 55-1930-209-14 P-20	Supplemental Data
TM 55-1930-209-14 P-21	Shore Winch

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
06881

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☆U.S. GOVERNMENT PRINTING OFFICE: 1994-555-121/R0103

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)
PFC JOHN DOE
CO A, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-1930-209-14&P-1	15 Oct. 1992	Water Purification Barges Normal Operations

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 Cylinders. The engine on my set only has 4 Cylinders. Change the manual to show 4 Cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered, so the NSN is wrong. Please give me a good NSN

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER	SIGN HERE
JOHN DOE, PFC (268) 317-7111	John Doe JOHN DOE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

DRSTS-M Overprint 1, 1 Nov 80

P S --IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

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UNIT'S ADDRESS

FOLD BACK

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DEPARTMENT OF THE ARMY

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COMMANDER
U.S. ARMY TROOP SUPPORT COMMAND
ATTN: AMSTR-MMTS
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ST. LOUIS, MO 63120-1798

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
I hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3.280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
I gram = 10 decigrams = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1.076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F Fahrenheit	5/9 (after subtracting 32)	Celsius	°C

PIN: 065349-000