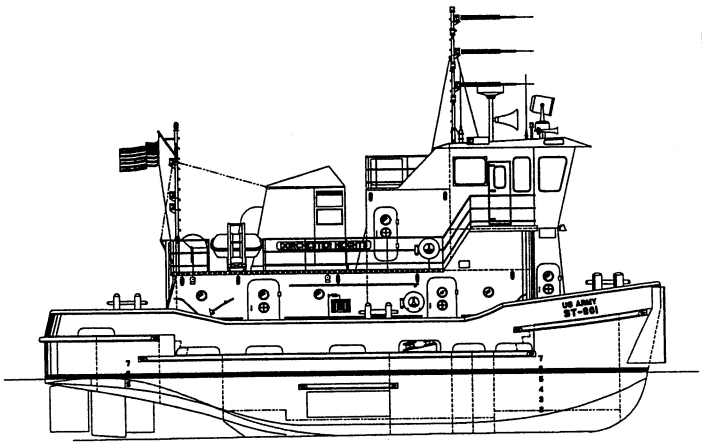
TECHNICAL MANUAL

DIRECT SUPPORT (DS) AND GENERAL SUPPORT (GS) MAINTENANCE MANUAL FOR

SMALL TUG

NSN: 1925-01-435-1713



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HEADQUARTERS, DEPARTMENT OF THE ARMY

20 JULY 2002

WARNING

MODIFICATION HAZARD

Unauthorized modifications, alterations or installations of or to this equipment are prohibited and are in violation of AR 750-10. Any such unauthorized modifications, alterations or installations could result in death, injury or damage to the equipment

WARNING

HIGH PRESSURE HYDRAULIC SYSTEM HAZARDS

If hydraulic system's high pressure lines or equipment fail, serious injuries could result.

Never work on hydraulic systems or equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment, and who can give first aid. A second person should stand by controls to turn off hydraulic pumps in an emergency.

WARNING

MOVING MACHINERY HAZARDS

Be very careful when operating or working near moving machinery. Running engine, rotating shafts, and other moving parts could cause personal injury or death.

WARNING

ELECTRICAL HAZARDS

Do not be misled by the term "low voltage". Potentials as low as 50 volts may cause death under adverse conditions. Be careful not to contact 115-VAC, 230-VAC or 460-VAC input connections when installing and operating equipment. Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

WARNING

FLAMMABLE LIQUID AND COMBUSTIBLE VAPOR HAZARDS

Gasoline, fuel oil, lubricating oil, grease, paint-thinner, cleaning solvents and other combustible liquids present a serious fire hazard. Always store combustible liquids in designated storage lockers. Insure exhaust and ventilation fans are operating while using cleaning solvents or paint products. Never store or charge batteries in a confined space without ventilation or near operating electrical equipment.

When refueling and de-fueling the vessel, ensure appropriate signs are posted in visible locations and warnings are announced over the vessel's public address system. Smoking, welding and any operation involving open flame must be prohibited throughout the vessel.

WARNING

CAUSTIC AND CORROSIVE CHEMICAL HAZARDS

Battery acid and water purification chemicals such as bromine and chlorine can cause serious burns to eyes or exposed areas of skin. Always wear eye protection and protective clothing when working with caustic and corrosive chemicals. If chemical accidentally contacts skin or eyes, immediately flush with large quantities of water and seek medical attention.

WARNING

COMPRESSED AIR HAZARDS

High pressure air tanks, piping systems and air operated devices possess potential for serious injury to eyes and exposed areas of skin due to escaping air pressure.

WARNING

ELECTROMAGNETIC RADIATION HAZARDS

Electromagnetic radiation from the searchlight, radar, and radio antennas has the potential for serious radiation burns. Do not stand in the path of radiation emission.

WARNING

HIGH TEMPERTURE FLUID HAZARD

Hot fluid such as engine coolants, hot water, engine lubrication oil, and hot hydraulic fluid possess the potential for serious burns to personnel.

WARNING

HIGH INTENSITY LIGHT HAZARDS

High intensity light from the searchlight and other flood-lights possess the potential to shatter lens covers creating a danger from flying glass.

Never stand directly in front of the searchlight or other powerful lights. Allow elements and bulbs to cool prior to performing maintenance. If elements and bulbs must be replaced while hot, wear protective gloves.

WARNING

CO_2 FIRE SUPPRESSENT HAZARDS

All personnel must immediately evacuate spaces when CO_2 fire suppressant systems are activated. CO_2 displaces oxygen to smother combustion. It can cause death by suffocation if personnel do not evacuate within 45 seconds after activating handle is pulled.

WARNING

FIRE SUPPRESSANT HAZARDS

Fire suppressant chemicals displace oxygen and can cause suffocation. Immediately evacuate areas where they will be used.

WARNING

WORKING IN CONFINED AREAS

Before entering or working in confined areas such as tanks, voids or machinery spaces, always insure space has adequate ventilation. Upon entering a confined area care should be taken to avoid protruding objects such as hatch dogs, piping, frame braces, machinery etc. Failure to wear necessary protective clothing/equipment could result in death or serious injury.

WARNING

HIGH NOISE LEVEL HAZARDS

Ear protection must be worn when engines and machinery are in operation. Failure to wear hearing protection in areas with high noise concentrations will result in eventual permanent hearing loss.

For Artificial Respiration, refer to FM 21-11

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 20 JULY 2002

TECHNICAL MANUAL

DIRECT SUPPORT (DS) AND GENERAL SUPPORT (GS) MAINTENANCE MANUAL for SMALL TUG NSN: 1925-01-435-1713

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028-2 (Recommended changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or email your letter, DA Form 2028, or DA Form 2028-2 direct to: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-AC-NML, Rock Island, IL 61299-7630. The email address is amsta-ac-nml@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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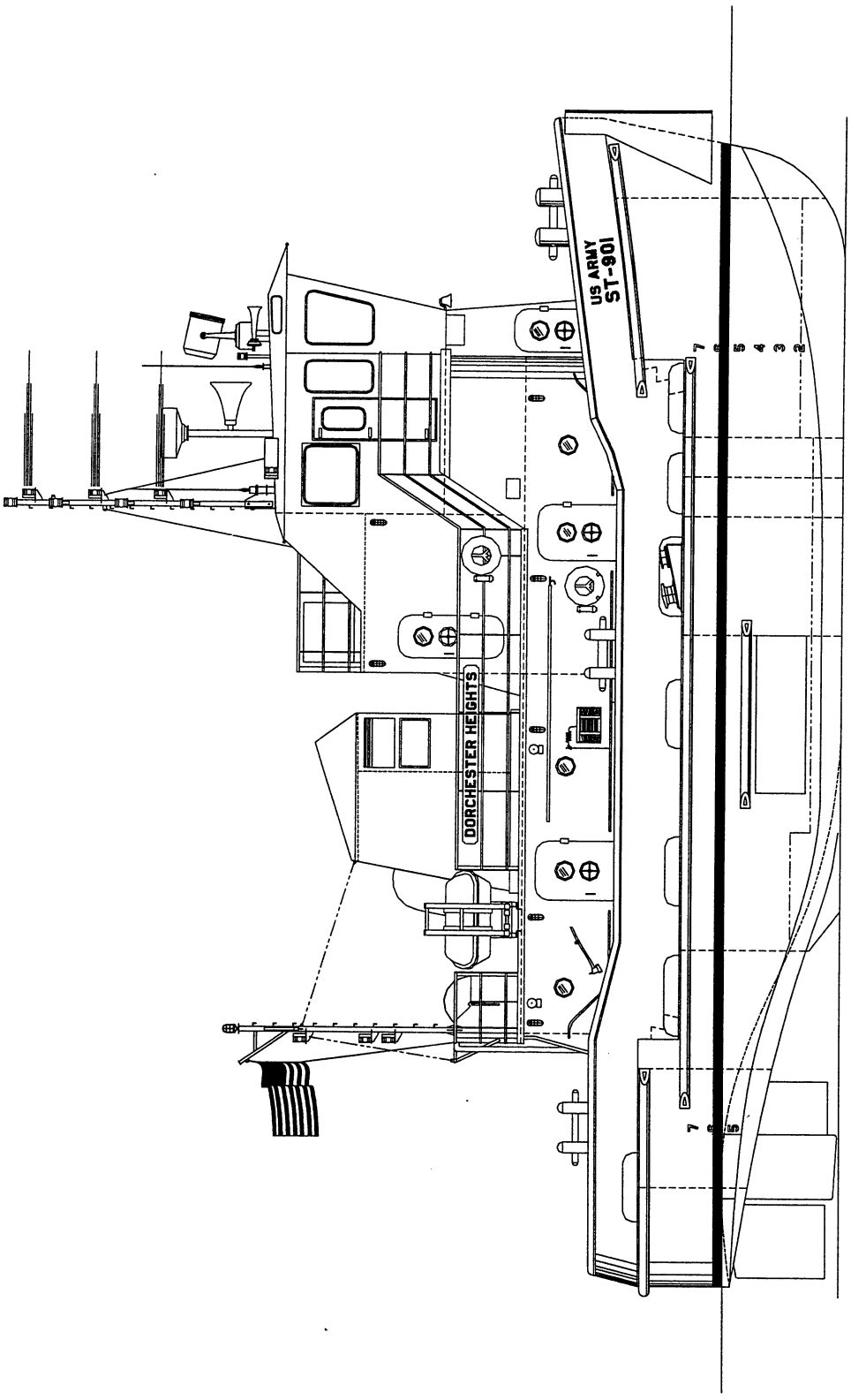

Figure 1-0. Small Tug.

CHAPTER 1
INTRODUCTION

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SECTION I
GENERAL INFORMATION

1.1. Scope. This manual describes the Direct and General Support maintenance for the Class A1, Maltese Cross, Small Tug (ST) Towing Vessel (see Figure 1-0). The ST is designed to provide towing of barges and general cargo barges in harbors, inland waterways, and along coastlines. It is also capable of assisting larger tugs in all types of harbor utility work, such as in the docking and undocking of ships of all sizes, the movement of floating cranes, floating machine shops, and in line handling duties. The ST will support deployment of forces and sustainment of forces in an overseas theater, including port operations in either fixed port facilities or during logistics over the shore (LOTS) type operations. The ST will accommodate all types of barges and non-powered types of lighterage expected to be encountered in deployment and sustainment operations worldwide.

1.2. Maintenance Forms, Records, and Reports. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750 (The Army Maintenance Management System-TAMMS).

1.3. Destruction of Army Material to Prevent Enemy Use. Department of the Army instructions/procedures for the destruction of army material to prevent enemy use will be those prescribed by TM750-244-3.

1.4. Preparation for Storage and Shipment. Instructions/procedures for preparation for storage or shipment, including packaging and administrative storage, can be found in Chapter 4, Section V: Unit Maintenance Procedures.

1.5. Nomenclature Cross-reference List. The following table contains a listing/cross-reference of major components used within this manual.

Table 1 - 1. Cross Reference List for Nomenclature Usage.

NO.	COMMON NAME	GOVERNMENT NOMENCLATURE
1.	Main Propulsion Engine	Engine, Main Diesel
2.	Reduction Gear	Gear, Reduction
3.	Propulsion Shafting	Shafting, Propulsion
4.	Genset	Generator Set, Diesel
5.	Motor Starter	Controller, Motor
6.	Power Panels	Panel, Power Distribution
7.	Communication System	Communication System, Integrated
8.	Bilge Pump	Pump, Bilge
9.	Potable Water Pump	Pump, Potable Water

Table 1 - 1. Cross Reference List for Nomenclature Usage – CONT.

NO.	COMMON NAME	GOVERNMENT NOMENCLATURE
10.	Water Heater	Heater, Water
11.	Hydraulic Power Unit	Power Unit, Hydraulic
12.	Grey Water Pump	Pump, Grey Water
13.	Incinolet Toilet	Toilet, Incinerator
14.	Incinolet Urinal	Urinal, Incinerator

1.6. Reporting Equipment Improvement Recommendation (EIR).

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

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 U.S. Army Tank-Automotive and Armaments Command (ATTN: AMSTA-AC-NML), Rock Island, IL 61299-7630. A reply will be furnished to you.

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1.7. Warranty Information. The ST is warranted for 24 months from formal acceptance. The warranty starts on the date found in block 23, DA Form 2408-9 in the logbook. Report all defects in material and workmanship to your supervisor, who will take appropriate action.

1.8. Critical Safety Items List. The following table contains the Critical Safety Items and their location.

Item	Smoke Detector	Carbon Monoxide Indicator	Fire Extinguisher	Carbon Dioxide Bottles	Personal Floatation Device (PFD)	Fire Station	Throwable Life Rings With Floating Light
Location	Pilot House, Double Berth, HVAC Room, Mess Area	Pilot House, Double Berth, Generator Room, Upper EngineRoom, Mess Area, Triple Berth	Pilot House, Generator Room, Mess Area, Lower EngineRoom, Engine Stores, Tankage Space	01 Deck	01 Deck	Main Deck	01 Deck, Main Deck

Critical Safety Items List - Continued

Item	Life Raft	Heat Detector	Emergency Escape Breathing Devices (EEBD's)	Fire Detection Alarm Panel
Location	01 Deck	Generator Room, Head, Forward Storage, Tankage Space, Lower Engine Room, Upper Engine Room	Double Berth, Triple Berth	Pilot House

1.9. Corrosion Prevention and Control.

Corrosion Prevention and Control (CPC). It is important to report any corrosion problems with the ST vessel and/or its equipment so that the problem can be corrected and improvements made to prevent it in future items. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. If you find a corrosion problem, report it on a SF 368 (Product Quality Deficiency Report). Using key words like corrosion, rust, deterioration, or cracking will help ensure identification as a CPC problem. Submit the form to the address specified in DA PAM 738-750.

1.10. List of Abbreviations. See Section I in the Glossary.

SECTION II.
EQUIPMENT DESCRIPTION AND DATA

1.11. Characteristics. The ST's hull and superstructure are of steel construction. Propulsion consists of two diesel engines fitted with reduction gearing, shafting and props. It is configured for pushing and stern and hip tows.

1.12. Capabilities. The ST is designed to provide towing of general cargo barges in harbors, inland waterways, and along coastlines. It has the ability to assist larger tugs in all types of harbor utility work, such as in the docking and undocking of ships of all sizes, the movement of floating cranes, floating machine shops, and in line handling duties. It can produce 30,000 pounds (13,605 kilograms) of ahead Bollard pull (15,000 pounds [6,802.50 kilograms] astern; 4,000 pounds [1,814 kilograms] side thrust) and can push six loaded barges in Sea State 0-1, and tow three loaded barges in Sea State 2-3. The ST can sustain a minimum speed of 8 knots in Sea State 2, and a minimum of 7 knots in Sea State 3 when under Full Load Condition. The ST is capable of 120 hours of operation at 6 knots with a 15% fuel reserve based on an initial Full Load Condition with no tow. It has a maximum range of 720.93 nautical miles.

The ST design capabilities allow satisfactory operations under the following weather and environmental conditions:

a. Weather air condition "Hot-Dry" (air temperature of 120° F (48.4°C) with relative humidity of 8%)

b. Weather air condition "Hot Humid" (air temperature of 105°F (40.15°C) with relative humidity of 88%)

c. Weather air condition "Basic Cold" (air temperature of –25° F (-31.35°C) with relative humidity of 100%)

d. Seawater temperature ranging from 28° F (-2.20°C) to 95° F (34.65°C).

e. Sea state 2 (SS2) Significant wave height 2.2 feet (0.67 Meters), modal period 4.1 seconds.

f. Sea state 3 (SS3) Significant wave height 4.6 feet (1.40 Meters), modal period 5.9 seconds.

The ST will support deployment and sustainment of forces in an overseas theater, including port operations in either fixed port facilities or during logistics over the shore (LOTS) type operations. The ST will accommodate all types of barges and non-powered types of lighterage expected to be encountered in deployment and sustainment operations worldwide.

The ST is capable of being operated by personnel wearing field duty uniforms, MOPP IV equipment or cold weather gear, and is capable of meeting applicable industry HFE requirements.

1.13. Features. The ST is transportable by deck loading aboard a commercial or military vessel (including a LMSR and/or Float-on/Float-off ship). The tug is equipped with installed lifting pads/eyes, cradle, sling, and lifting frame to facilitate loading. Design features are such that the towing arrangement and operating equipment allow for minimum manning requirements. The various operations required of the ST can be performed without reconfiguration between operations; thus, the tug can switch rapidly from one type of operation to another. The ST has been designed with the expectation that it will operate in waters throughout an overseas theater, and may be subject to small arms fire as well as major weapons systems. It is anticipated that, at some time, the ST may be required to operate in a nuclear, chemical and/or biological (NBC) environment, and may be attacked as a prime target of opportunity. For further guidance on NBC contamination see U.S. Army regulation AR 70-71 Nuclear, Biological and Chemical Contamination of Army Material.

1.14. Location and Description of Major Components. Major components and compartments of the ST are in the paragraphs that follow.

a. Decks (Overview). The ST decks are described below and are delineated in Figure 1-1 .

(1) Pilot House Overhead (Item 1)
(2) Pilot House Deck (Item 2)
(3) 01 Deck (Item 3)
(4) Main Deck (Item 4)
(5) Hold Deck (Item 5)

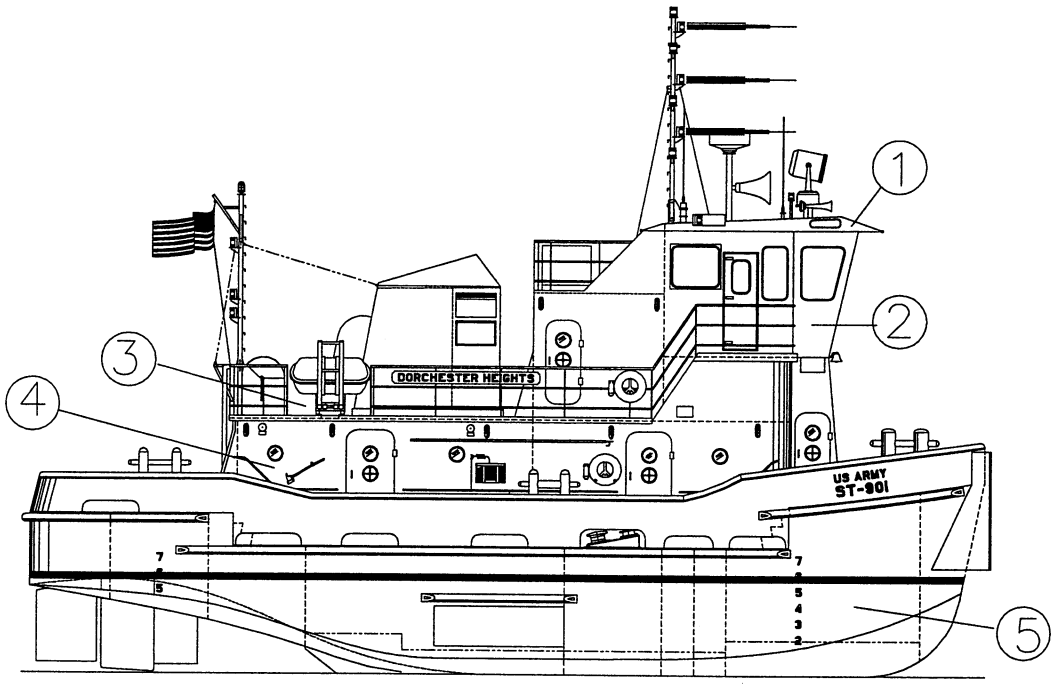


Figure 1-1. Deck Levels

(1) Pilot House Overhead. Features of the Pilot House overhead are depicted in Figure 1-2. Note that in this figure and others in this section, call-outs are keyed to the text with callout numbers in parenthesis.

(a) Searchlight. The searchlight (4) is located between Frames 5 and 6, port of centerline.

(b) Horn. A horn (7) is located between Frames 5 and 6, starboard of centerline with a white indicating light (10).

(c) Running Lights. Running lights (1) are located at Frame 9, one each port and starboard outboard.

(d) Forward Mast. A collapsible mast (6) is located centerline at Frame 10. The mast can be leaned forward for restricted clearance areas and for maintenance purposes. Figure 1-3 illustrates the forward mast. The mast contains the following:

1 Restricted in Ability to Maneuver (RIAM) Light (360° red light) (Item 1)

2 Towing Light #2 (225° white light for tow greater than 200 meters) (Item 2)

3 Towing Light #1 (225° white light for tow less than 200 meters) (Item 3)

4 RAM Light (360° white) (Item 4)

5 Restricted in Ability to Maneuver/Not Under Command (RIAM/NUC 360° red light) (Item 5)

6 Masthead Light (220° white) (Item 6)

7 Anchor Light (360° white) (Item 7)

(e) Radar Scanner. The radar scanner (2) (Raytheon Radome Scanner) is located at Frame 8, port outboard.

(f) Loudhailer Horn. A United Marine Model UM-HSWR loudhailer horn (3) is located at Frame 7 on the port side.

(g) Antennas. Antennas (5) for the VHF radios are located one each port and starboard. An antenna for the sincgars radio (8) is located aft on the starboard side. An antenna (9) for the GPS is located on the starboard side just aft of the horn indicating light.

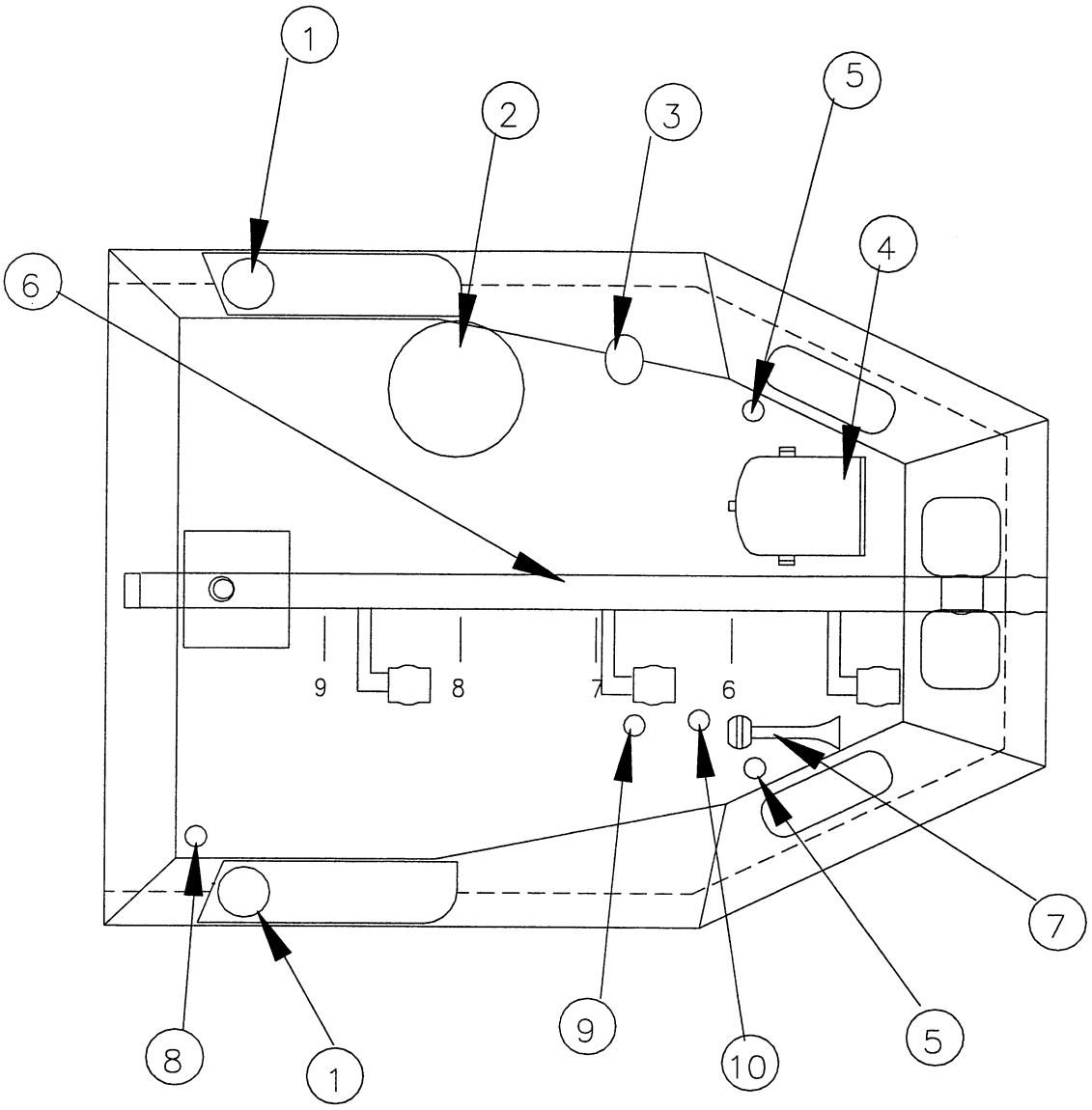


Figure 1-2. Pilot House Overhead

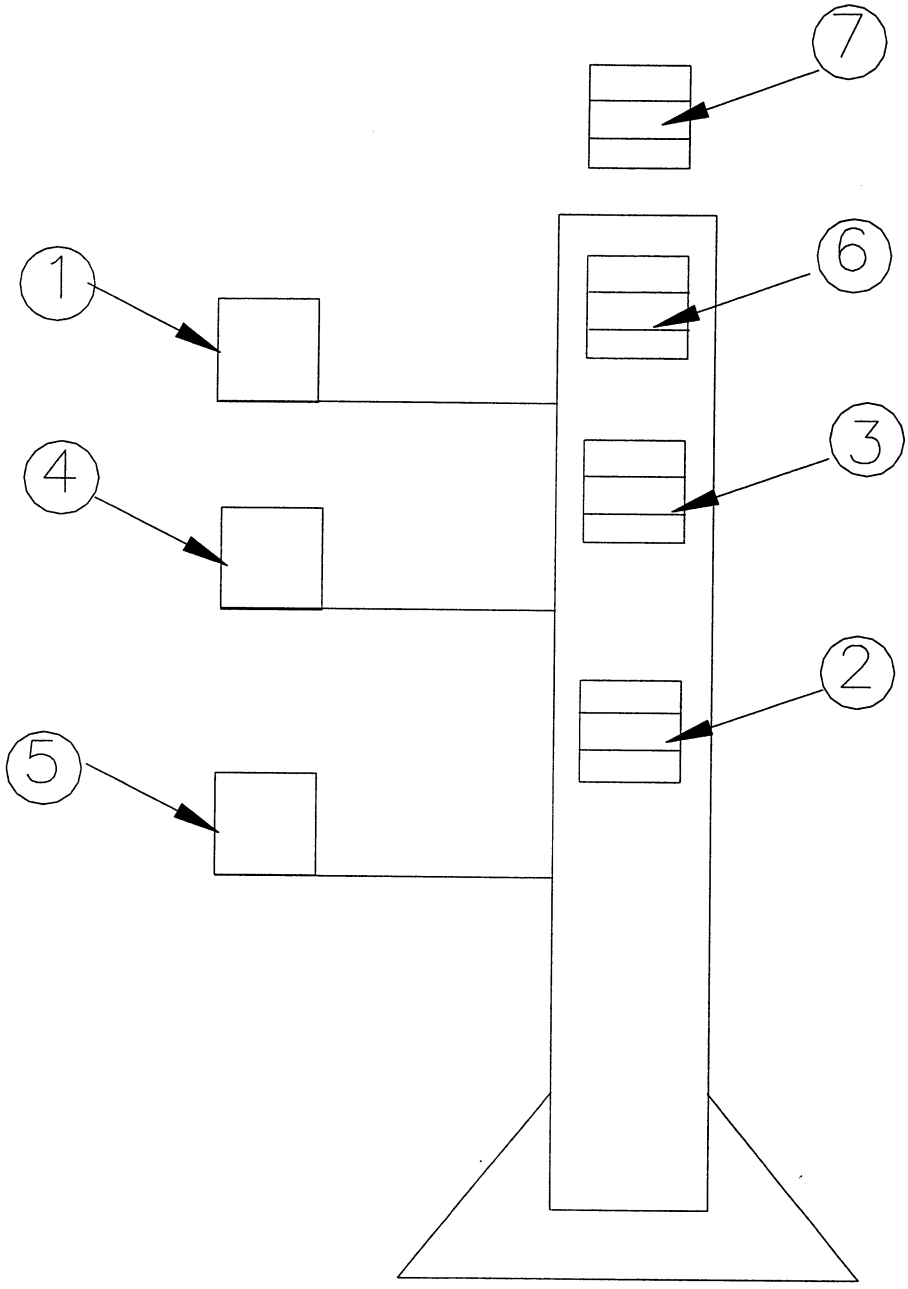


Figure 1-3. Forward Mast

(2) Pilot House Deck. The Pilot House is the control center of the vessel. Primary components located on the Pilot House Deck are depicted in Figure 1-4. These components include the sound powered phone (1), control console (2), navigation light panel (3), air conditioning condenser (4), air condition service disconnect controller (5), fire detection alarm panel (6), fire extinguisher (7), ventilation shutdown (8), captains chair (9), fluorescent lights (10), emergency DC light (11), smoke detector (12), A/C thermostat (13), carbon monoxide detector (14), fire alarm pull station (15), clock (16), level indicator (17), chart table (18), fire alarm beacon/horn (19), AC receptacles (20), and a light switch (21).

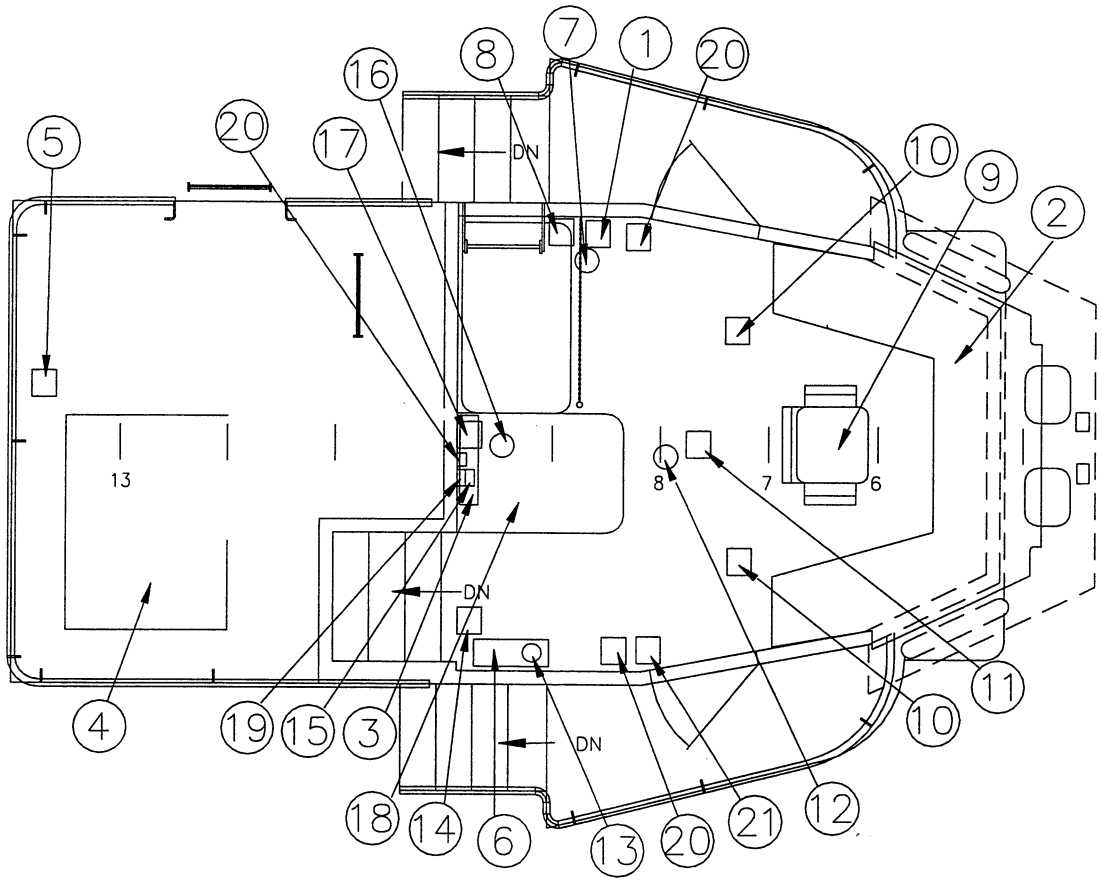


Figure 1-4. Pilot House Deck

(a) Control Console. The control console is located between Frames 5 and 7. The equipment located on the control console is depicted in Figures 1-5 and 1-6 and includes the following:

1 Main Rudders Full Follow Up Controls (Item 1)

2 Flanking Rudders Full Follow Up Controls (Item 2)

3 Main Rudders Non Follow Up Controls (Item 3)

4 Flanking Rudders Non Follow Up Controls (Item 4)

5 Pilot House 208 Volts Alternating Current (VAC) Power Panel (DP5) (Item 5)

6 Two Main Engine Gauge Panels (includes lube oil temperature, gear oil pressure, engine oil pressure, tachometer, low coolant level lamp, water temperature, dimmer, and panel power ON/OFF switch) (Item 6)

7 Main Rudder Angle Indicator (Control General) (Item 7)

8 Flanking Rudder Angle Indicator (Control General) (Item 8)

9 Two Marine Band VHF Radio Sets (Ross Engineering Model DSC500) (Item 9)

10 Loudhailer/Public Address Digital Control Head (United Marine Model Um-IDCH-7200) (Item 10)

11 Emergency Start/Stop Fire Pump (Item 11)

12 Horn Control (Item 12)

13 Radar Monitor, overhead (Raytheon Model R40XX) (Item 13)

14 Main Engine Throttle Control (Mathers Controls) (Item 14)

15 Fluxgate Compass (Ritchie Model MD200E) (Item 15)

16 Magnetic Compass (Ritchie Powerdamp) (Item 16)

17 Emergency Fuel Valve Shutoff Switch (Item 17)

18 Two Main Engine Emergency Stop Buttons (Item 18)

19 Two Generator Start/Stop Buttons (Item 19)

20 Search Light Controls (Carlisle and Finch) (Item 20)

21 Depth Sounder (Autohelm Seatalk) (Item 21)

22 Global Positioning System (GPS) (Item 22)

23 CO_2 Pull Station (Item 23)

24 Watertight Door and Carbon Monoxide Alarm (Seawatch) (Item 24)

25 Clearview Screen Controls (Item 25)

26 Singuars Radio (GFE) (Item 26)

27 Backup Engine Controls and Selector Switch (Mathers Controls) (Item 27)

28 Steering Control Panel (Control General) (Item 28)

29 DC Distribution Panel (Newmar) (Item 29)

30 Generator Selector Switch for DC Panel (Item 30)

31 Remote Intercom Station (United Marine Model UM-RIMI) above the console (Item 31)

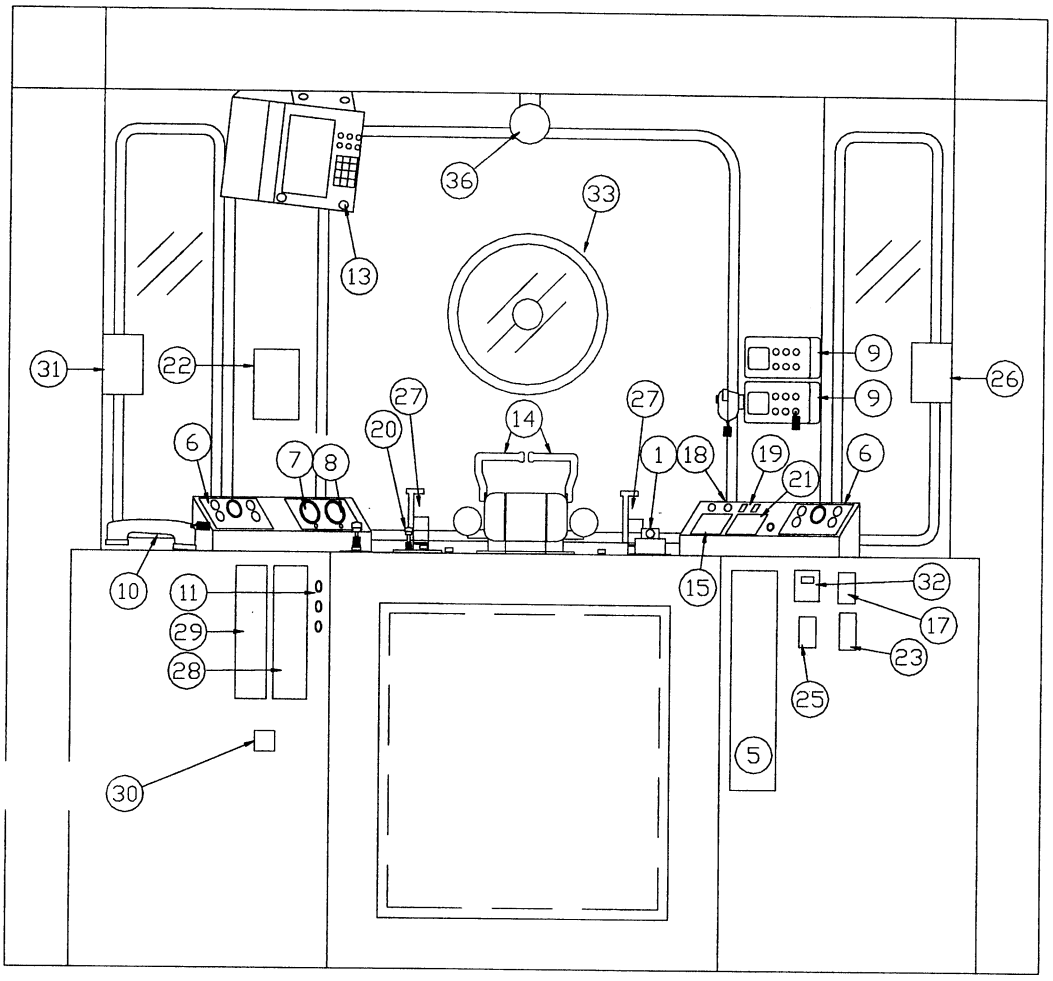
32 AC receptacle (located above Clearview screen control) (Item 32)

33 Clearview Screen (Item 33)

34 A/C Vents (Item 34)

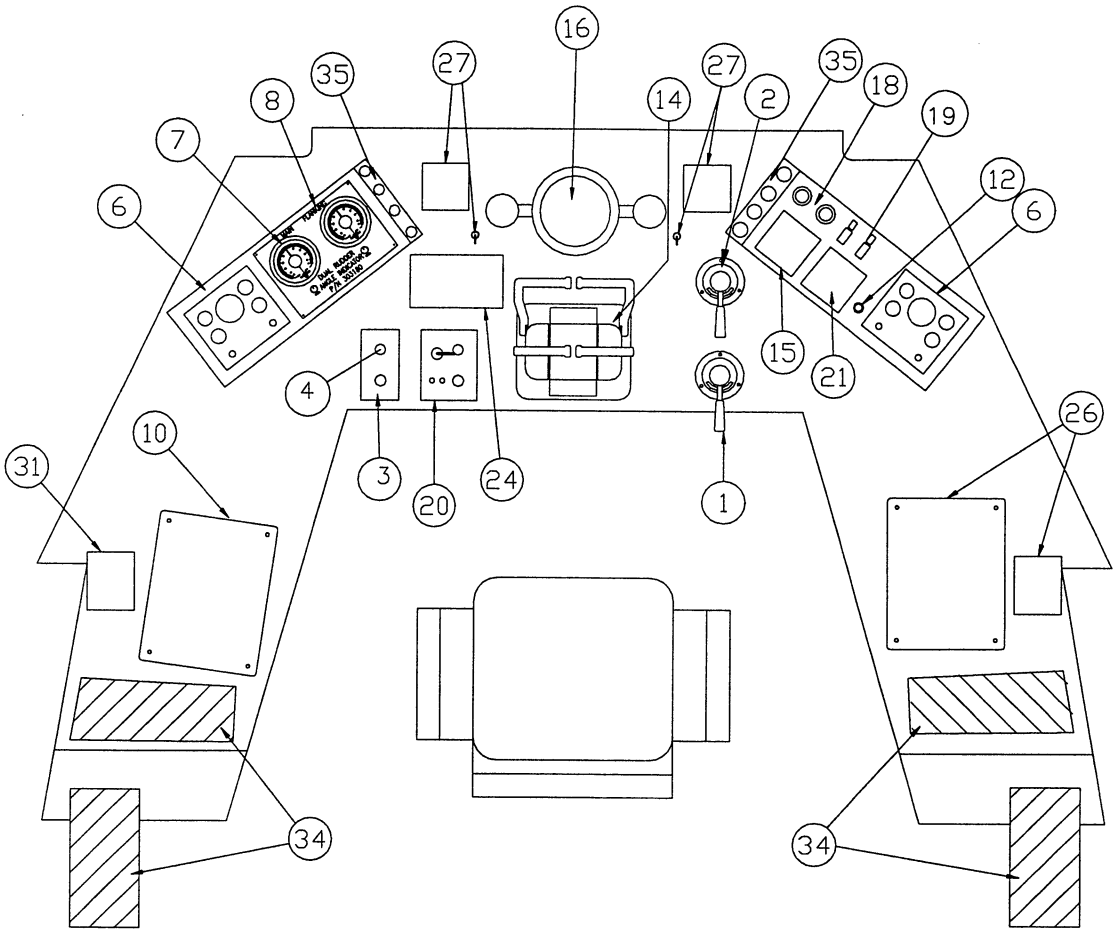
35 Winch Controls (Item 35)

36 Fluxgate Heading Sensor (Item 36)



Front View

Figure 1- 5. Control Console



Console Layout

Figure 1- 6. Control Console

Refer to Figure 1-4 for the following components.

(b) Navigation Light Panel. The navigation light panel is located aft of the chart table on the bulkhead starboard of centerline at Frame 10 (Item 3).

(c) Air Conditioning Compressor. The air conditioning compressor (Item 4) is located outside of the Pilot House between Frames 11 and 14 at centerline. The disconnect (Item 5) for the compressor is located adjacent to the compressor, mounted on the deck handrail.

(d) Circuit JV-General Purpose Sound Powered Telephone. The sound powered telephone (Hose McCann model) is located on the port side adjacent to the doorway (Item 1).

(e) Chart Table. A chart table is located centerline at Frame 9 (Item 18).

(f) Clock. A clock is located on the aft bulkhead above the navigation light panel (Item 16).

(g) Captain's Chair. A captain's chair is located between Frames 6 and 7 at centerline (Item 9).

(h) Fire Detection Alarm Panel. The Fire Alarm Panel is located at Frame 9 on the starboard side bulkhead, aft of the doorway (Item 6).

(i) Air Conditioning Thermostat. The air conditioning thermostat is located on the starboard side of the Pilot House just above the fire detection alarm panel (Item 13).

(k) Fire Alarm Pull Station. A fire alarm pull station is located above the navigation light panel (Item 15).

(l) Fire Alarm Beacon/Horn. A fire alarm beacon/horn is located adjacent to the fire alarm pull station (Item 19).

(m) Break Glass Ventilation Shutdown. A break glass ventilation shutdown station is located aft of the sound powered telephone (Item 8).

(n) Level Indicator. The level indicator displays the level of the ST during operations (Item 17).

(o) Fluorescent Light Fixtures. Two fluorescent light fixtures (with two white lamps and one low-level red lamp) are located overhead in the Pilot House (Item 10).

(p) Emergency DC Light. A 24VDC emergency DC light is located overhead in the Pilot House (Item 11).

(q) Smoke Detector. A smoke detector is located overhead in the Pilot House (Item 12).

(r) AC Receptacles. Three AC receptacles are located on the bulkheads in the Pilot House (Item 20).

(s) AC Light Switch. An AC light switch is located on the starboard side (Item 21).

(t) Carbon Monoxide Detector. A carbon monoxide (CO) detector is located over the aft doorway to the two-person berthing area (Item 14).

(u) Fire Extinguisher. A fire extinguisher is located on the starboard side, just aft of the control console (Item 7).

(3) 01 Deck. The layout of the 01 Deck is discussed below. See Figure 1-7.

(a) Berthing Area (Figure 1-7, Item 1). The accommodation area includes a two-person berthing area between Frames 10 and 14 from centerline. Figure 1-8 illustrates the two-person berth. The berthing area includes the following:

1 Double Berth (Item 1)

2 Lockers to include a linen locker (Item 4) under the weapons stowage , two personal lockers (Item 3), and a key locker (Item 2) under the safe

3 Two Berth Lights (Item 5)

4 Desk and Chair (Item 6)

5 Smoke Detector (Item 7)

6 Fire Protection/Detection to include a fire alarm pull station (Item 8), fire alarm beacon/horn (Item 9), and a carbon monoxide detector (Item 10)

7 Fire Proof Safe (Item 11)

8 Two AC Receptacles (Item 12)

9 Fluorescent Light Fixture (Item 13)

10 Remote Intercom Station (UM-RIMI) (Item 14)

11 Weapons Stowage (Item 15)

12 Clock (Item 16)

13 Emergency Escape Breathing Device (EEBD) (Item 17)

14 A/C Vent (Item 18)

15 Light Switch (Item 19)

16 Hand Rail (Item 20)

17 Steps to Pilot House (Item 21), access to HVAC Room under steps

(b) HVAC Room (Figure 1-7, Item 2). The HVAC Room and storage area is located between Frames 6 and 10 at centerline. The stairwell from the two-person berth to the Pilot House must be removed to access the HVAC room. Figure 1-9 illustrates the HVAC Room. The HVAC Room contains the following:

1 Air Handling Unit (Item 1)

2 Smoke Detector (Item 2)

3 Searchlight Rectifier Panel (Item 3)

4 Wheelhouse Distribution Panel (Item 4)

5 Steering Amplifier #1 (Item 5)

6 Steering Amplifier #2 (Item 6)

7 Marine Integrated Control Cabinet (United Marine 1338-ICSC) (Item 7)

8 Communication Control Center (United Marine) (Item 8)

9 Air Conditioning Control Panel with Start/Stop Buttons (Item 9)

10 Fluorescent Light Fixture (Item 10)

11 Communication Speaker (Item 11)

12 AC Receptacles (Item 12)

13 Sound Powered Phone Junction Box (Item 13)

14 Light Switch (Item 14)

(c) CO_2 Bottles (Figure 1-7, Item 3). Three CO_2 bottles with manual pull stations are located aft of the two-person berthing area on the Frame 14 bulkhead, port of centerline.

(d) Intake and Exhaust Stacks/Ports (Figure 1-7, Item 4). Two Engine Room air supply blowers are located outside of the accommodation area at Frame 16, one each port and starboard of centerline. The exhaust stack is located aft of the Engine Room intake ports between Frames 16 and 20, at centerline. The Engine Room exhaust fan is located aft of the exhaust stack between Frames 20 and 21, at centerline.

(e) Lockers (Figure 1-7, Item 5). A general stores locker is located between Frames 21 and 23 port outboard. A damage control locker is located forward of the general stores locker between Frames 19 and 21. A flammable liquids locker is located forward of the damage control locker between Frames 17 and 19. A Personal Floatation Device (PFD) locker is located starboard outboard between Frames 17 and 19. An ammunition locker is located just port of centerline aft. An exposure and survival suit locker is located on the port side, forward of the flammable liquids locker, between Frames 16 and 17.

(f) Life Raft (Figure 1-7, Item 6). A life raft with cradle/launching device is located between Frames 19 and 22, starboard outboard. The launching device facilitates launching the life raft by releasing it from its cradle and pushing it overboard. An automatic release mechanism actuates the CO_2 cartridge, which inflates the life raft.

(g) Aft Control Station (Figure 1-7, Item 7). An Aft Control Station is provided starboard of centerline on the aft of the 01 Deck. The control station facilitates vessel control during operations under which it is beneficial to see that aft portion the ST. Figure 1-10 illustrates the Aft Control Station. The Aft Control Station contains the following:

1 Main Engine Throttle Control (Mathers Controls) (Item 1)

2 Steering Alarm Panel (Control General) (Item 2)

3 Loudhailer Microphone (United Marine Model HMUM-MICH) (Item 3)

4 Two Main Engine Tachometers (Cummins) (Item 4)

5 Main Rudder Angle Indicator (Control General) (Item 5)

6 Flanking Rudder Angle Indicator (Control General) (Item 6)

7 Main Non Follow Up Steering Controls (Item 7)

8 Flanking Non Follow Up Steering Controls (Item 8)

(h) Ventilation Trunk for Generator Room (Figure 1-7, Item 8). The ventilation trunk is located starboard outboard between Frames 21 and 23.

(i) Floodlights (Figure 1-7, Item 9). Floodlights (Pauluhn Model Lamp Type 3) are located one each, port and starboard on the aft railing. A floodlight is also located on the forward main deck, mounted on the deckhouse.

(j) Throwable Life Rings (Figure 1-7, Item 10). Throwable life rings with floating light are accessible from the 01 deck. These are mounted as such: one on the starboard side above the galley door and one on the port side above the main deck fire station. A third life ring (without a floating light) is located just starboard of centerline aft.

(k) Ensign Mast. (Figure 1-7, Item 11) An ensign mast is located at centerline aft. Figure 1-11 illustrates the ensign mast. The ensign mast contains the following lights: one bilge light (Item 1), two yellow towing lights (Item 2), and one white stern light (Item 3).

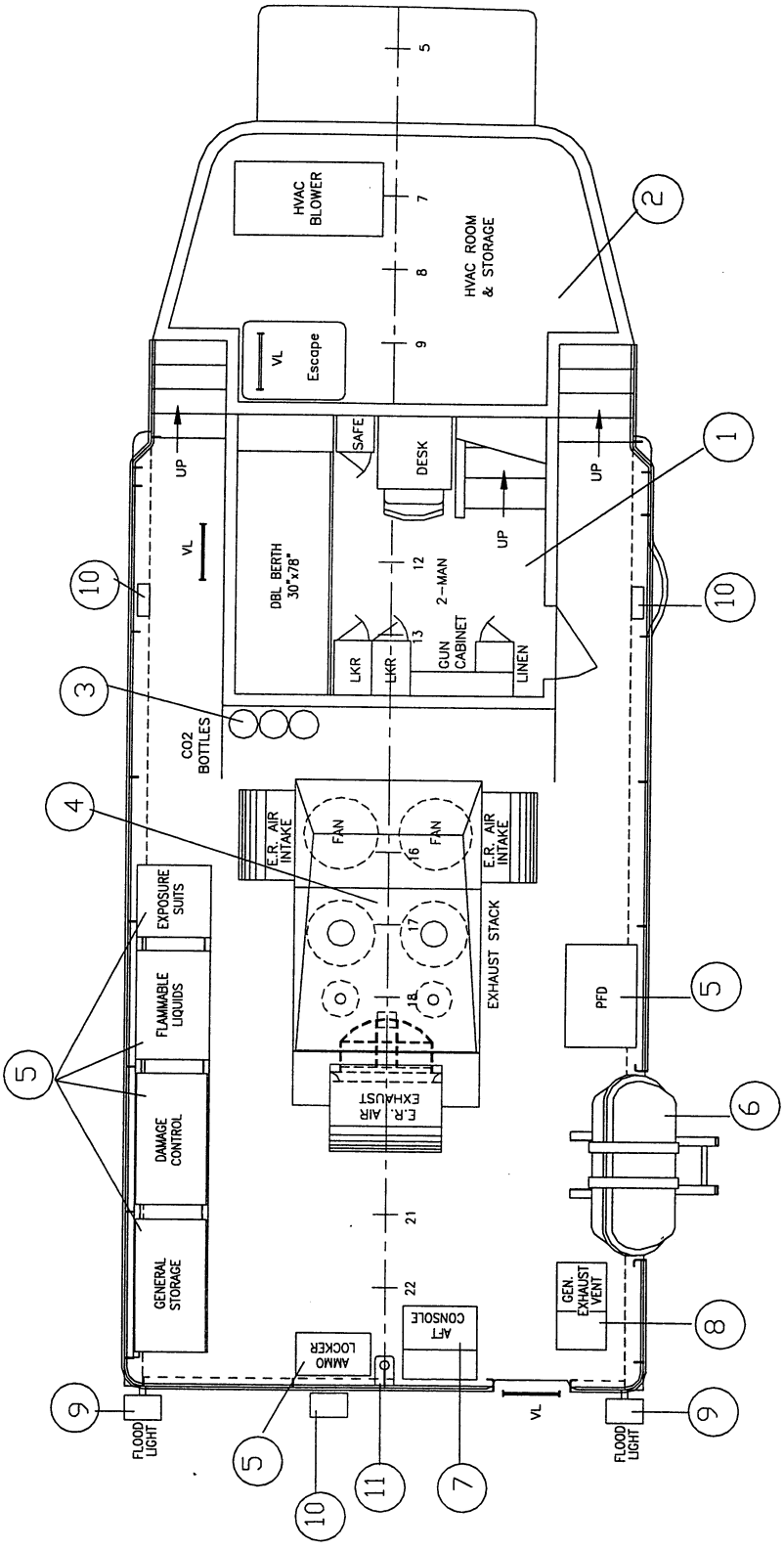


Figure 1-7. 01 Deck

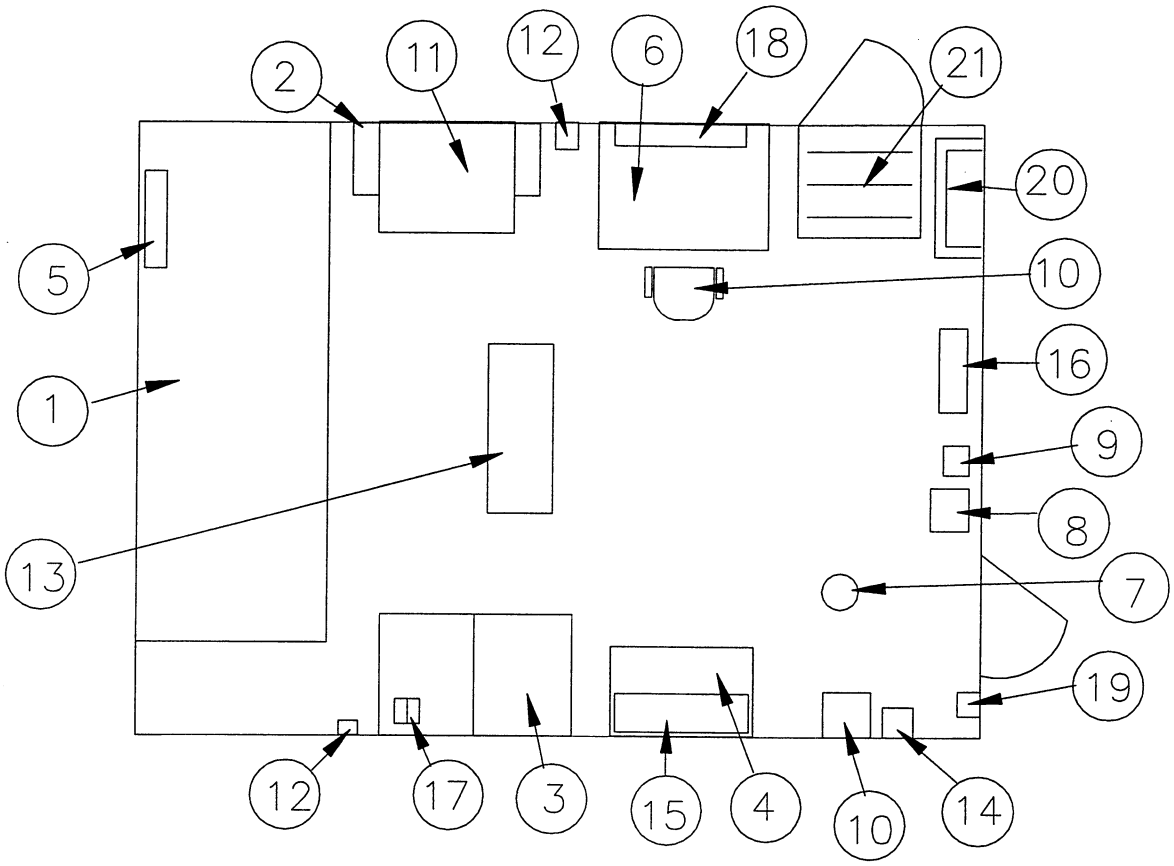


Figure 1-8. Double Berth Area

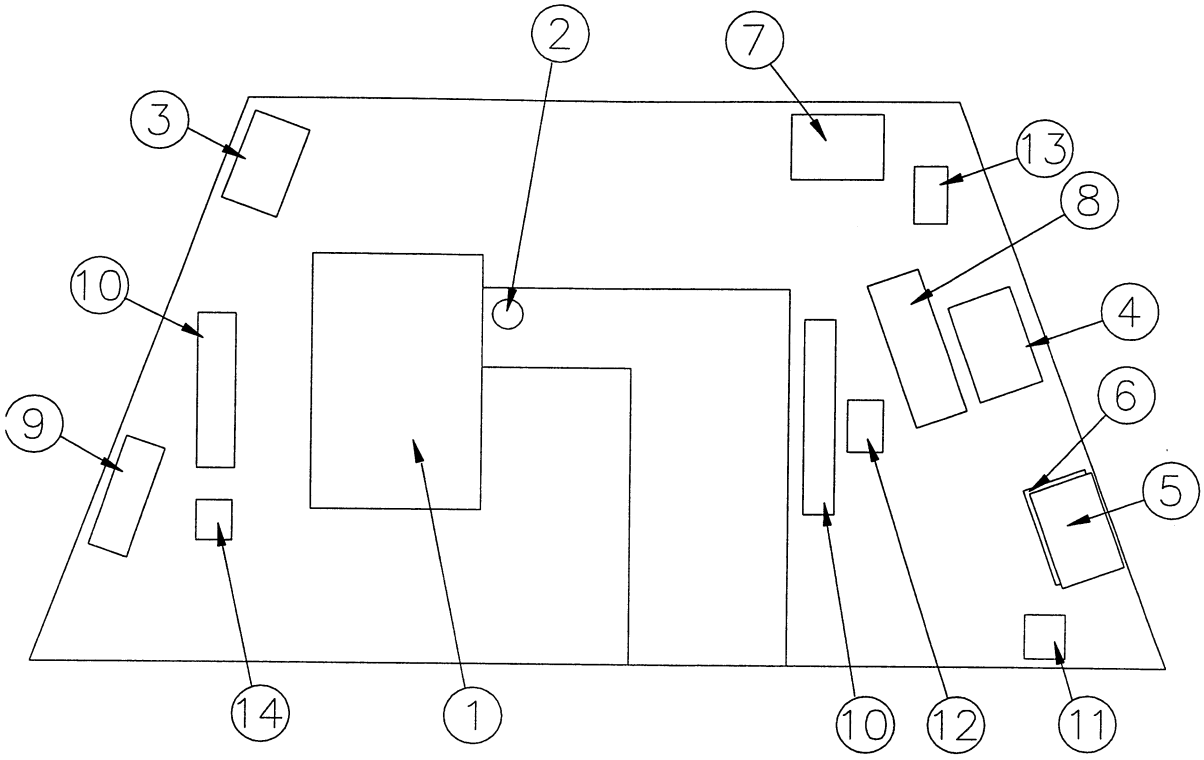


Figure 1-9. HVAC Room

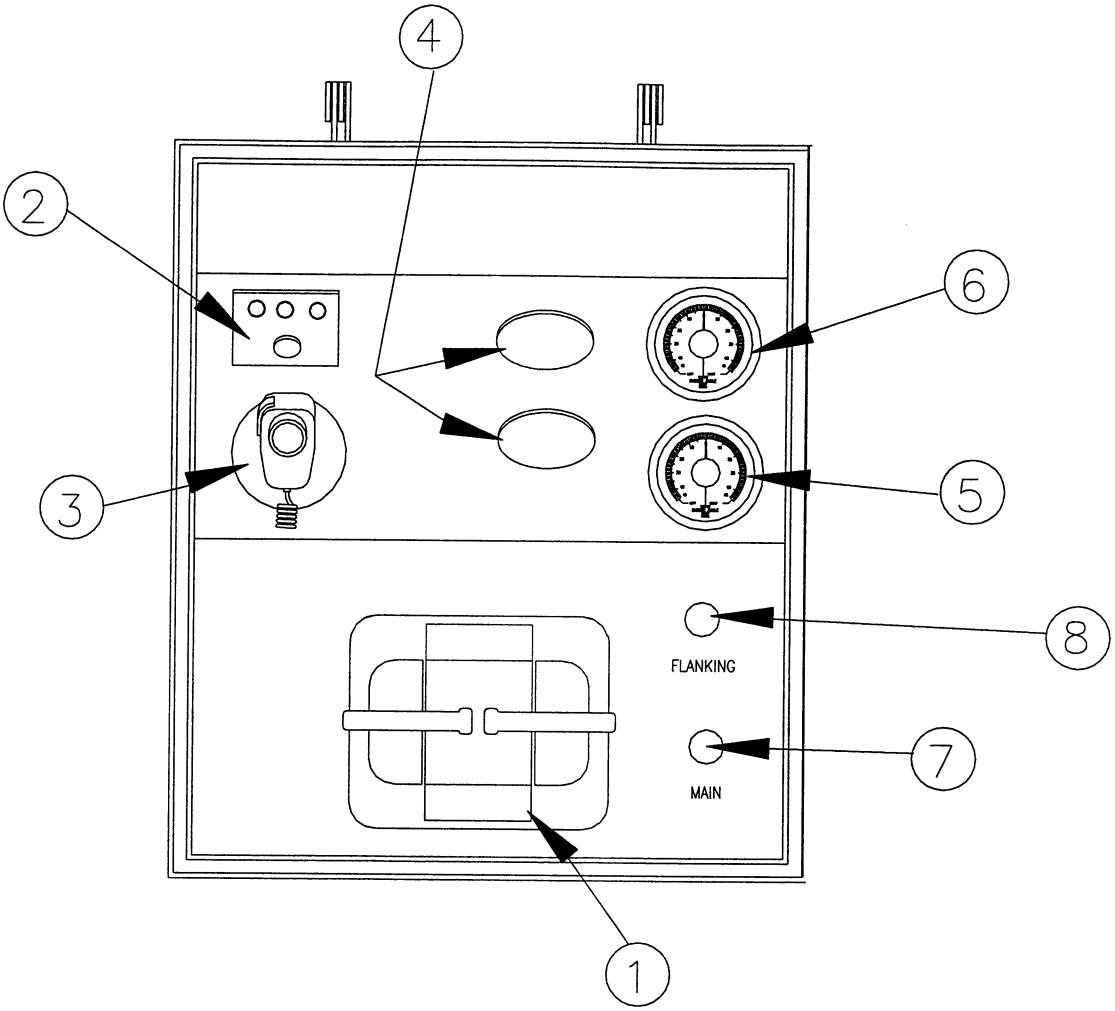


Figure 1-10. Aft Control Station

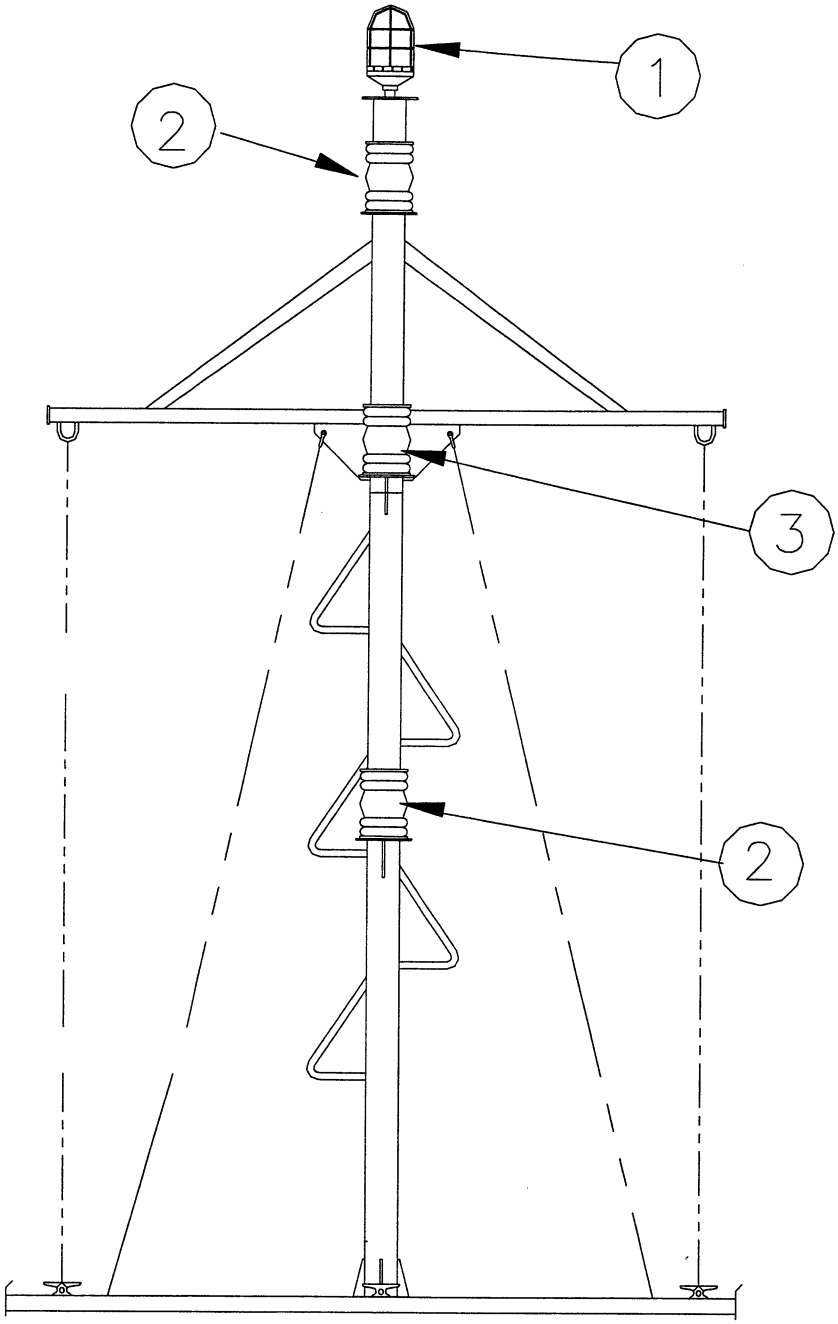


Figure 1-11. Ensign Mast

(4) Main Deck. The rooms on the Main Deck are depicted in Figure 1-12. These include the generator room (1), mess area (2), three-person berthing area (3), and head (4). The layout of the Main Deck is discussed below.

(a) Generator Room (Figure 1-12, Item 1). The generator room is located between Frames 19 and 24, at centerline. See Figure 1-13 for a plan view of the generator room. Key components in the generator room are outlined below.

1 Service Generator Set (Item 1). Two Onan/Admiral MCGA 55 kW, 450V AC, 60Hz generator sets are located in opposing corners of the generator room. One generator is positioned on the starboard side between Frames 20 and 22. The second generator is positioned on the port side between Frames 21 and 23.

2 Main Switchboard (Item 2). The main switchboard (450V, 208/120V-100A shore power) is located on the port bulkhead between Frames 20 and 22.

3 Generator Set Batteries (Item 3). Each generator set is provided with a 24 VDC battery bank to provide power for starting. 24VDC power in each battery bank is derived from two 12V batteries (with boxes) located one each, port and starboard, on the aft bulkhead between Frames 21 and 23.

4 Battery Chargers (Item 4). Two 24V-battery chargers (Charles Marine Products 5000 Series) for charging the generator battery banks are located above the generator set batteries on the Frame 23 bulkhead, starboard of centerline.

5 Fire Alarm Beacon/Horn (Item 5). A fire alarm beacon/horn is located forward on the starboard bulkhead at Frame 20.

6 Heat Detector (Item 6). A heat detector is located starboard of centerline between Frames 21 and 22.

7 Transformers (Item 7). Three single-phase 10-kilo volt ampere (kVA) transformers are located at the forward starboard bulkhead at Frame 23.

8 Battery Disconnects (Item 8). Two battery disconnects (Perko Model 8603) are provided, one for each battery bank. The disconnects are located on the aft bulkhead at Frame 23 above the battery banks. The disconnects facilitate starting generator sets or main engines, by selecting the designated circuit on the switch.

9 Generator Room Supply Fan (Item 9). A supply fan (Hartzell model) is provided on the aft port bulkhead at Frame 23.

10 Generator Room Supply Fan Motor Starter (Item 10). A motor starter (Siemens model) is provided for controlling the generator room supply fan. The fan is located on the port bulkhead at Frame 22.

11 Distribution Panels (Item 11). Panel DP3 (208 VAC) is located on the aft starboard bulkhead at Frame 23. Panel DP2 (480VAC) is located on the starboard bulkhead between Frames 22 and 23.

12 Generator Exhaust (Item 12). Exhaust from each generator is piped upward from the generator room to the exhaust stack.

13 Receptacles (Item 13). Two general service receptacles are provided. One is located on the Frame 20 bulkhead starboard side and one is located on the Frame 23 bulkhead starboard side. Two engine heater receptacles are provided adjacent to the engines.

14 Escape Hatch (Item 14). An escape hatch (from the Hold Deck) is located on the aft starboard side between Frames 22 and 23.

15 Lighting (Item 15). Three fluorescent light fixtures are located in the room. An emergency DC light is located in the generator room as well.

16 Fixed Port Lights (Item 16). Fixed port lights are located one each, on the port and starboard bulkhead.

17 Communication Horn (Item 17). A communication horn (United Marine Model UM-HSIS) is located on the starboard bulkhead above the fixed port light.

18 Fire Extinguisher (Item 18). A fire extinguisher is located under the fixed port light on the port side.

19 Sound Powered Phone Jackbox (Item 19). A sound powered phone jackbox is located port and forward of the #1 generator set.

20 Remote Intercom Station (Item 20). A remote intercom station (United Marine Model UM-RIMI) is located port and forward of the #1 generator set.

21 AC Light Switch (Item 21). An AC light switch is located on the forward bulkhead just port of the doorway.

22 DC Light Switch (Item 22). A DC light switch is located on the forward bulkhead just starboard of the doorway.

23 Carbon Monoxide Detector (Item 23). A carbon monoxide detector is located on the starboard bulkhead forward of the communication horn.

24 Space Heater (Item 24). A space heater is located on the starboard bulkhead below the fixed port light.

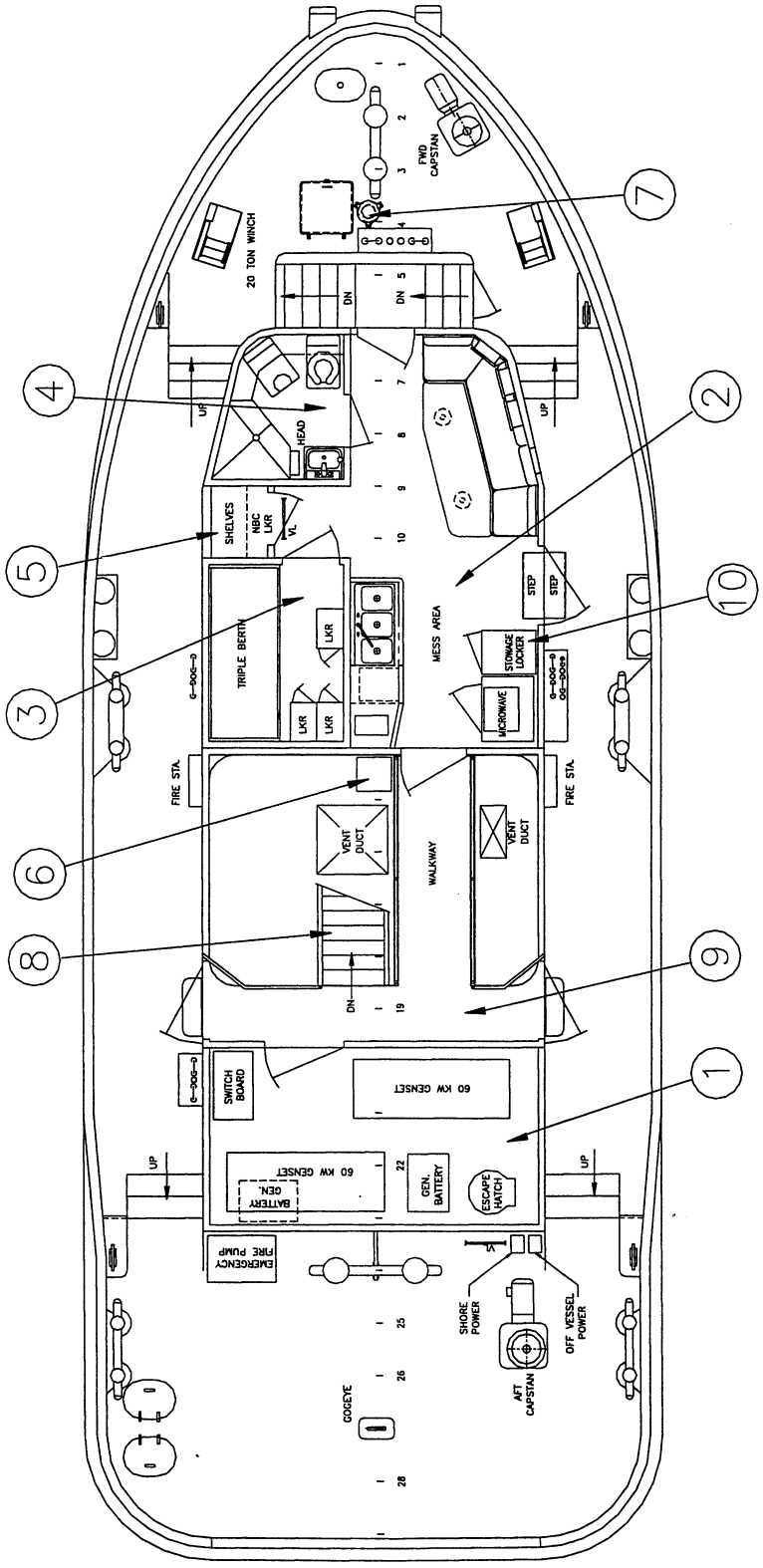


Figure 1-12. Main Deck

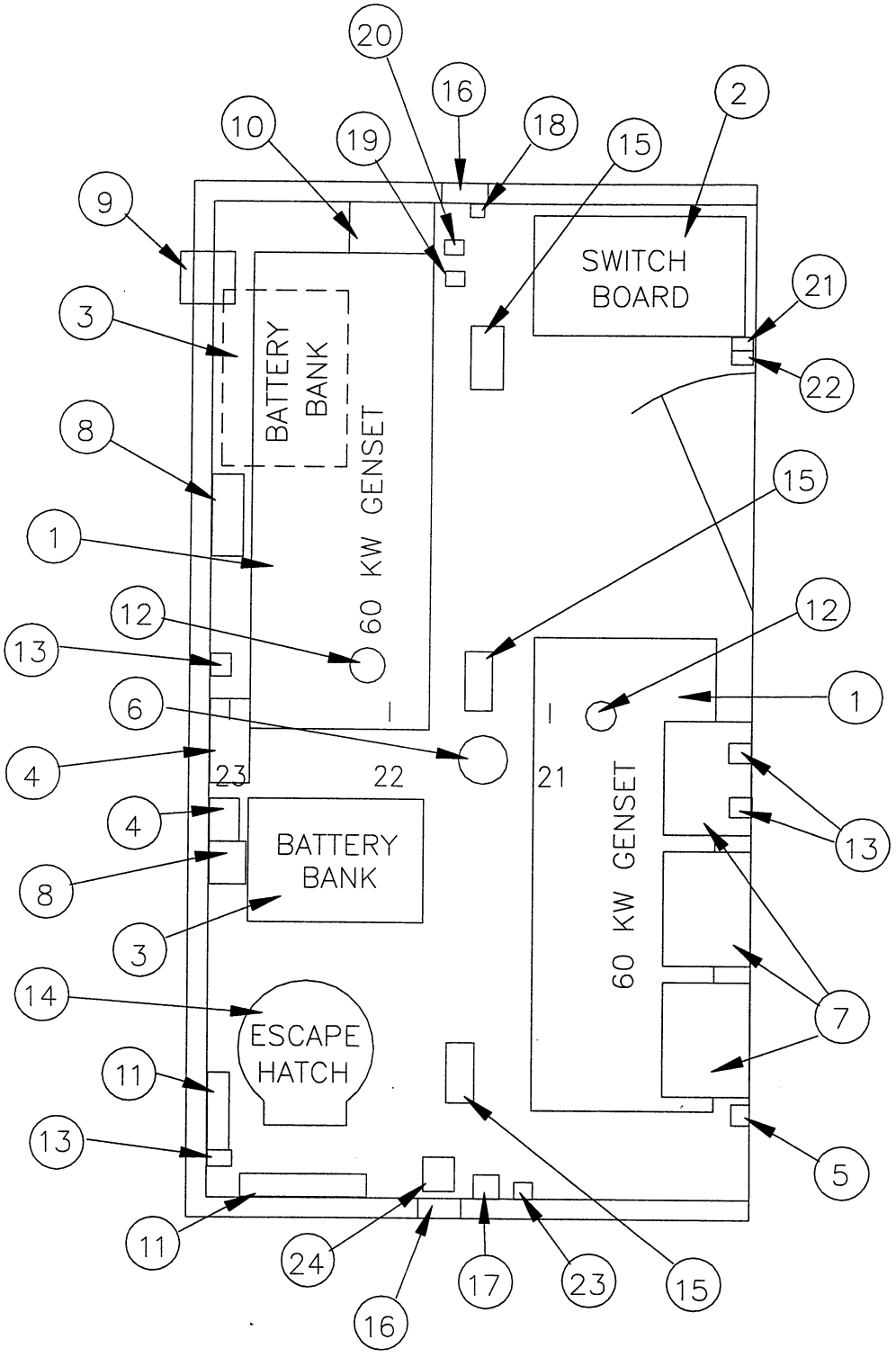


Figure 1-13. Generator Room

(b) Mess Area (Figure 1-12, Item 2). The mess area is located on the starboard side between Frames 6 and 14. The mess area (Refer to Figure 1-14) contains a refrigerator/freezer (Item 1), a stowage locker (Item 3), a microwave oven (Item 2), a mess table with seating (storage provided below seating) (Item 6), a sink with storage above (Item 4), a fire alarm beacon/horn (Item 5), a fire alarm pull station (Item 7), a smoke detector (Item 8), sounding tubes (Item 9), a deck drain (Item 10), a fixed port light (Item 11), a remote intercom station (Item 12), a fire extinguisher (Item 13), a clock (Item 14), a first aid kit (Item 15), six receptacles (Item 16), a sound powered phone (Item 17), an engine alarm (item 18), a ventilation shutdown (Item 19), an intercom speaker (Item 20), a carbon monoxide detector (Item 21), a light switch (Item 22), three fluorescent light fixtures (Item 23), an emergency DC light (Item 24), and an air condition vent (Item 25).

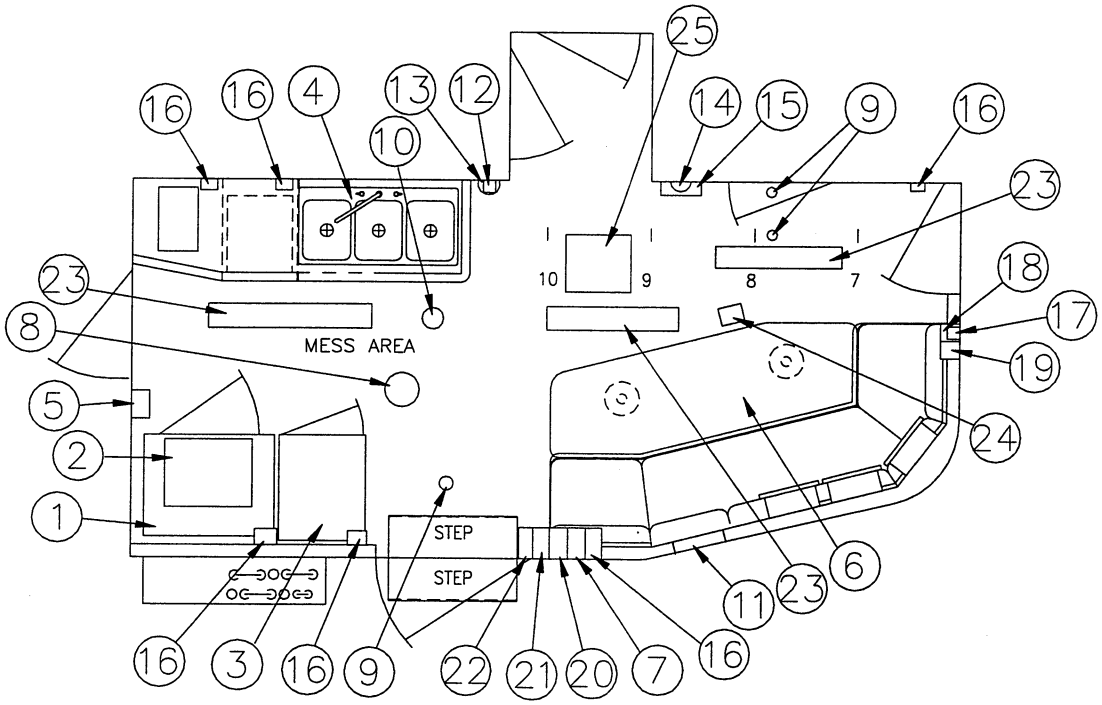


Figure 1-14. Mess Area

(c) Three-Person Berthing Area (Figure 1-12, Item 3). A three-person berthing area (Refer to Figure 1-15) is located port of centerline between Frames 10 and 14. The berthing area contains a triple berth (Item 1), three lockers (Item 2), berthing lights (Item 3), a receptacle (Item 4), a light switch (Item 5), a remote intercom station (Item 6), a carbon monoxide detector (Item 7), an air condition vent (Item 8), a clock (Item 9), a mirror (Item 10), three emergency escape breathing devices (EEBD's) (Item 11) and a fluorescent light fixture (Item 12).

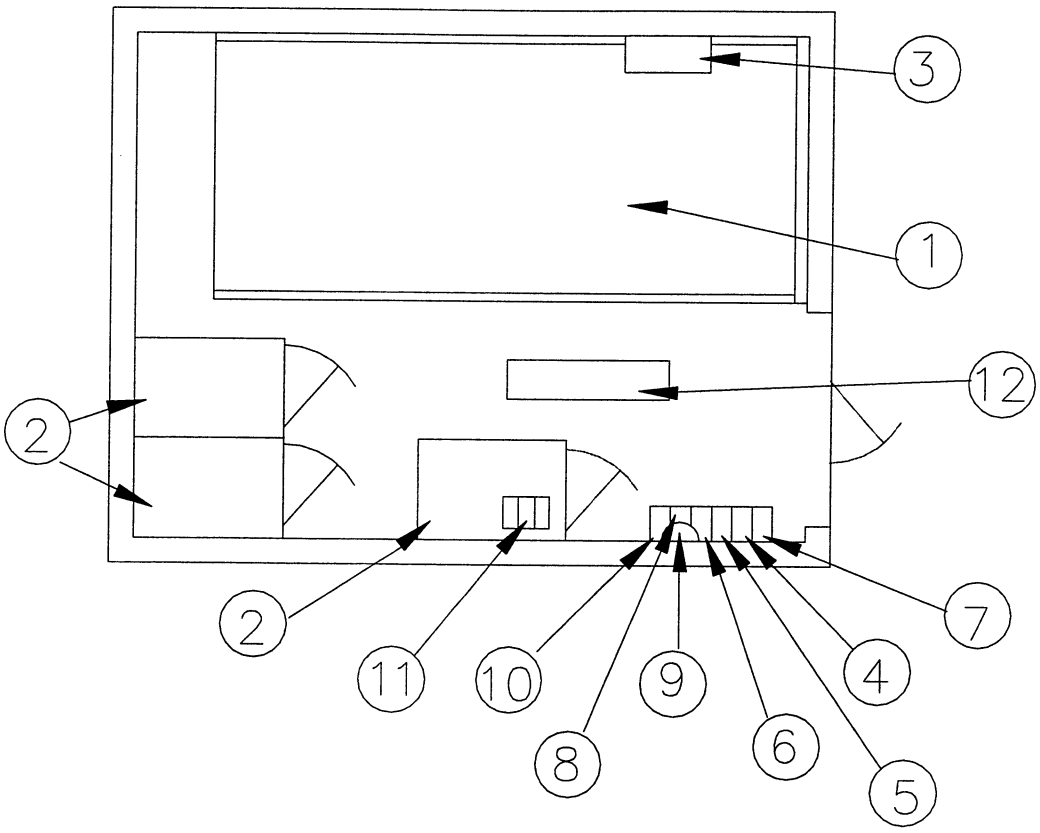


Figure 1-15. Three-Person Berthing Area

(d) Lockers and First Aid Station (Figure 1-12, Items 5,6,7, and 10). The NBC locker (Item 5) is located forward of the three-person berthing area and is situated between Frames 9 and 11. The foul weather gear locker (Item 6) is located on the starboard side of centerline aft of the mess area on the Frame 14 bulkhead in the upper engine room. A first aid station is located on the starboard outside wall of the head between Frames 8 and 9. The chain locker (Item 7) is located centerline at Frame 3 and the stowage locker (Item 10) is located on the starboard side of the mess area.

(e) Head (Figure 1-12, Item 4). A head is located between Frames 6 and 9 on the port side of the mess area. The head includes the following:

1 Shower

2 Incinerating Urinal (Incinolet Model UR)

3 Incinerating Toilet (Incinolet Model WB)

4 Sink

5 Heat detector

6 Exhaust Vent

7 Light Switch

8 Mirror

9 Fluorescent Light Fixture

(f) Walkway (Figure 1-12, Item 9). There is a walkway between the galley and generator room providing access to the generator room, main deck, and to a stairwell leading to the lower engine room.

(g) Stairwell (Figure 1-12, Item 8). A stairwell is located aft of the galley and three-person berthing area. The stairwell is accessed from the walkway and provides access to the Hold Deck below.

(h) Main Deck Equipment and Components. The deck equipment and components are discussed in the paragraphs that follow. See Figure 1-16 for a plan view of the main deck.

1 Capstans (Item 1). Two capstans are located on the Main Deck with one located forward between Frames 1 and 3 and another located aft on the starboard side between Frames 24 and 26. The aft Capstan is a McElroy Machine & Mfg. Co. model MCR-18-10EN with 10,000 pound (4,536 Kilograms) line pull at 30 feet (9.14 Meters) per minute (FPM)/10HP. The aft capstan has 18 inch (0.4572 Meters) warping heads and is coupled with a marine 460 VAC severe duty TEFC electric motor. The forward capstan is a McElroy Machine & Mfg. Co. model MCR-12-3EN with 2000 pound (907.20 Kilograms)line pull at 43 FPM (13.10 Meters)/3 HP. The forward capstan is equipped with a 12 inch (0.3048 Meters) warping head. They have marine 460 VAC severe duty TEFC electric motors.

2 Hatches and Manholes (Item 2). A manhole is located port outboard between Frames 27 and 28 providing access to Void #2. A manhole is located port outboard between Frames 26 and 27 providing access to Void #1. A manhole is located on port of

centerline on the forward Main Deck providing access to the ballast tank between Frames 1 and 2. A hatch is located on the forward Main Deck port side of centerline between Frames 3 and 4. The hatch provides access to the forward stores.

3 Towing Pad (Item 3). The towing pad is located centerline at Frame 24 on the aft main deck.

4 Deck Winches (Item 4). Two 20-ton deck winches (Nabrico Model #20-7HE) are located on the Main Deck, with one each port and starboard, between Frames 3 and 5.

5 Anchor (Item 5). Ground tackle includes a Fortress Model FX125 style anchor stowed in brackets on the starboard bulkhead; the attached anchor rode, to be stowed in chain locker, includes 500 feet (152.40 Meters) of nylon line. The forward capstan is used for hoisting the anchor.

6 Grease Zerks (Item 6). Grease zerks for each of the rudders are provided on the Main Deck. Two sets for the flanking rudders are located at Frame 24, one each port and starboard at the outboard edge of the deckhouse. Two sets for the main rudders are located aft at Frame 29, one each port and starboard of centerline.

7 Bitts (Item 7). The side bitts are constructed of 6-1/2 inch (0.1651 Meters) extra-heavy pipe with a 3-1/2 inch (0.0889 Meters) cross pipe. The forward and aft double bitts are constructed of 12-1/2 inch (0.3175 Meters) EH pipe with 4-1/2 inch (0.1143 Meters) cross pipe. They are securely tied off with shelf plate and vertical brackets to the bulwark. A towing bitt and associated capstan are located 8 feet (2.43 Meters) forward of the steering rudder stocks for line retrieval for towing barges astern when seas are in excess of 2 to 3 feet.

8 Buttons (Item 8). A pair of roller button chocks is connected by means of a shelf plate to the Main Deck on the port and starboard sides between Frames 10 and 13. The buttons are used for towing by pushing ahead utilizing fairleaded makeup winch wires.

9 Fire Stations (Item 9). Fire Stations #1 and #2 are located outside of the deckhouse on the Main Deck. Fire Station #1 is located on the starboard side between Frames 16 and 17. Fire Station #2 is located on the port side between Frames 16 and 17.

10 Boat Hook (Item 10). A boat hook is located on the starboard side of the deckhouse on the Main Deck just above Fire Station #1.

11 CO_2 Pull Stations (Item 11). CO_2 pull stations are located one each, port and starboard on the Main Deck just aft of the fire stations.

12 Axes (Item 12). Axes are located one each port and starboard at Frame 21 (just aft of the engine room doors).

13 Lifting Eyes (Item 13). Four lifting eyes are positioned on the Main Deck. Two are located just forward of Frame 24, one each port and starboard outboard. Two are located just forward of Frame 6, one each port and starboard outboard. These lifting eyes facilitate lifting the ST onto/from another vessel with the required lifting cradle arrangement.

14 Throwable Life Rings (Item 14). Throwable life rings with floating light are located one each, port and starboard, forward of the fire stations between Frames 12 and 14.

15 Gogeye (Item 15). A gogeye is located on the aft main deck at Frame 27 centerline.

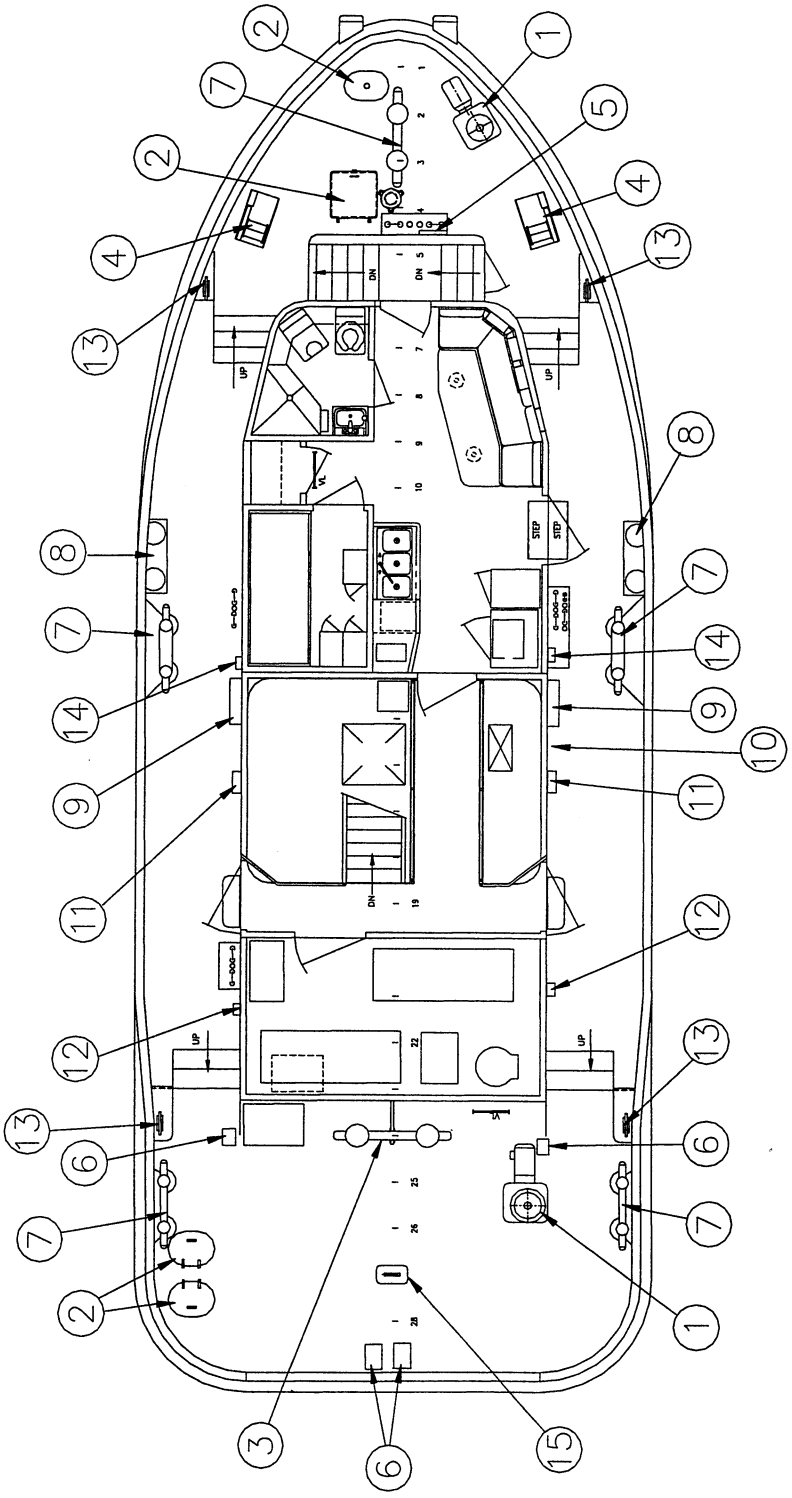


Figure 1-16. Main Deck Equipment and Components

(5) Hold Deck. The compartments on the Hold Deck consist of the following: ballast tank (3); voids (6); engine stores compartment (5); upper and lower engine room (1); tankage space (2); forward storage area (4). Each of these is discussed below. See Figure 1-17 for a plan view of the hold deck.

(a) Ballast Tank (Figure 1-17, Item 3) . A ballast tank is located between Frames 0 and 2 from centerline, port and starboard.

(b) Forward Storage Area (Figure 1-17, Item 4). A storage area is located aft of the ballast tank between Frames 2 and 8. Components within the forward storage area are depicted in Figure 1-18. These components include:

1 Stairwell (Item 1). Located from centerline and between Frames 5 and 6 is a stairwell.

2 Locker (Item 2). A locker is located between Frames 4 and 5, port inboard.

3 Tool Locker (Item 3). A tool locker is provided port outboard between Frames 6 and 7.

4 Fire Detection and Alarms (Item 4). A heat detector is located starboard of centerline between Frames 4 and 5. A fire alarm beacon/horn is located centerline at Frame 5.

5 Forward Capstan Motor Starter (Item 5). The forward capstan motor starter (Siemens Model) is located aft starboard in the storage area at the Frame 6 bulkhead.

6 Towing Winch Disconnects (Item 6). A disconnect switch (Square D Model) is provided for each of the towing winches. These disconnects are located starboard outboard between Frames 5 and 6.

7 Transducer Well (Item 7). A well for the depth sounder transducer is provided at aft centerline under the stairway.

8 Rope Locker (Item 8). A rope locker is located beneath the stairwell.

9 Storage Bins (Item 9). Storage bins are provided around the forward bulkhead and the port and starboard bulkheads. Basic issue items are stored in this area.

10 Fuel Oil Cleanout (Item 10). A fuel oil cleanout is located aft on the port side.

11 Equipment Removal Hatch (Item 11). An equipment removal hatch (quick acting dog type) is located overhead on the port side between Frames 3 and 4.

12 Bilge Suction (Item 12). A bilge suction is located beneath the floor plates at centerline.

13 Fire Alarm Pull Station (Item 13). A fire alarm pull station is located on the starboard side bulkhead.

14 Fuel Oil Tanks (Item 14). There are two fuel tanks (1,248 gallons; 5,677.95 Liters each), located one each, port and starboard between Frames 6 and 8.

15 Space Heater (Item 15). A space heater is located above the capstan controller.

16 Fluorescent Light Fixtures (Item 16). There are five fluorescent light fixtures located overhead.

(c) Tankage Space (Figure 1-17, Item 2). The tankage space is depicted in Figure 1-19 and includes the following:

1 Gray Water Tank (Item 1). A gray water tank (759 gallons; 2,873.04 Liters) is located forward and to the port side of the fuel tanks, between Frames 8 and 11.

2 Sea Chest (Item 2). A sea chest is located starboard outboard between Frames 12 and 13.

3 Oily Water Tank (Item 3). The oily water tank (365 gallons; 1,381.63 Liters) is located to the port of the sea chest, between Frames 11 and 13.

4 Fuel Oil Day Tank (Item 4). The fuel oil day tank (546 gallons; 2,066.77 Liters) is located to the port of the oily water tank, between Frames 11 and 13.

5 Lube Oil Tank (Item 5). The lube oil tank (266 gallons; 1,006.88 Liters) is located above the oily water tank and the fuel oil day tank between Frames 12 and 13.

6 Potable Water Tanks (Item 6). Two potable water tanks (392 gallons; 1,483.83 Liters each) are located on the port side between Frames 11 and 13.

7 Water Heater (Item 7). A water heater (Vanguard Model 6E733) is located port outboard between Frames 11 and 13.

8 Pressure Set (Item 8). A potable water pressure set (consisting of a Myers Model MPD 20 pressure tank and an Aermotor Model 5K38PN48 potable water pressure pump) is located forward of the water heater between Frames 11 and 12.

9 Gray Water Pump (Item 9). A gray water pump (Teel Model 2P375) is located to the starboard of the gray water tank between Frames 8 and 9.

10 Ballast Pump (Item 10). A ballast pump (Burks Model 350G6-2-A-B) is located starboard of the gray water pump and port of centerline between Frames 8 and 9.

11 Bilge Pump (Item 11). A bilge pump (Burks Model 350G6-2-A-B) is located at centerline between Frames 8 and 9.

12 Fire Pump (Item 12). A fire pump (Worthington Model D-824) is located beneath the workbench on the starboard side between Frames 8 and 9.

13 Fuel Oil Transfer Pump (Item 13). The fuel oil transfer pump (Roper Type 1, Fig. 2AM12) is located on the starboard side between Frames 8 and 9.

14 Fire Detection and Alarms (Item 14). A heat detector is located port of centerline between Frames 10 and 11. A fire alarm beacon/horn is located starboard centerline at Frame 10.

15 Work Bench (Item 15). A workbench is located forward starboard between Frames 8 and 10.

16 Distribution Panel (Item 16). Panel DP1 (480VAC) is located on the starboard bulkhead.

17 Seawater Suction Line (Item 17). A seawater suction line is piped to the sea chest. The line includes two valves and a strainer.

Motor controllers are provided for the following equipment in the tankage space:

18 Fuel Oil Transfer Pump Motor Controller (Item 18).

19 Fire Pump Motor Controller (Item 19).

20 Bilge/Ballast Pump #1 Motor Controller (Item 20).

21 Bilge/Ballast Pump #2 Motor Controller (Item 21).

22 Grey Water Pump Motor Controller (Item 22).

23 Potable Water Pressure Set Motor Controller (Item 23).

24 Bilge Suction (Item 24). A bilge suction is located below the floor plates centerline between Frame 10 and 11.

25 Fuel Filters (Item 25). Fuel filters inline from the fuel oil tanks are provided one each, port and starboard at Frame 9 and 10.

26 Firemain Piping Valves (Item 26). Firemain piping valves are located overhead port inboard.

27 Remote Intercom Station (Item 27). A remote intercom station (United Marine Model UM-RIMI) is located above the workbench.

28 Sight Glasses (Item 28). Sight glasses are provided for monitoring the level of the fuel oil day tank, fuel oil tank, grey water tank, and potable water tanks

29 Fire Extinguisher (Item 29). A fire extinguisher is located forward on the starboard side bulkhead.

30 AC Receptacles (Item 30). Two (2) AC receptacles are located on the forward bulkhead above the work bench.

31 Space Heater (Item 31). A space heater is located on the forward bulkhead port of the Bilge/Ballast pump #2 motor controller.

32 Emergency DC Light (Item 32). An emergency DC light is located overhead just port of centerline at Frame 9.

33 Intercommunications Horn (Item 33). An intercommunications horn is located overhead on the forward bulkhead starboard of centerline.

34 Remote Intercom Station (Item 34). A remote intercom station (United Marine Model UM-RIMI) is located on the forward bulkhead starboard of centerline above the work bench.

35 Light Switch (Item 35). A light switch is located on the forward bulkhead just port of the door leading to the forward stores room.

36 Bench Grinder (Item 36). A bench grinder is located on top of the work bench.

37 Vice (Item 37). A vice is located on top of the work bench.

38 Fluorescent Light Fixtures (Item 38). Four fluorescent light fixtures are located overhead in the Tankage Space.

39 Hand Operated Fuel Oil Transfer Pump (Item 39). A hand operated fuel oil transfer pump is located on the starboard side of the workbench.

(d) Lower Engine Room (Figure 1-17, Item 1). The Engine Room is located between Frames 13 and 21. Key components and fixtures in the lower Engine Room are depicted in Figure 1-20.

1 Main Diesel Engines (Item 1). The two main propulsion diesels (Cummins KTA19-M3, 640 BHP @ 1800 RPM) are located one each port and starboard between Frames 15 and 20.

2 Reduction Gearing (Item 2). A Twin Disc MG 5202, deep case reduction gear is coupled to each main diesel engine.

3 Dirty Oil Tank (Item 3). The waste oil tank (350 gallons; 1,324.85 Liters) is located at centerline between Frames 19 and 21 and below the deck plates in the Engine Room.

4 Oil Content Bilge Alarm (Item 4). The oil content bilge alarm (oily water tank monitor HF Scientific BA-1/MA-1/BA-100) is located on the port side between Frames 18 and 19.

5 Oily Water Separator (Item 5). The oily water separator (Nelson Model #10025, Bilge Boy 96504A) is located port inboard between Frames 20 and 21.

6 FLOCS Pump (Item 6). The fast lube oil change system (FLOCS) pump is located port of centerline between Frames 17 and 18. This unit is a Model 15 gear Aeroquip #FF9315-01.

7 Multi-jet Nozzles (Item 7). Two multi-jet nozzles (CO_2 release) are located one each at the main diesel engines, port and starboard between Frames 17 and 18.

8 Heat Detectors (Item 8). There are two heat detectors, one each port and starboard, at Frame 17 near the main diesel engines.

9 Emergency Transfer Switch and Dual Emergency Steering Station (Item 9). The emergency transfer switch and dual emergency steering station is located on the port of the doorway on the forward bulkhead.

10 Bilge Alarm/Tank Alarm Panel (Item 10). The Bilge Alarm/Tank Alarm panel is located on the port forward bulkhead.

11 Lower Engine Room Panel DP4 (Lower Engine Room) (Item 11). Panel DP4 is located on the port forward bulkhead.

12 Batteries (Item 12). Each main engine is provided with a 24 VDC battery bank to provide power for starting. 24VDC power in each battery bank is derived from two 12V batteries (with boxes) located one each port and starboard at Frame 20.

13 Oily Water Hand Pump (Item 13). An oily water hand pump is mounted on the starboard side of the staircase in the Engine Room.

14 Staircase (Item 14). A staircase is located centerline in the Engine Room providing access upward to the Main Deck.

15 Engine Control Panels (Item 15). Engine control panels are located one each, adjacent to each of the main engines, port and starboard.

16 Fuel Filters (Item 16). Two duplex fuel filters (Racor Model 75/900 MAX) are provided port and starboard inboard forward of the main engines. These provide filtered fuel to the main engines and to the generators.

17 Bilge Suction (Item 17). A bilge suction is located below the floor plates between Frames 15 and 16. An emergency suction is provided below the deck plates at Frame 14 starboard of centerline.

18 Main Engine Cooling Cofferdams (Item 18). Main engine cooling cofferdams are located between Frames 13 and 14 port and starboard outboard.

19 Generator Engine Cooling Cofferdams (Item 19). Generator engine cooling cofferdams are located above the main engine cooling cofferdams.

20 Receptacles (Item 20). Four 120VAC receptacles are located in opposing corners.

21 Bilge Sump Pumps (Item 21). Bilge sump pumps (Rule Model 3700) are located port and starboard at Frame 19.

22 Fast Lube Oil Change System (FLOCS) Quick Disconnects (Item 22). FLOCS quick disconnects for the generator set lube oil/waste oil are provided one each, port and starboard.

23 Oily Water Separator Overboard Discharge (Item 23). An oily water separator overboard discharge is provided in the aft port corner.

24 Watertight Door Detector Switch (Item 24). Both of the doors in the lower engine room are provided with a watertight door detector switch. The status of doors in the engine room are indicated at the Pilot House watertight door alarm panel. The indicator for the door to the engine stores compartment is located within the engine room. The indicator for the door to the tankage space is located within the tankage space.

25 Fire Extinguisher (Item 25). Two (2) fire extinguishers are located in the lower engine room. They are located one each port and starboard mounted just below the main engine control panels.

26 Communication Strobe Lights (Item 26). A communication strobe light is located forward overhead on the port side bulkhead.

27 Intercommunication Speaker (Item 27). Two (2) intercommunication speakers are located in the lower engine room. One is located forward overhead on the port bulkhead and one is located forward overhead on the starboard bulkhead.

28 Steering Control Panels (Item 28). Two (2) steering control panels (Mathers Intercommand) are located port on the forward bulkhead. One is a Model MS547-11760 and the second is a Model MS12521.

29 Remote Intercom Station (Item 29). A remote intercom station (United Marine Model UM-RIMI) is located port of centerline on the forward bulkhead.

30 Space Heater (Item 30). A space heater is located port of centerline on the forward bulkhead just below the Bilge Alarm/Tank Alarm Panel.

31 Main Engine Throttle Controls (Item 31). Main engine throttle controls are located on the forward bulkhead just port of the doorway.

32 Intercommunication Strobe Light (Item 32). An intercommunication speaker is located forward overhead just port of the doorway.

33 Sound Powered Phone (Item 33). A sound powered phone is located on the forward bulkhead just starboard of the doorway.

34 Emergency Eyewash Station (Item 34). An emergency eyewash station is located on the forward bulkhead just starboard of the sound powered phone.

35 Sound powered Phone Bell (Item 35). A bell for the sound powered phone is located starboard overhead on the forward bulkhead.

36 Fluorescent Lights (Item 36). Seven (7) fluorescent light fixtures are located in the lower engine room. Four (4) fixtures are located overhead on the port side and three (3) fixtures are located overhead on the starboard side.

37 Battery Chargers (Item 37). Two (2) battery chargers are located in the lower engine room centerline under the stairs.

38 Lower Engine Room Heaters Panel (DP6). Panel DP6 is located on the forward bulkhead below the space heater.

(e) Upper Engine Room (Figure 1-17, Item 1). The components of the upper Engine Room are outlined below and depicted in Figure 1-21.

1 Ventilation Fan (Item 1). One ventilation fan which provides supply air to the Engine Room is located centerline. Two air ducts are located overhead, one at centerline and one starboard.

2 Engine Cooling Day Tanks (Item 2). Engine Cooling Day tanks are located one each, port and starboard.

3 Air Filters (Item 3). Air intake filters for the Engine Room are located port and starboard in the upper Engine Room.

4 CO_2 Nozzle (Item 4). A CO_2 nozzle for extinguishing fires in the Engine Room is located centerline in the upper Engine Room.

5 Exhaust Fan Motor Starter (Item 5). The motor starter for the exhaust fan is located on the forward starboard bulkhead.

6 Supply Fans Motor Starters (Item 6). The motor starter for supply fan #1 and #2 are located on the forward starboard bulkhead.

7 Fixed Port Lights (Item 7). Fixed port lights are provided one each, port and starboard.

8 Fire Alarm Pull Stations (Item 8). A fire alarm pull station is located at each main deck entrance to the upper Engine Room.

9 Fire Alarm Beacon/Horn (Item 9). A fire alarm beacon/horn for the fire alarm is located on the aft bulkhead, starboard side in the upper Engine Room.

10 Heat Detector (Item 10). A heat sensor is located aft, starboard of centerline in the upper Engine Room.

11 Generator Exhaust Trunk (Item 11). The generator exhaust trunk is routed upward from centerline from the generator room below.

12 Main Engine Exhaust Trunk (Item 12). The main engine exhaust trunk is routed upward from centerline.

13 Communication Head Sets (Item 13). Two communication head sets (United Marine Model UM-CPHI-A) are provided in the upper Engine Room, one each port and starboard.

14 Pressure Switch for CO_2 (3PDT) System (Item14). A pressure switch is located at centerline.

15 Generator Ventilation Manual Pull Station Junction Boxes (Item 15). Two generator ventilation manual pull station junction boxes are located in the upper Engine Room, centerline on the aft bulkhead.

16 Engine Room Exhaust Fan (Item 16). The Engine Room exhaust fan is located centerline aft.

17 Main Engine and Generator Mufflers (Item 17). The main engine generator mufflers (1 for each engine) are mounted in the stack in the upper Engine Room.

18 Alarm Sirens (Item 18). Two alarm sirens are located on the aft starboard bulkhead.

19 Carbon Monoxide Detector (Item 19). A carbon monoxide detector is located on the aft starboard bulkhead.

20 Remote Lamp Indicating Panel (Item 20). A remote lamp-indicating panel (fire alarm) is located on the starboard side forward of the doorway.

21 Communication Speaker (Item 21). A surface mount communication speaker (United Marine Model UM-SFIS-C) is located on the starboard side forward of the doorway.

22 Foul Weather Gear Locker (Item 22). A foul weather gear locker is located alongside the walkway.

23 Receptacle (Item 23). A receptacle is located alongside the walkway across from the foul weather gear locker.

24 Fluorescent Light Fixtures (Item 24). Three fluorescent light fixtures are located overhead.

25 Light Switches (Item 25). Two light switches are located on the port side aft bulkhead and three light switches are located on the starboard side aft bulkhead.

26 Emergency DC Light (Item 26). An Emergency DC Light is located starboard overhead to the aft.

27 CO_2 Bell Alarm (Item 27). A CO_2 bell alarm is located overhead on the forward port bulkhead.

28 Intercommunication Strobe Light (Item 28). An intercommunication strobe light is located forward port overhead.

(f) Engine Stores Compartment (Figure 1-17, Item 5). The engine stores compartment is located aft of the Engine Room. The main components of this room are depicted in Figure 1-22 and are identified below.

1 Hydraulic Steering Power Unit (Item 1). The hydraulic steering power unit (Control General supplied Model A0009U Parker) is situated within this compartment.

2 Steering Flanking System Motor Starters (Item 2). A motor starter is provided for each of the steering flanking systems.

3 Aft Capstan Motor Starter (Item 3). A motor starter is provided for the aft capstan.

4 Disconnect for Aft Capstan Motor Starter (Item 4). A disconnect for the aft capstan is located in the engine stores compartment.

5 Vent Line for Stern Tubes (Item 5). A vent line for the stern tube is provided in the engine stores compartment, one each port and starboard (with valves).

6 Bilge Suction (Item 6). A bilge suction is located on the port side.

7 Vertical Ladder (Item 7). A vertical ladder is provided for access to an escape hatch to the Main Deck.

8 AC Receptacle (Item 8). A 120VAC receptacle is located overhead.

9 Generator Coolant Lines (Item 9). Coolant lines for the generators run through the engine stores compartment overhead.

10 Bilge Piping (Item 10). Bilge piping runs on the port side of the engine stores compartment.

11 Communication Speaker (Item 11). A communication speaker horn (United Marine) is located at centerline overhead.

12 Light Switch (Item 12). A light switch is located at centerline overhead.

13 Drain Valve at Escape Hatch (Item 13). A drain valve is located on top of the escape hatch.

14 Flooding Alarm (Item 14). A flooding alarm is located on the port side inboard.

15 Fluorescent Light Fixtures (Item 15). Three (3) fluorescent light fixtures are located overhead.

16 Fire Extinguisher (Item 16). A fire extinguisher is located centerline on the support beam.

(g) Voids (Figure 1-17, Item 6): Two voids are located aft of the engine stores compartment. Void #1 is located between Frames 24 and 27. Void #2 is located between Frames 27 and 29.

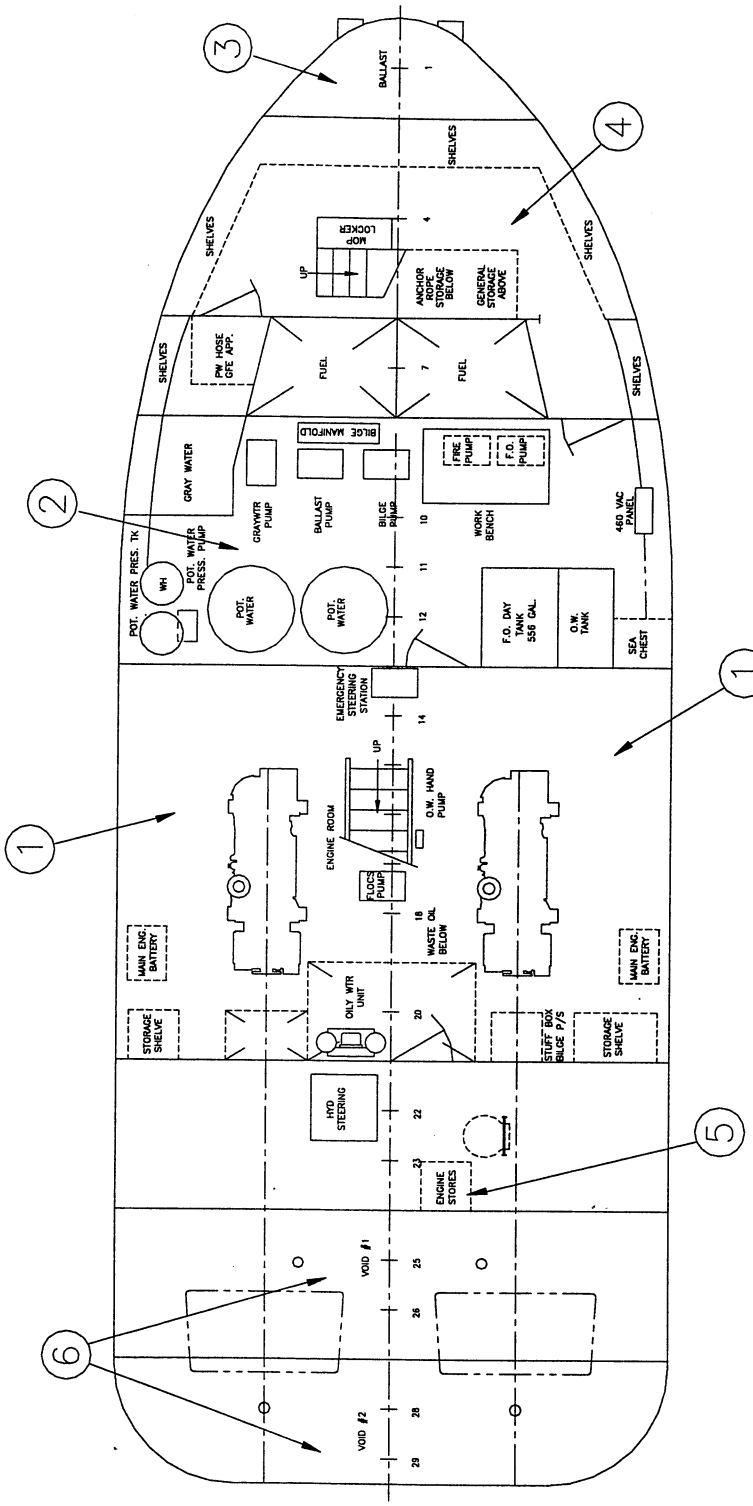


Figure 1-17. Hold Deck

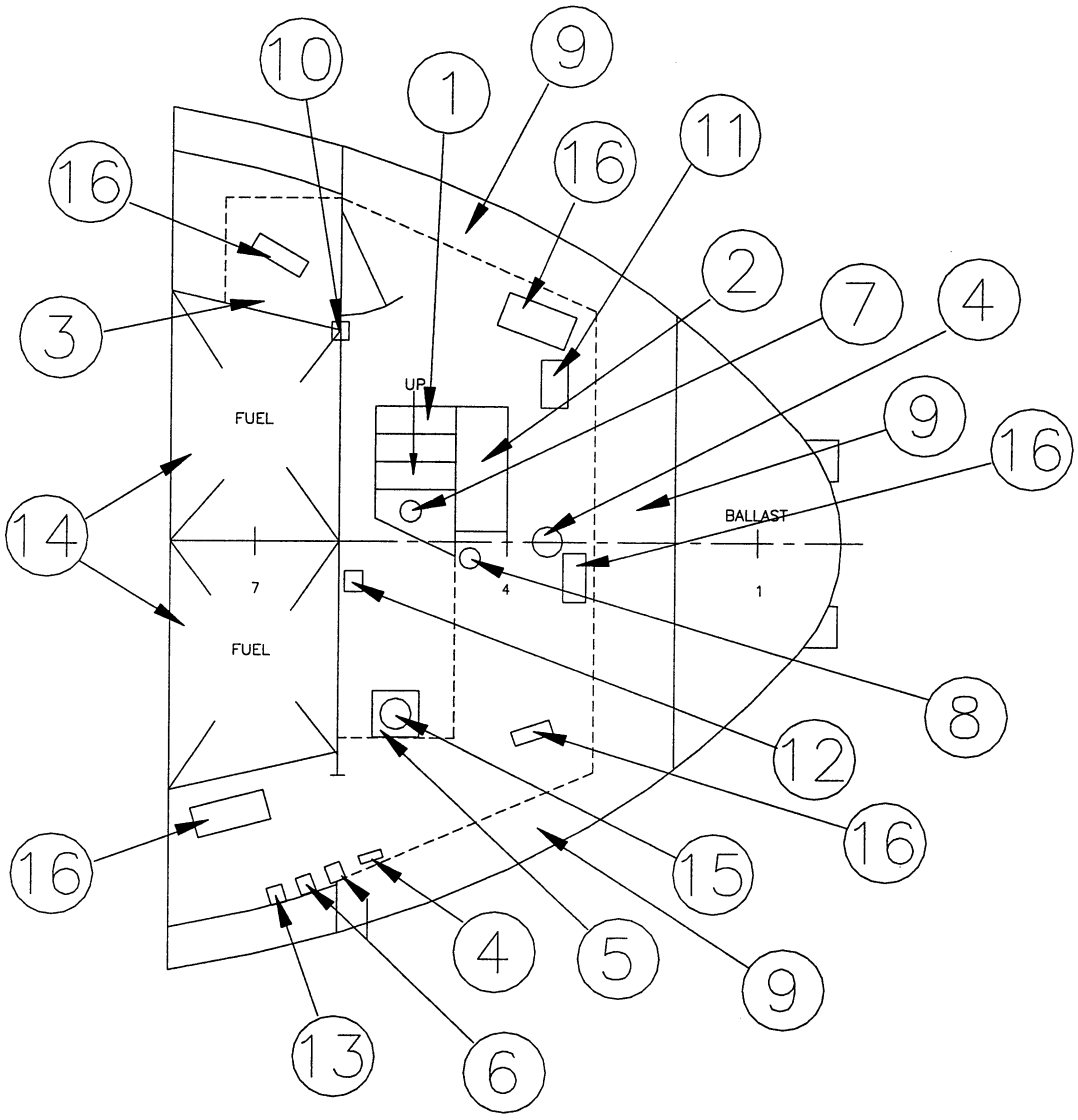


Figure 1- 18. Forward Storage

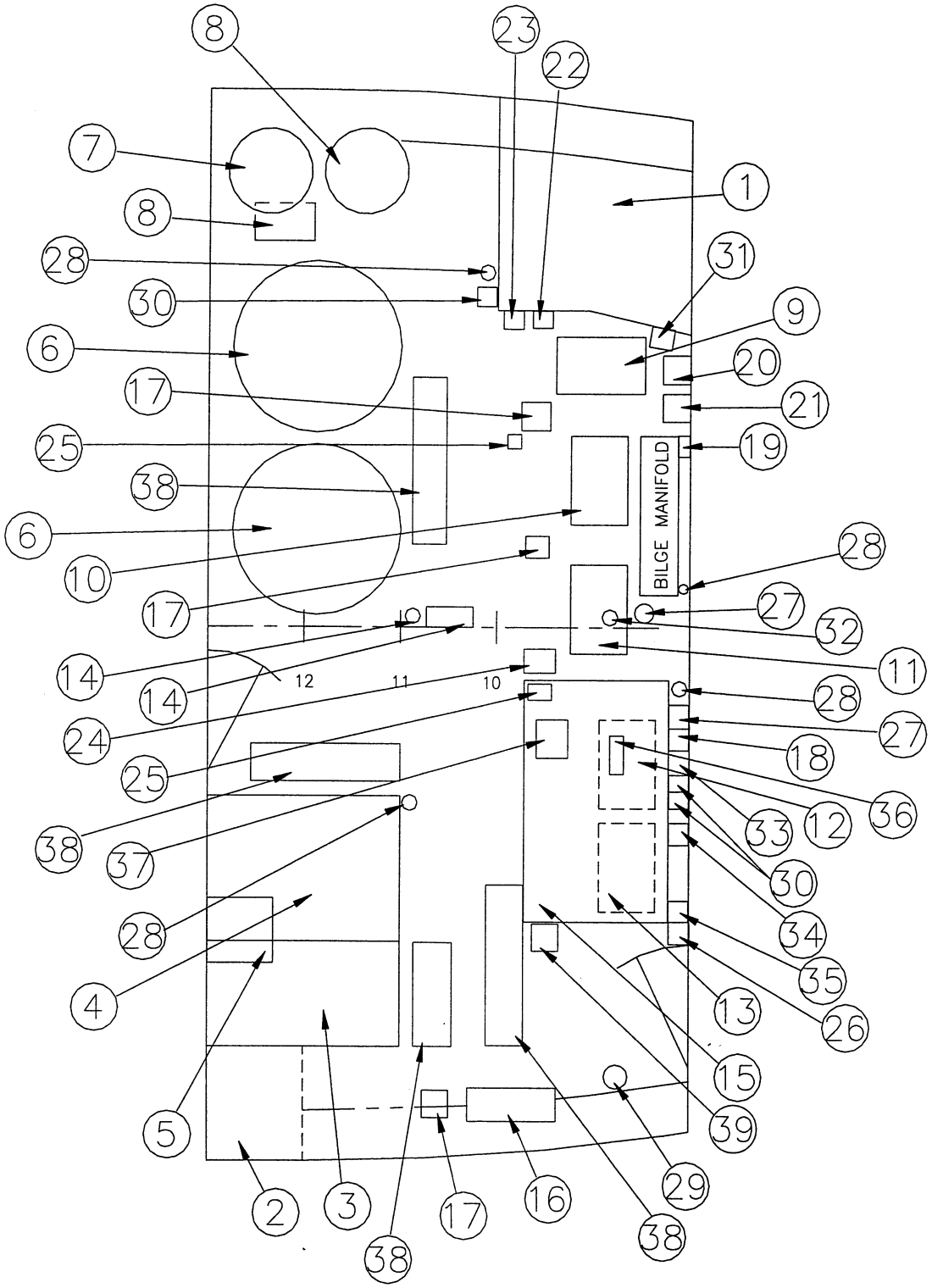


Figure 1-19. Tankage Space

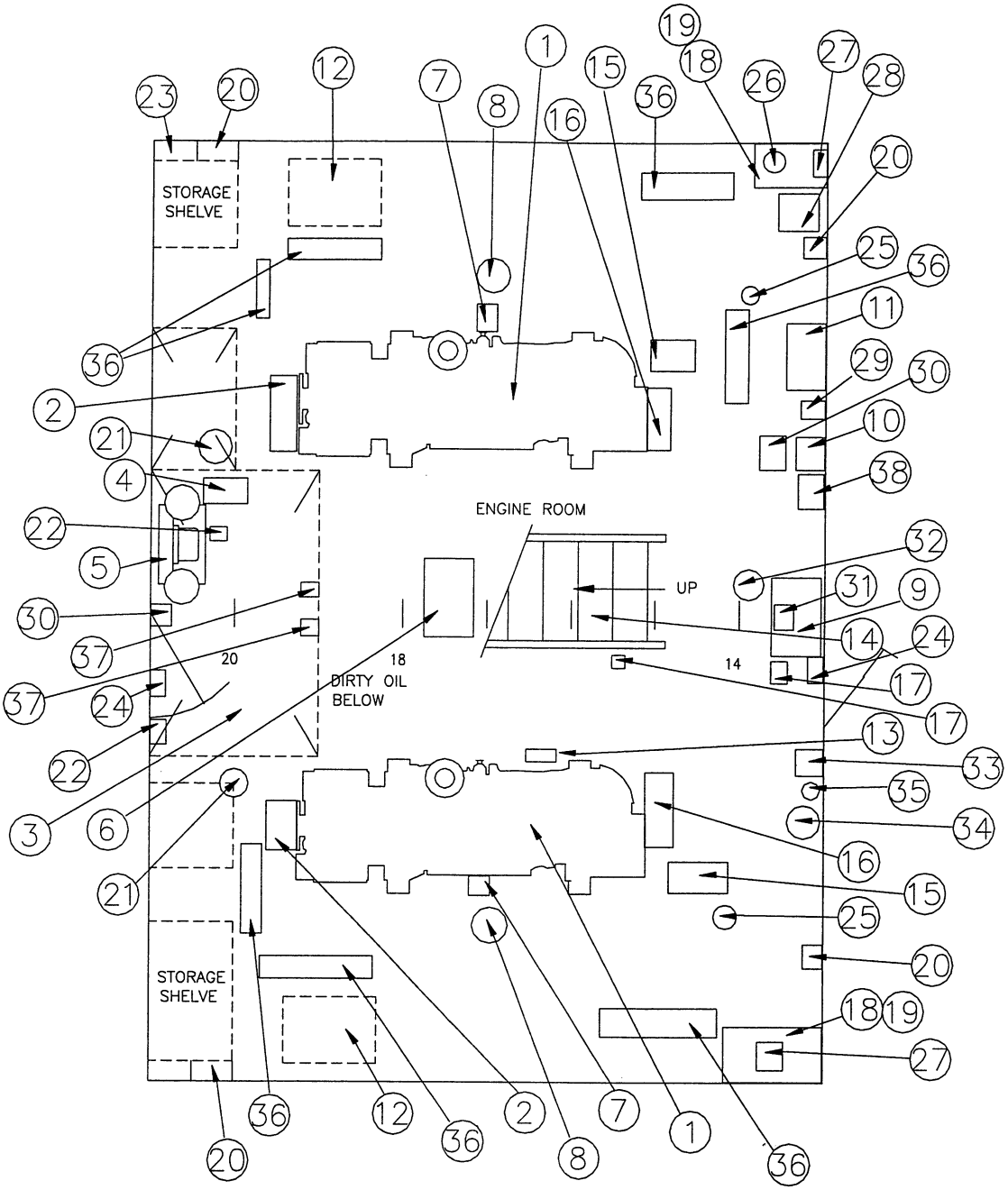


Figure 1-20. Lower Engine Room

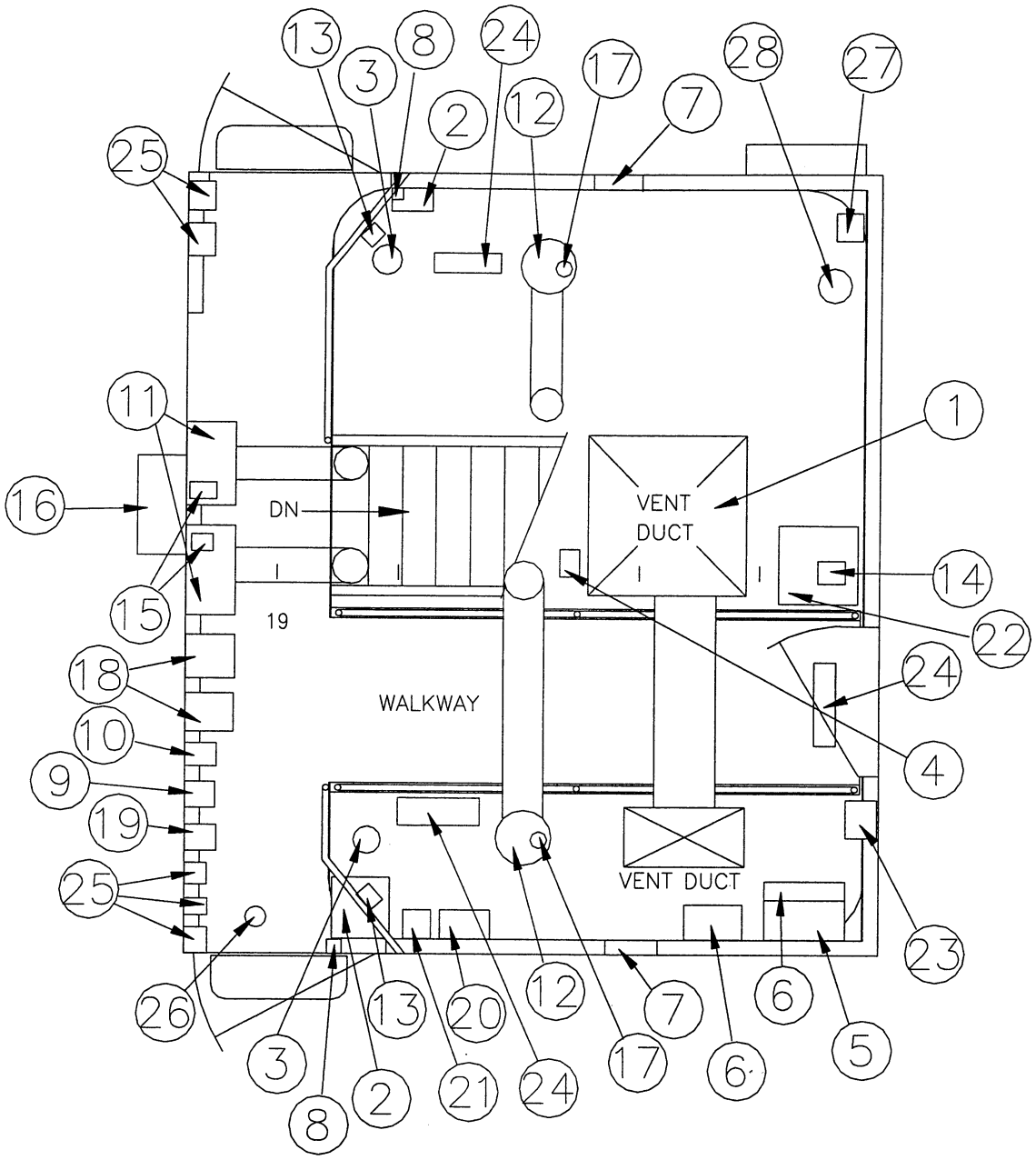


Figure 1-21. Upper Engine Room

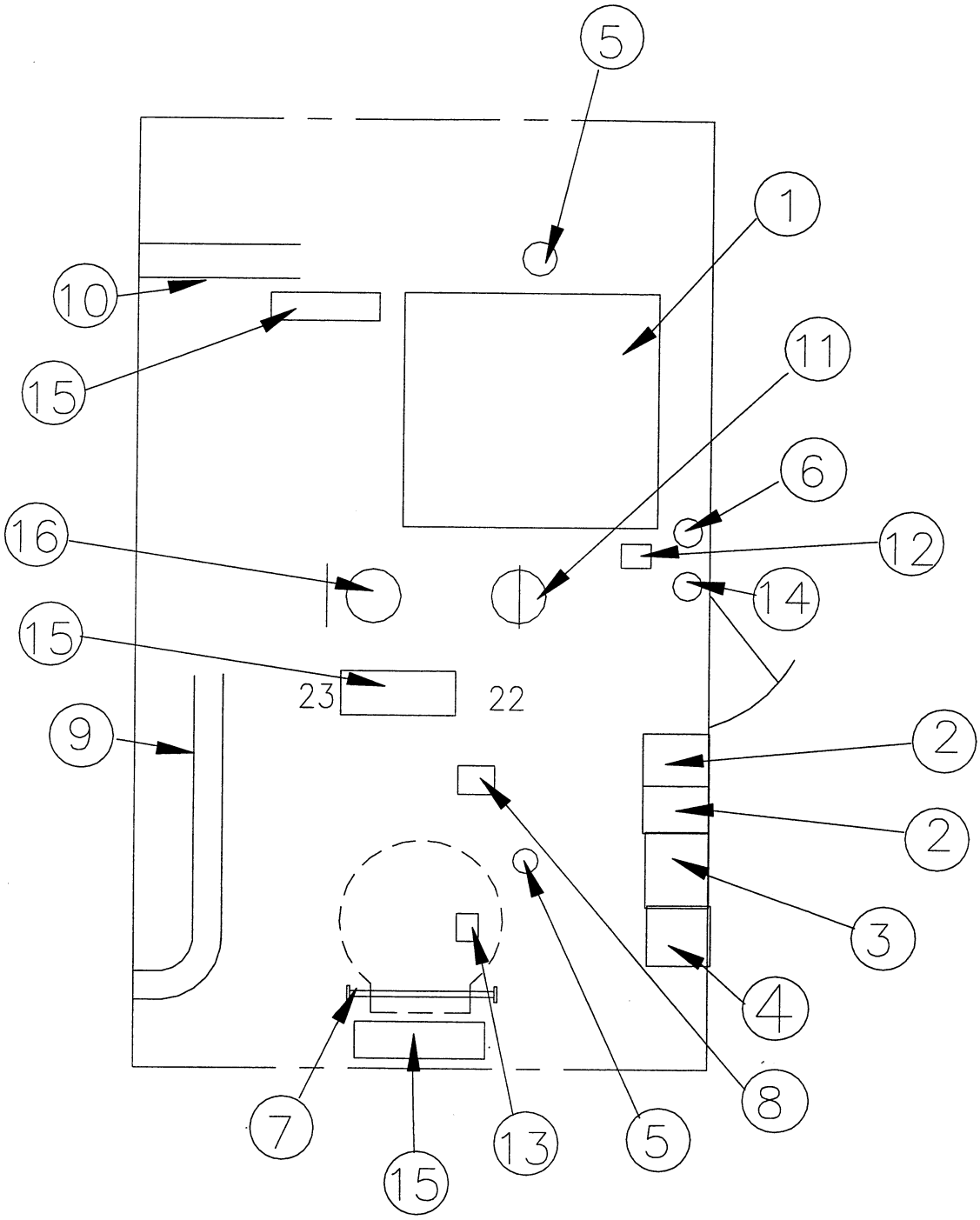


Figure 1-22. Engine Stores

b. ST External Profile Features. External features of the ST are discussed below.

(1) Hull. Both hull and superstructure are of steel construction.

(2) Cathodic Protection System. Sacrificial zinc anodes (Corrthern Type M-24 and M-12) are installed for cathodic protection of the underwater hull and other susceptible surfaces. The system is designed to last a minimum of 3 years to conform with normally scheduled overhaul periods. Anodes are attached by bolt-on method with a 3/8 inch (0.009398 Meters) plate installed between the anode and the protected surface.

The anodes are equally divided into two rows, port and starboard; half are installed forward of midship, the other half aft of midship. The remaining one-third anodes are located along the centerline keel, just beneath the turn of the bilge and divided equally between port and starboard.

(3) Fendering. Refer to Figure 1-23 for a depiction of the ST's fendering system. The fendering system includes rectangular rubber fenders (Hule "D" series) (Item 1) surrounding the ship's perimeter and a Johnson DB-1510 standard push knee (Item 2). The caprail (Item 3), located on top of the gunwale, is constructed of 4-inch (0.1016 Meters) pipe.

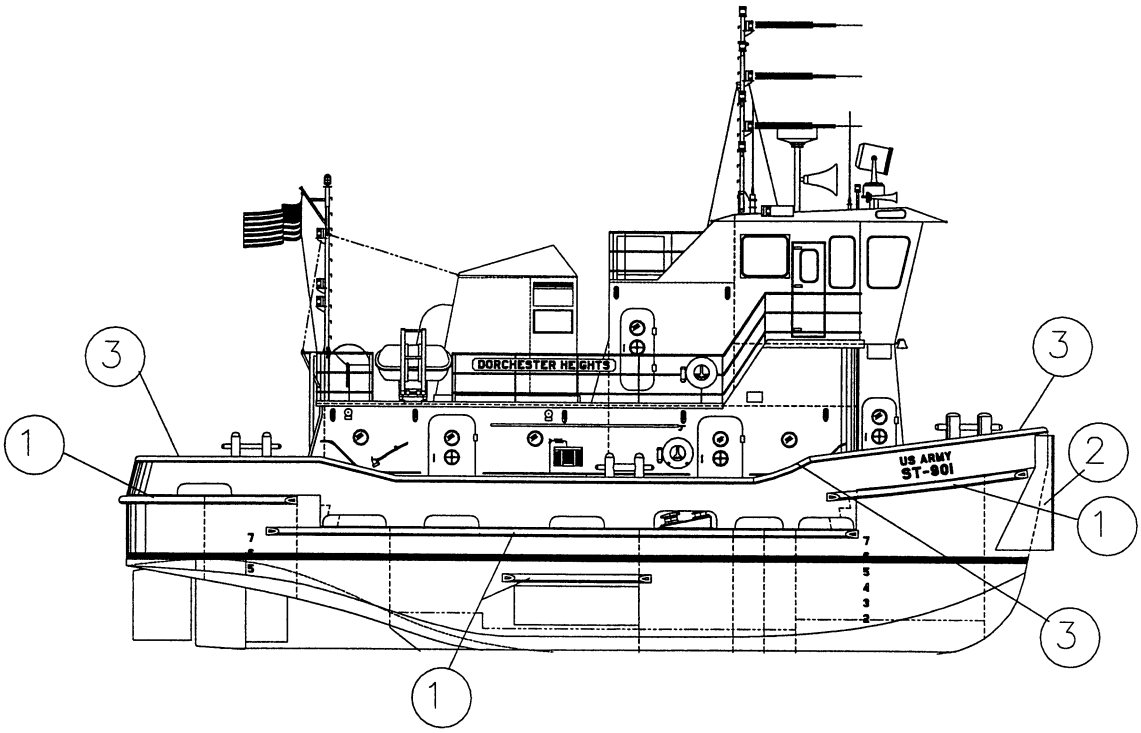


Figure 1-23. Fendering

(4) Handrails. Handrails are provided on the 01 Deck and Pilot House Deck. The handrails are of steel construction (Tubal Caine Industries Model A-120/A53B). See Figure 1-24 for a plan view of the handrails.

(a) 01 Deck (Item 1). A handrail is provided on the port side extending diagonally downward from the Pilot House Deck where it joins a parallel railing at Frame 10. From there, the railing extends until the stern of the 01 deck. A handrail extends from port to starboard on the stern of the deck. A handrail is also provided on the starboard side extending diagonally downward from the Pilot House Deck where it joins a parallel handrail at Frame 10. From there, it extends to Frame 19, where a break is provided for launching the life raft. The handrail then extends from the aft of the life raft to the stern railing.

(b) Pilot House Deck. A handrail (Item 2) extends from Frames 6 to 9, port and starboard, where it meets with the diagonal handrail extending upward from the 01 Deck. A handrail (Item 3) extends from Frame 10 to Frame 14, port and starboard, aft of the Pilot House. This encloses the area which contains the AC compressor and deck area.

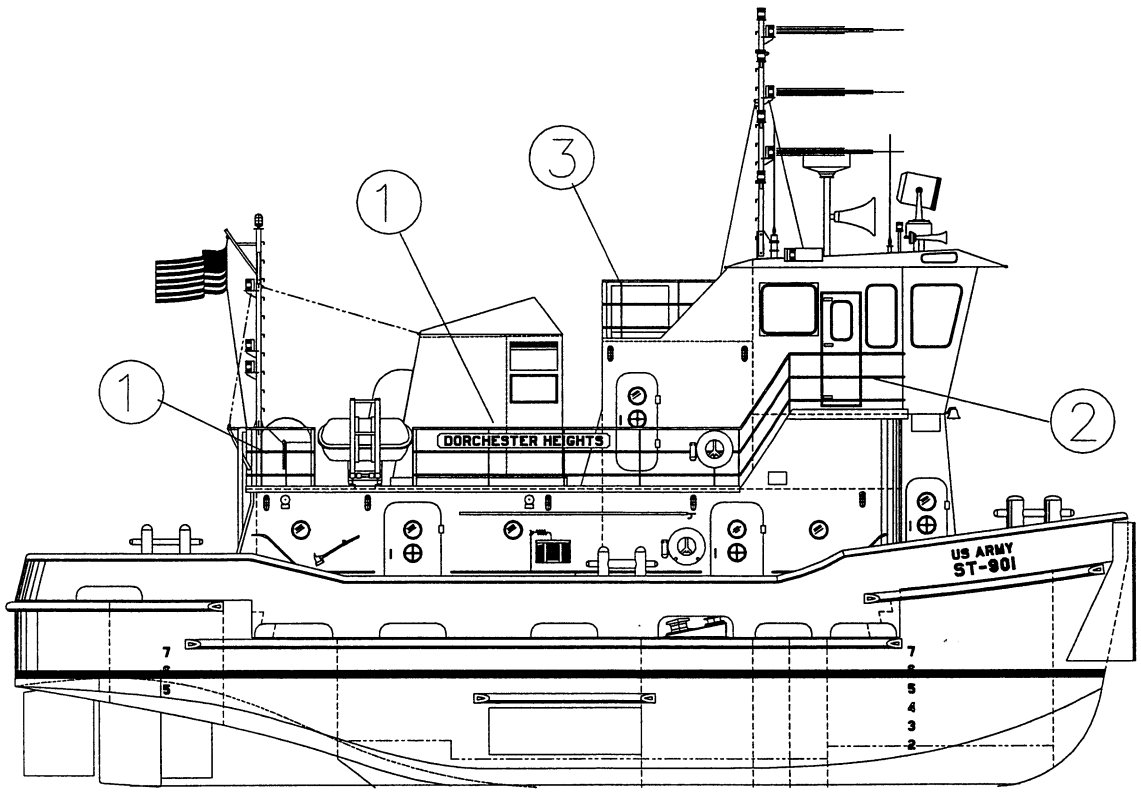


Figure 1-24. Handrails

1.15. Equipment Data.

Length Overall (LOA) ..... 59' 8" (18.18 Meters)
Length Water Line (LWL) ..... 57' 6" (17.52 Meters)
Beam ..... 22' 0" (6.70 Meters)
Depth ..... 8' 0" (2.43 Meters)
Des. Draft ..... 6' 0" (1.82 Meters)
Brake Horsepower (BHP) ..... 2 @ 640
Fuel Capacity ..... 3,044 gallons (11,514.87 Liters)
Maximum Speed ..... 8.0 knots
Bollard Ahead (AHD) ..... 30,000 Pounds (13,605.00 Kilograms)
Bollard Astern ..... 15,000 Pounds (6,802.50 Kilograms)
Side Thrust ..... 4,000 Pounds (1,814.00 Kilograms)
Displacement Full ..... 126LT (128.01 Metric Tons)
Lightship ..... 110LT (11.76 Metric Tons)
Lube Oil Tank Capacity ..... 266 gallons (1,006.88 Liters)
Dirty Oil Tank Capacity ..... 350 gallons (1,324.85 Liters)
Oily Water Tank ..... 365 gallons (1,381.63 Liters)
Potable Water Tank Capacity ..... 2 @ 392 gallons (2 @ 1,483.83 Liters)
Grey Water Tank Capacity ..... 759 gallons (2,873.04 Liters)
Fuel Oil Day Tank Capacity ..... 546 gallons (2,066.77 Liters)
Fuel Oil Storage Tank Capacity ..... 2 @ 1,248 gallons (2 @ 4,724.05 Liters)
Range ..... 120 hours/720.93 nautical miles (1,335.88 Meters) (at 6 knots)
40.4 hours/384 nautical miles (711.55 Meters) (at 9.5 knots)
Personnel Capacity 5
Endurance ..... 25 years, minimum
Propulsion System Components:
Engine [Type and Size] ..... Cummins KTAI9-M3
Reduction Gear ..... MG 5202 Deep Case
Shaft ..... Aquamat 17
Propeller ..... 58.5/59 four blade Caplan Style
Port ..... Clockwise Rotation
Starboard ..... Counterclockwise Rotation
Kort Nozzles ..... Type 37, 59 inch Diameter
Stuffing Box and Bearings ..... Johnson 5 inch, M88IR; Johnson Code Earths

SECTION III

PRINCIPLES OF OPERATION

1.16. Overview of Systems. The following paragraphs provide technical principles of operation of the ST systems. Actual operational procedures (step-by-step) are provided in Chapter 2, Section III of this manual.

1.16.1. Propulsion Plant. The ST's propulsion system consists of two main propulsion plants. Figure 1-25 provides a plan view of the propulsion plant. Each plant consists of a main engine (1) coupled to a two-speed reversing reduction gear (2). The output shaft of the reduction gear is coupled to the propulsion shafts. The machinery plant monitoring system accomplishes monitoring of the propulsion plant. Operational control is provided by an electronic control system.

a. Main Propulsion Engines. The ST is equipped with two Cummins KTA19-M3 Model four-stroke, turbo-charged, after-cooled, inline six cylinder diesel engines providing 640 horsepower at 1800 RPM.

(1) Governor. The operator sets the desired engine speed using throttle control at the station in command. The governor converts the impulse from the throttle controls to the proper setting of the engine injector rack linkage that controls fuel to the cylinders. The governor also contains a manual shutdown button mounted on top for shutdown locally or in an emergency.

(2) Fuel System. The fuel oil service system consists of day tank, fuel suction strainer, connecting lines, fuel injectors, fuel pump, engine mounted fuel filter, and fuel supply and return manifolds. Fuel from the day tank is drawn in by the fuel pump, through a suction strainer, to the engine mounted filters. Fuel passes through the filter elements to the supply manifold and through the injector inlet filter to the injector. A small amount of fuel is pumped into the cylinder, at very high pressure, through the needle valve and spray tip of the injector. Excess fuel flows through the fuel return manifold and back to the day tank.

(3) Air Intake System. The air is thoroughly cleaned by passing through the air intake filters; this protects the engine from abrasive material and the lubricating oil from contaminants. This filtered air is then provided to the engine air intake manifold, by the turbocharger.

(4) Engine Exhaust System. Figure 1-26 provides a plan view of the engine exhaust system. Exhaust gases from the engine cylinders are discharged from the cylinder heads into the exhaust manifold and turbocharger turbine. Going through the turbine, the gases pass through the turbocharger ducting, and upwards to silencers (1) located in the exhaust stack (2) on the rear of the 01 Deck and are finally released into the atmosphere. Engine exhaust silencers also have condensate drain lines (3) located in the stack.

(5) Lubricating Oil System. The lubricating oil system for the main propulsion engines is a wet-sump, forced-feed system. A lube oil pump within the engine draws oil from the oil pan. The oil flows to the engine oil filters and then to the individual lubrication points within the engine.

(6) Cooling System. Figure 1-27 provides a plan view of the engine cooling system. The engines (2) are coupled to fresh water grid coolers (1). The grid coolers are recessed into the vessel's hull. Fresh water (closed system) from the engines is pumped through the grid exchanger by the engine fresh water pump, is cooled by the surrounding seawater, and is re-circulated through the engine.

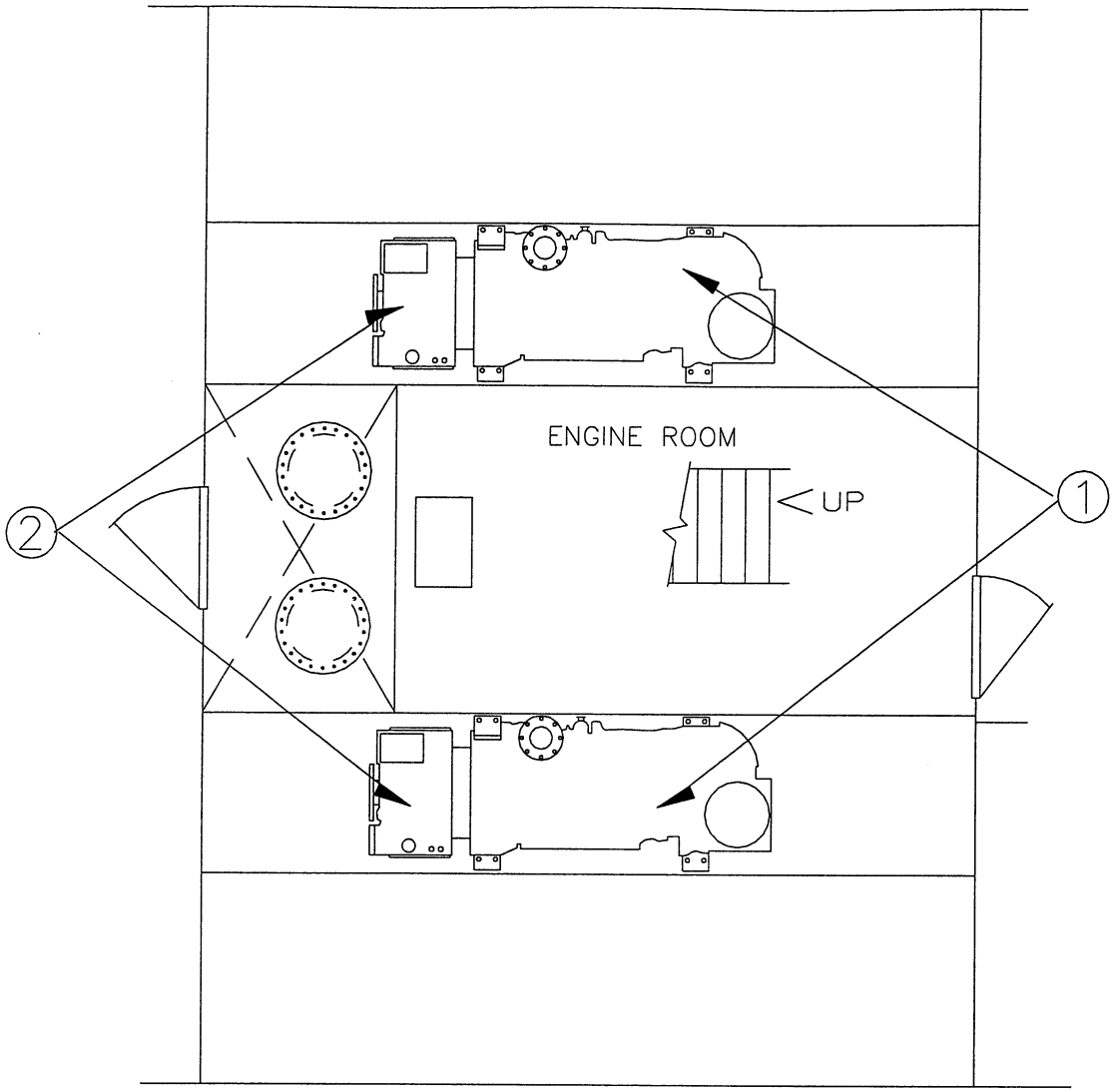


Figure 1-25. Propulsion Plant

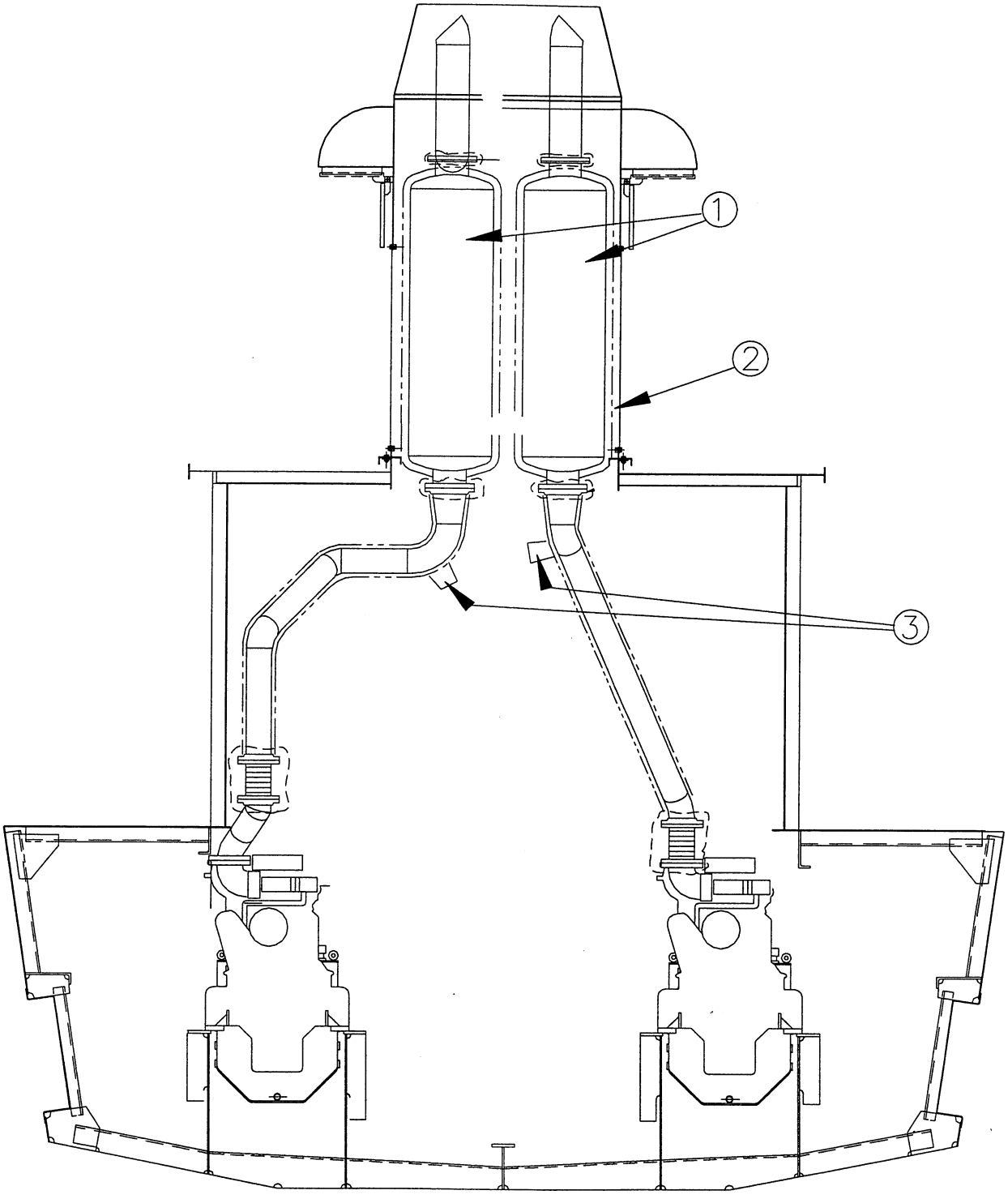
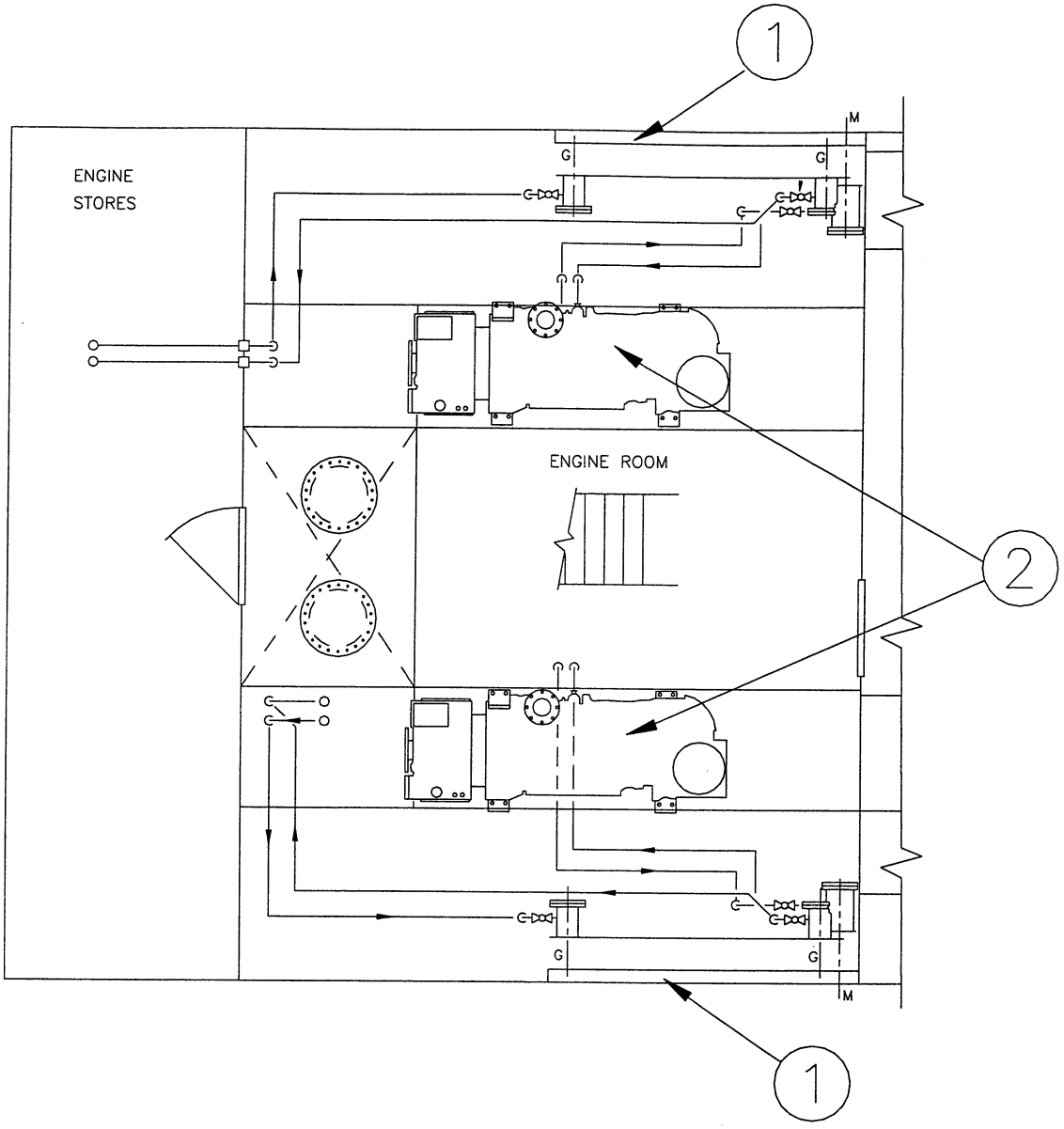
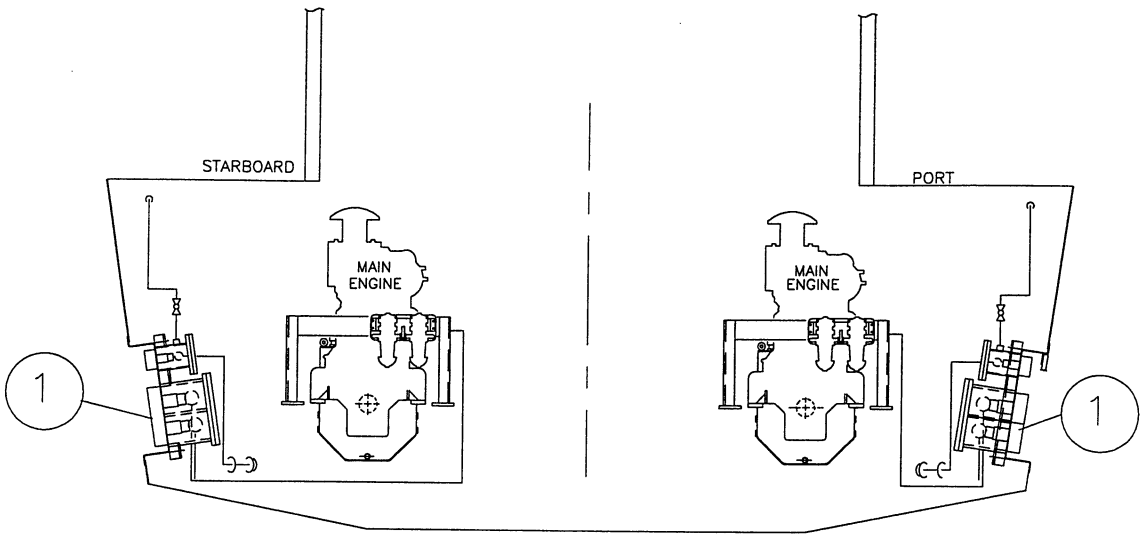


Figure 1- 26. Main Engine Exhaust System



HOLD DECK LEVEL

Figure 1- 27. Main Engine Cooling System, Sheet 1 of 2.



PROFILE

Figure 1-27. Main Engine Cooling System, Sheet 2 of 2.

(7) Engine Control System. Figure 1-28 provides detailed views of the engine control system. These views include system overview, control head views, and views of control stations. The control system provides for clutch and throttle control of the ST's main propulsion engines and reduction gears. The system includes main control and back-up control. This system does not include provisions for starting and stopping the engines. This is accomplished locally at the engine, as described in paragraph (8) below.

(a) Main Control System. A Mathers Controls ClearCommand Model MS547-11760 Control Processor System (7) is utilized for controlling various engine operations. The control system consists of a control head installed in the Pilot House Control Console (1), a control head installed in the engine room control station (2), and a control head installed at the aft control station (3) on the 01 Deck. A single lever at the Station-in-Command control head (i.e., the station in command at present time) facilitates selecting clutch direction and engine RPM. The system allows for transferring command from any of the three control stations. Only one station can be in command at a time. However, the aft control station is live at all times allowing for immediate intervention in the event of an emergency. Key features of the main control system include: sequencing of clutch selection and engine speed; proportional pause on through neutral shifts; neutral fast idle; station-in-command indication; system fault indication; failure alarm contact; clutch oil pressure interlock; neutral start interlock; and high/low idle.

(b) Back-up Control. There is also a backup control system (4), Model MS12521 consisting of two single lever control heads (5) with separate clutch selector switches (6) at the secondary Pilot House station for emergency backup control. This system operates in conjunction with the main control processor to provide independent back-up control in case of a failure condition. The operator may take command of this station by engaging the activation switch on the back up control head.

(8) Propulsion Engine Panels. Propulsion engine panels consist of two engine control panels (one for each engine) and two engine gauge panels (one for each engine). Each of these is discussed in the paragraphs that follow.

(a) Engine Control Panels. Each engine, port and starboard is provided with an engine control panel mounted forward of the engine. Figure 1-29 depicts the engine control panel. The engine control panels include the following:

1 Lube Oil Temperature (Item 1)

2 Tachometer (Item 2)

3 Jacket Water Temperature (Item 3)

4 Lube Oil Pressure (Item 4)

5 Crankcase Pressure Alarm (Item 5)

6 Crankcase Pressure Shutdown (Item 6)

7 Reduction Gear Drive Oil Pressure (Item 7)

8 Maintained Stop Button (Item 8)

9 Start Button (Item 9)

10 Alarm Reset Button (Item 10)

11 Shutdown/Shutdown Override Switch (Item 11)

12 Power "OFF" – "ON" Toggle Switch (Item 12)

13 Timer Gauge (Includes "Start Run Timer", "Not Locked Out By Timer", and "Locked Out By Timer) (Item 13)

14 Low Lube Oil Pressure Alarm (Item 14)

15 High Engine Crankcase Pressure Alarm (Item 15)

16 Spare Alarm (Item 16)

17 Engine Overspeed Alarm (Item 17)

18 Jacket Water Temperature Alarm (Item 18)

19 Low Coolant Level Alarm (Item 19)

20 Low Lube Oil Pressure Shutdown (Item 20)

21 High Engine Crankcase Pressure Shutdown (Item 21)

22 Spare Shutdown (Item 22)

23 Engine Overspeed Shutdown (Item 23)

24 Jacket Water Temperature Shutdown (Item 24)

25 Lube Oil Temperature Shutdown (Item 25)

(b) Engine Gauge Panels. An engine gauge panel is provided for each propulsion engine. The panels are located on the PilotHouse console and are located one on the port side and one on the starboard side, corresponding to the appropriate engine. Figure 1-30 depicts the engine gauge panels. The engine gauge panels include the following:

1 Gear Oil Pressure Gauge (Item 1)

2 Tachometer (Item 2)

3 Oil Pressure Gauge (Item 3)

4 Water Temperature Gauge (Item 4)

5 Panel Power ON/OFF Toggle Switch (Item 5)

6 Low Coolant Level Indicator Light (Item 6)

7 Panel Dimmer Switch (Item 7)

8 Lube Oil Temperature Gauge (Item 8)

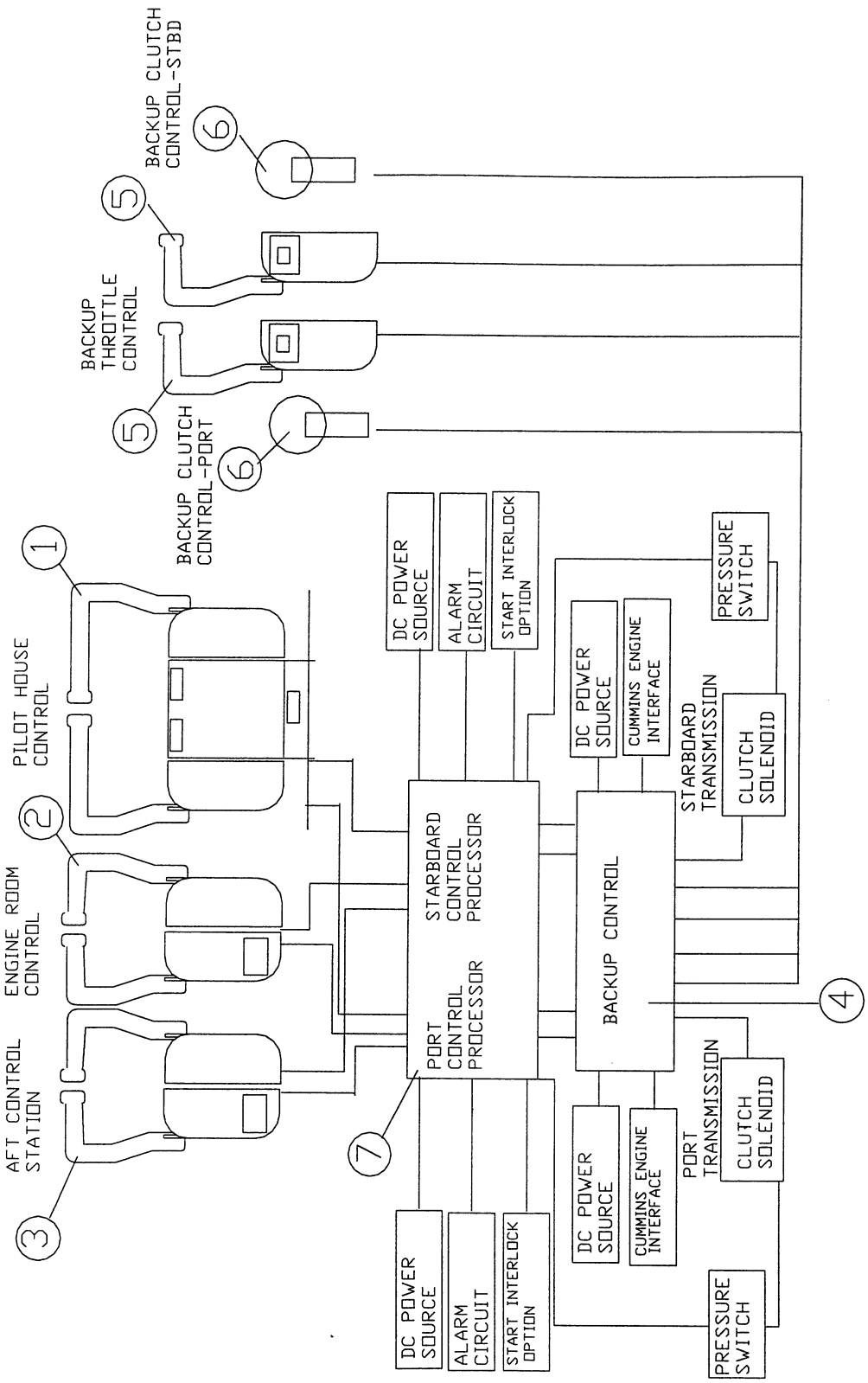


Figure 1-28. Engine Control System Overview, Sheet 1 of 4.

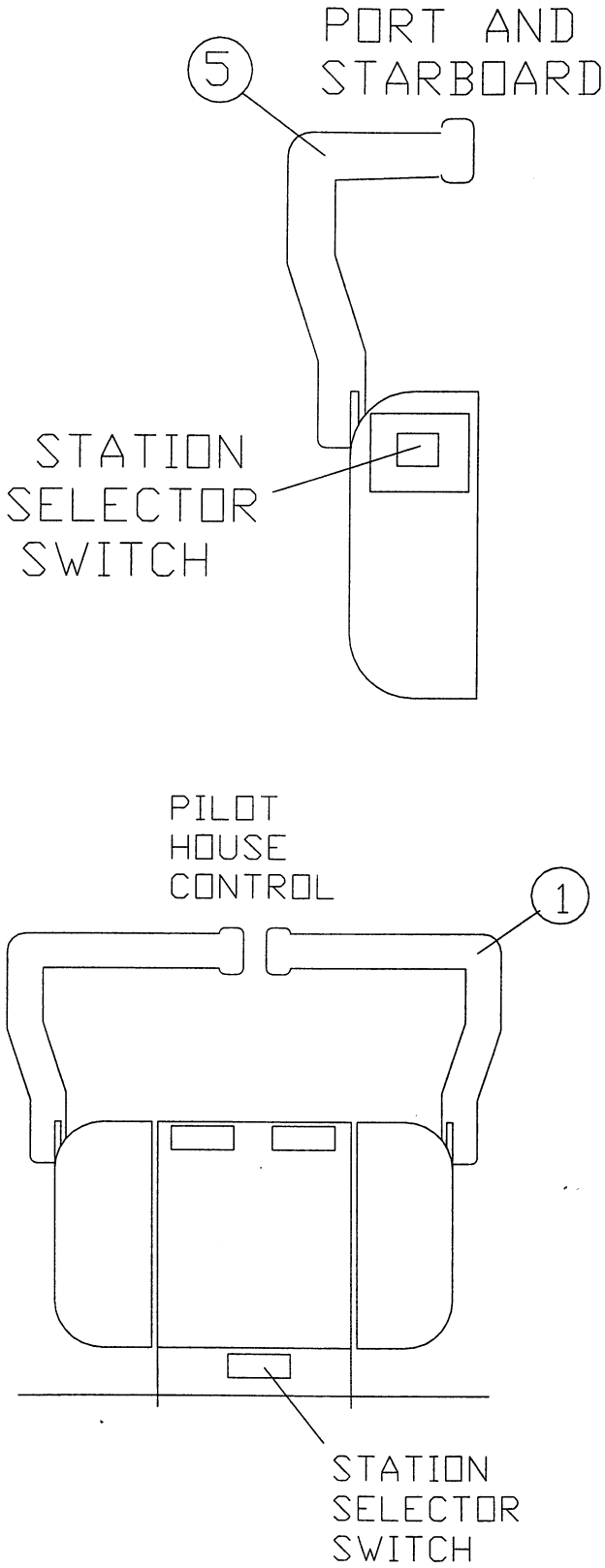


Figure 1-28. Engine Control System (Control Heads), Sheet 2 of 4.

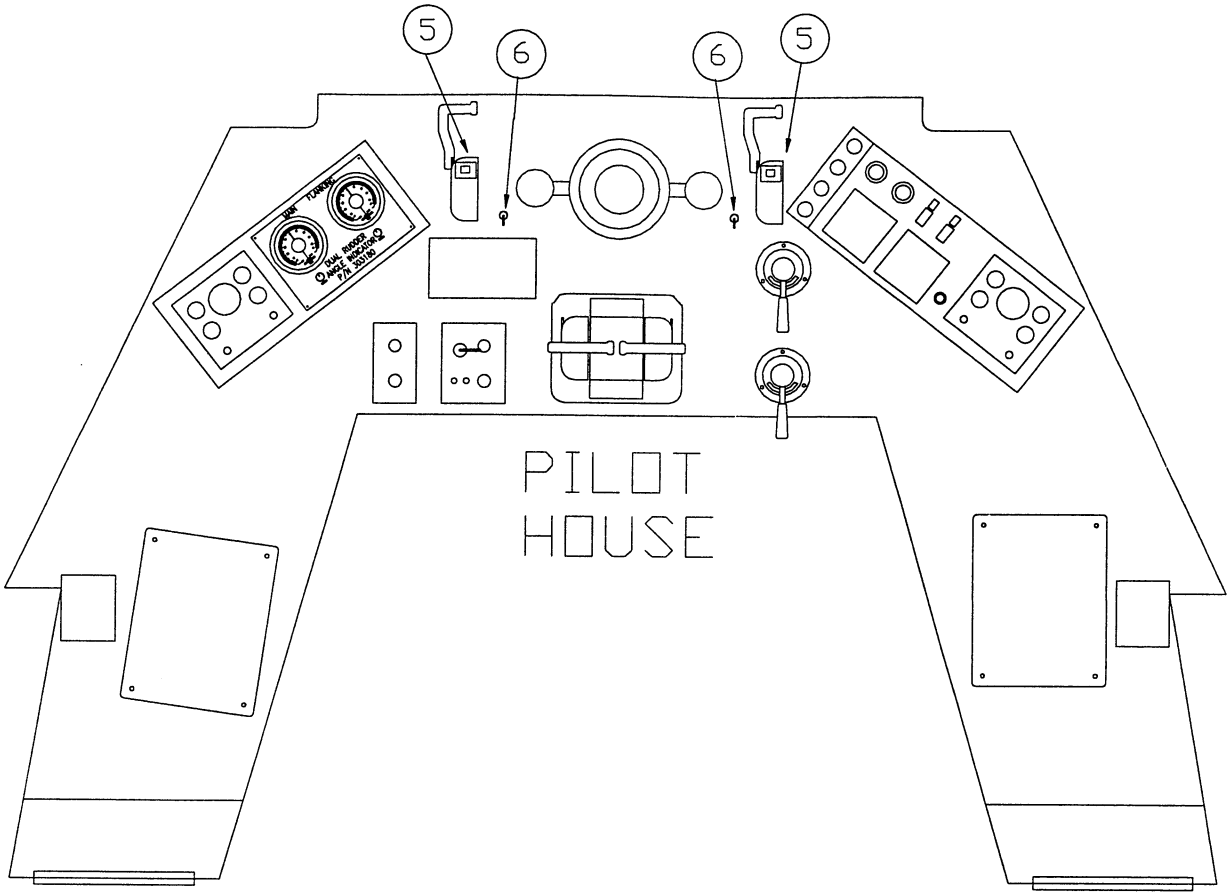
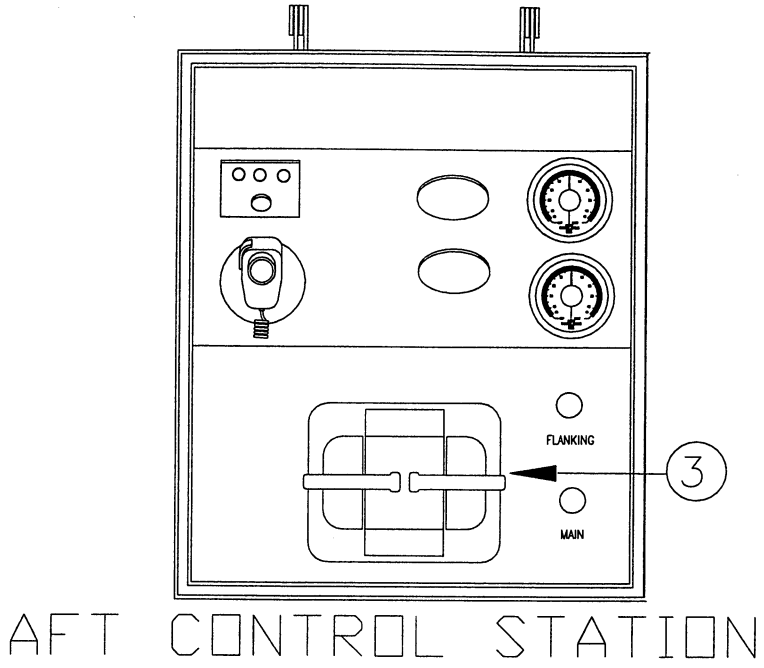


Figure 1-28. Engine Control System (Pilot House Console Control Station), Sheet 3 of 4.



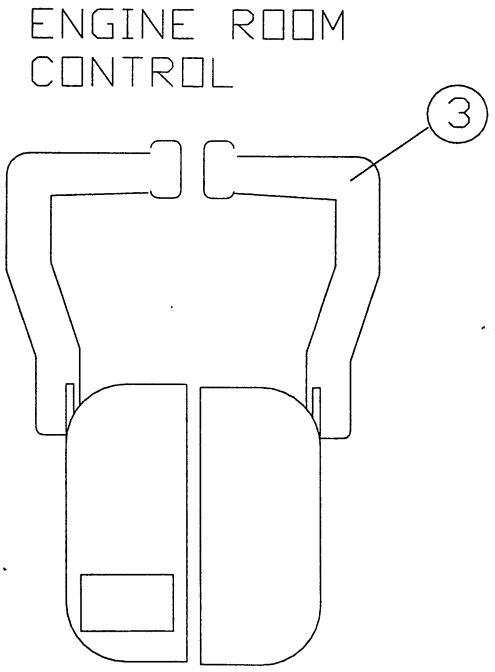


Figure 1-28. Engine Control System, Sheet 4 of 4.

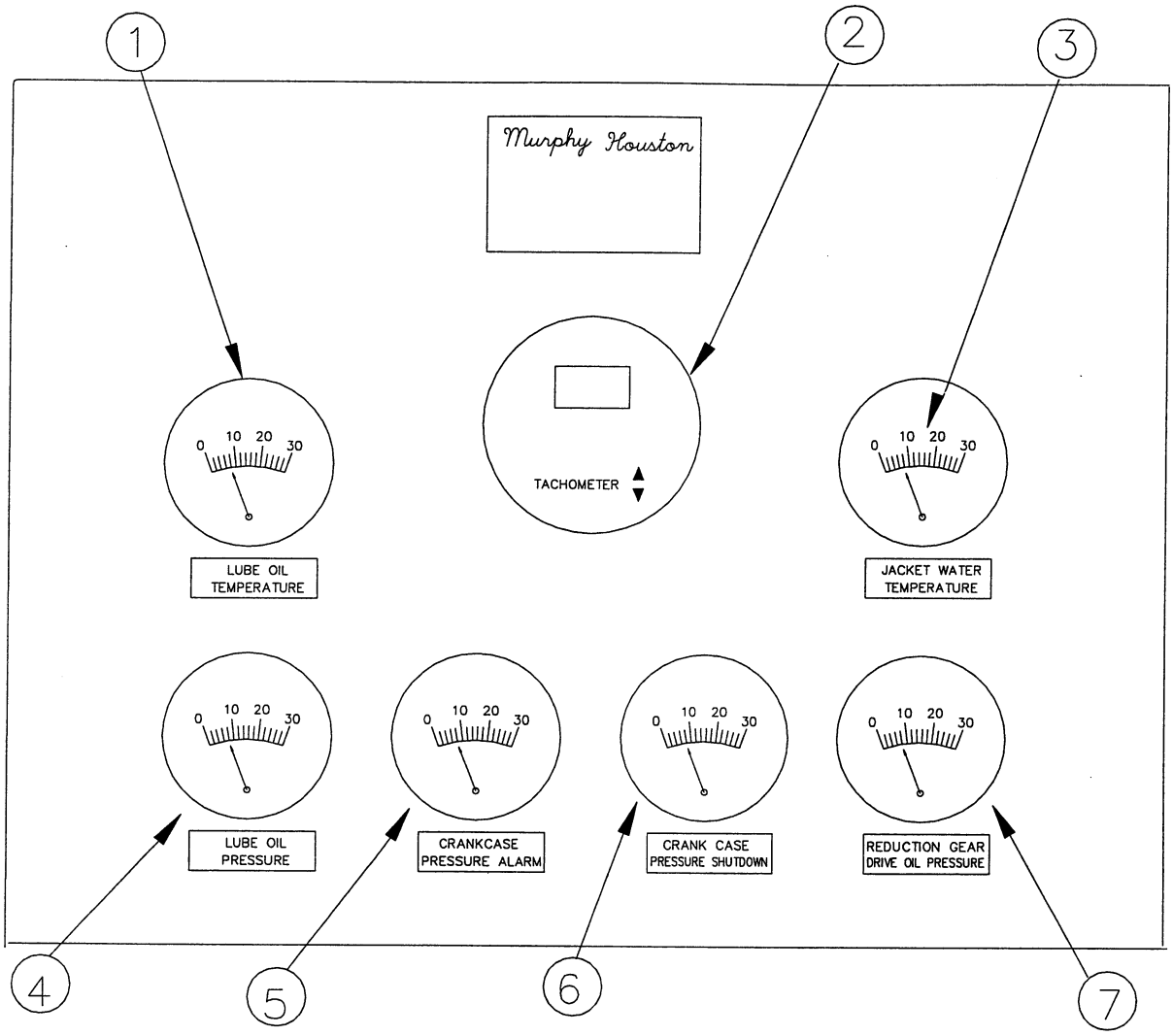


Figure 1- 29. Main Engine Control Panel, Sheet 1 of 2.

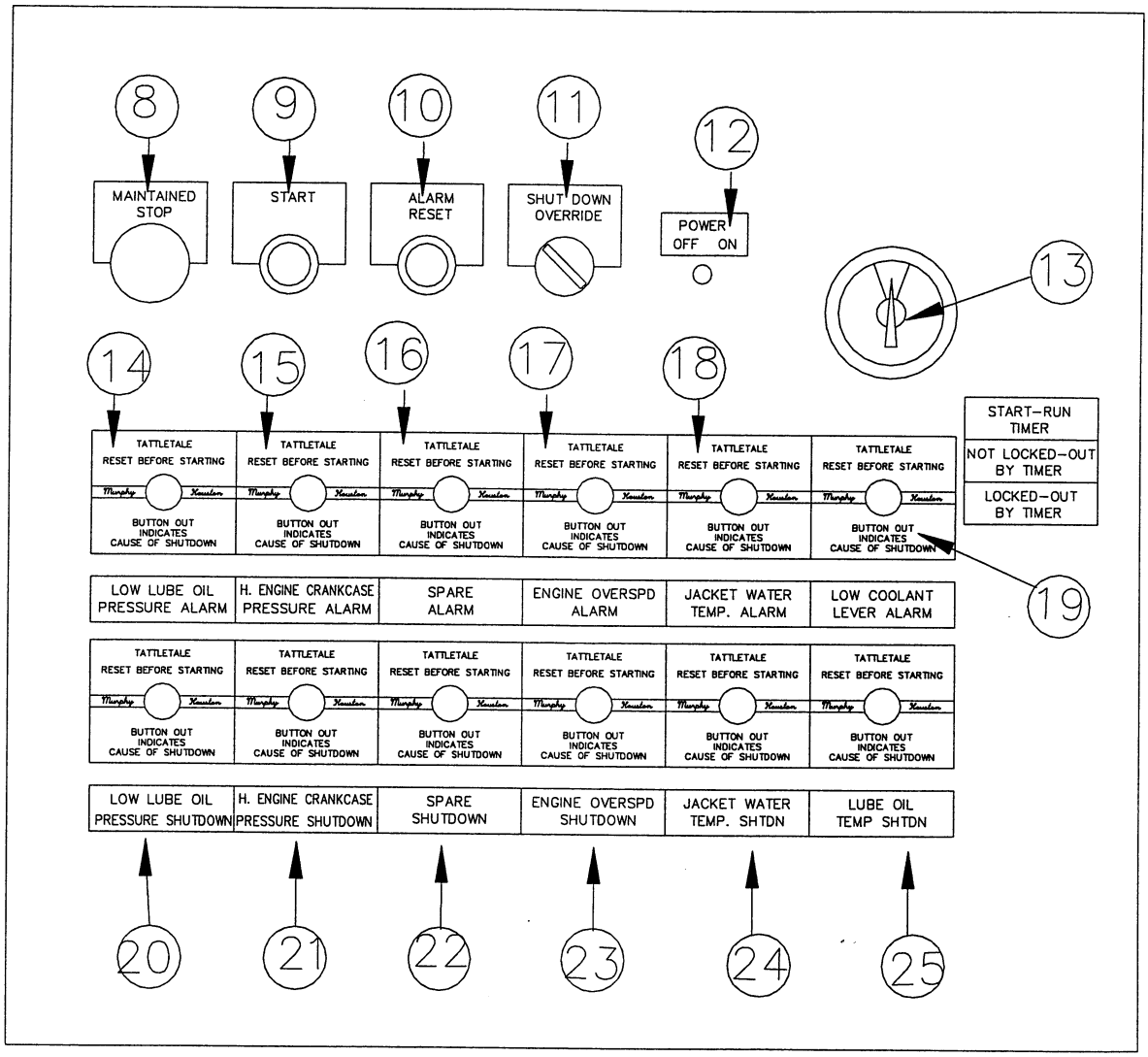


Figure 1-29. Main Engine Control Panel, Sheet 2 of 2.

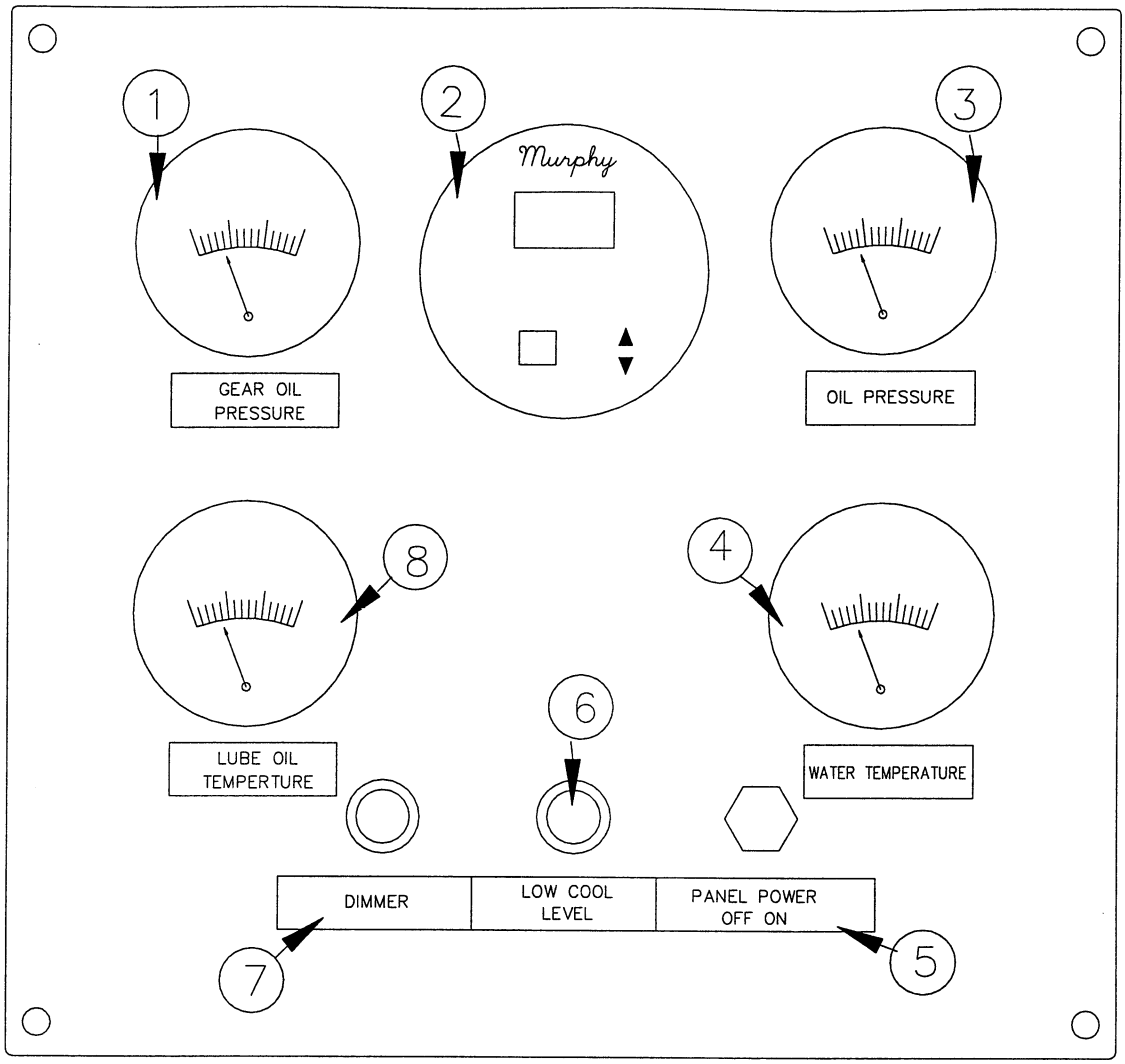


Figure 1-30. Main Engine Gauge Panel

b. Reverse Reduction Gears. Each propulsion system is equipped with a Twin Disc Model MG 5202DC reverse reduction gear (5.04:1ratio). The reduction gear for the port engine is left-hand rotating and the reduction gear for the starboard engine is right-hand rotating. Reduction gears are lubricated by low-pressure oil within a closed lubricating system. Key features of the unit are provided in the paragraphs below:

(1) Input power to the transmission is through a torsional coupling mounted on the engine flywheel. The coupling is splined to the forward end of the primary (forward clutch) shaft causing the primary shaft to rotate in engine direction. Power is transmitted to the secondary (reverse clutch) shaft through transfer gear teeth on the outside diameter of the primary clutch housing causing the secondary shaft to rotate in the reverse direction as the engine (anti-engine direction). The primary and secondary pinions on their respective shafts are in constant mesh with the output gear, which is connected to the output shaft through a keyless tapered joint.

(2) Application of the primary clutch locks the primary pinion to the primary shaft causing the pinion to turn in shaft direction and causing the output to rotate in anti-engine direction.

(3) Application of the secondary clutch locks the secondary pinion to the secondary shaft, causing the pinion to turn in shaft direction and causing the output shaft to rotate in engine direction.

(4) Primary and secondary clutch shafts and pinions are supported and located by a combination of straight and tapered roller bearings.

(5) An oil pump provides lubrication to the internal components of the reduction gear and is driven by the secondary clutch shaft. Lubrication is provided via a lubrication tube located inside the main housing. The tube extends from the front to the rear of the inside of the housing. The lubrication tube has drilled holes in the tube that spray oil on the transfer gears and the primary and secondary shafts are lubricated through drillings in the shafts. Output shaft bearings are gravity and splash lubricated. A suction strainer is located below the oil pump and an oil filter is located atop the reduction gear.

c. Propeller, Shafting and Nozzle. The ST's propellers are driven by the main diesel engines via shafting and reverse reduction gearing. The portside propeller turns in a counterclockwise (CCW) direction (forward direction). The starboard side propeller turns in a clockwise (CW) direction (forward direction). Propellers are housed in kort nozzles (3) (Type 37, 59-inch [1.4986 Meters] diameter) to increase bollard pull by controlling thrust direction. Other components of this system include stainless steel keys (1), propulsion shafts (2) (5 inch Aquamet), propellers (4) (4 blade 58-1/2" X 59 pitch), heavy hex nuts (5) (3-3/4", 4 threads per inch) and shaft couplings (6). See Figure 1-31.

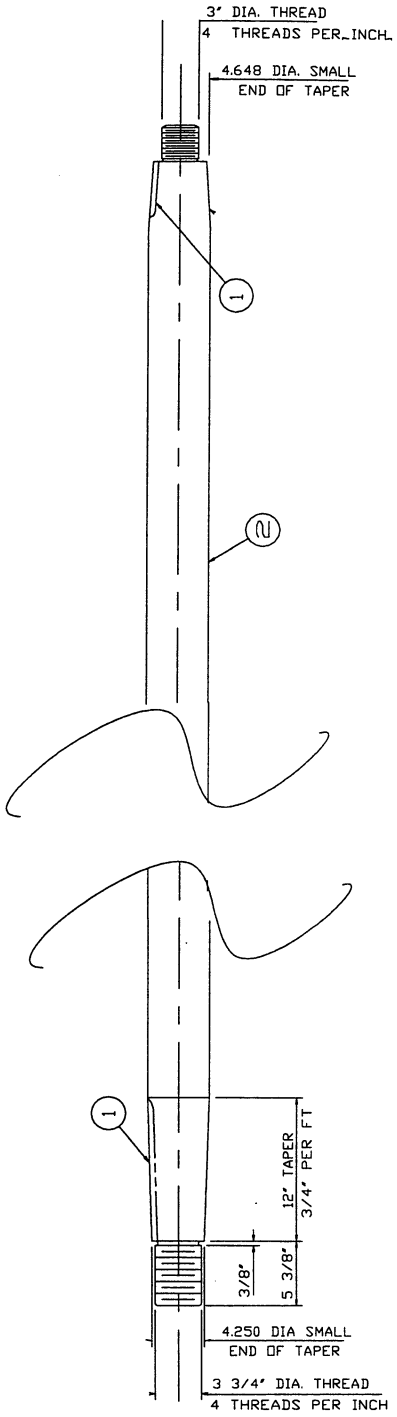
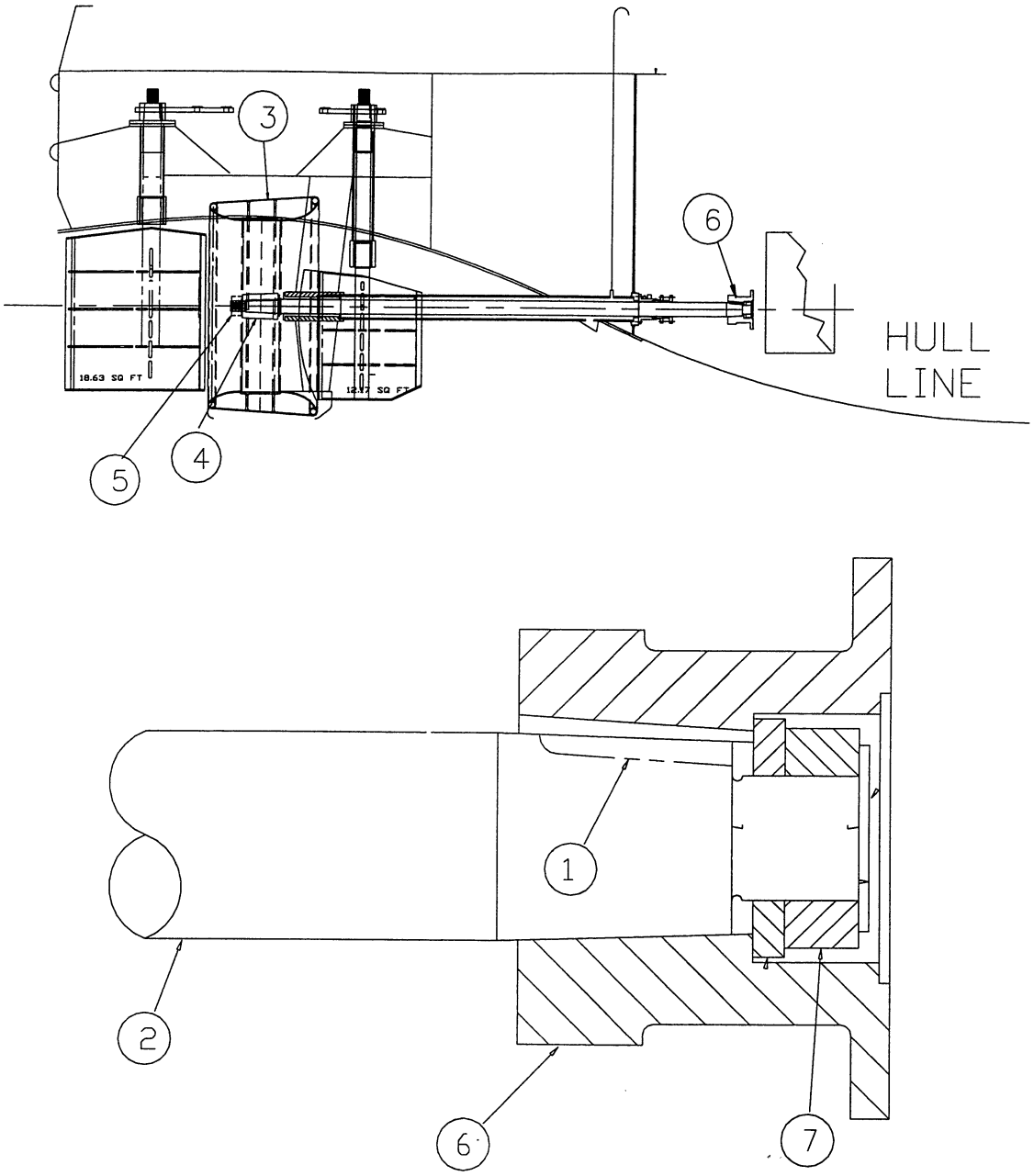
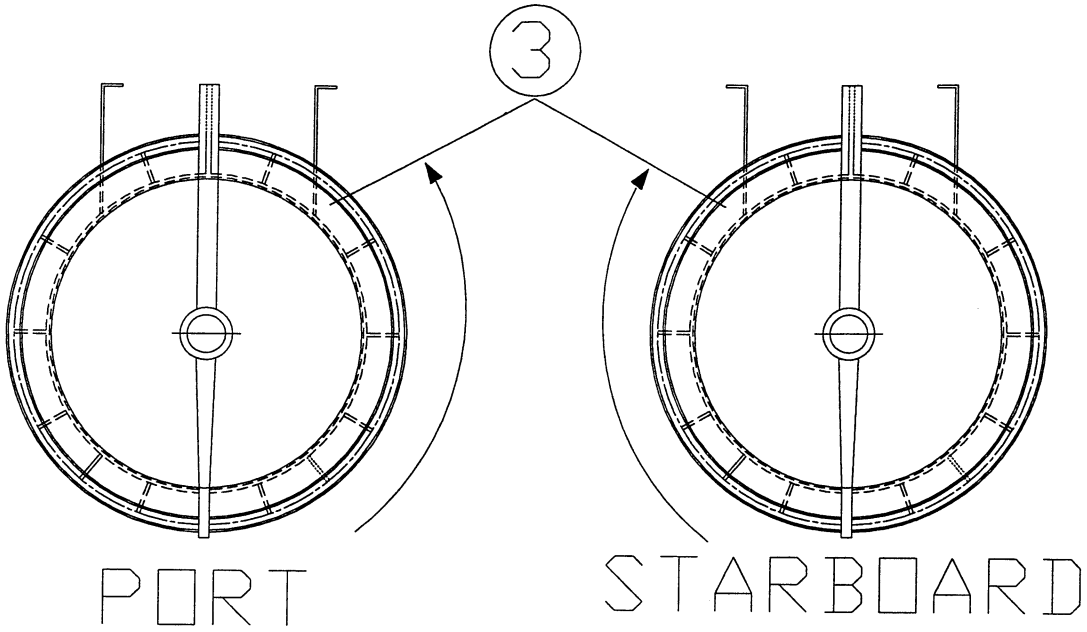


Figure 1-31. Propulsion Shafting Arrangement, Sheet 1 of 3.



Shaft Coupling

Figure 1-31. Propulsion Shafting Arrangement, Sheet 2 of 3.



Kort Nozzle Looking Forward

Figure 1-31. Propulsion Shafting Arrangement, Sheet 3 of 3.

1.16.2. Electrical Plant. The ST's electric plant consists of the Power Generation System, the Shore Power System, and the Power Distribution System. Figure 1-32 provides a diagram of the electrical plant.

a. Power Generation System. The following sub-paragraphs describe the various components and capabilities of the ST's power generation system:

(1) Generator Set. Two 55 kW brushless exciter generators provide 450 Volt AC, three-phase, 60 Hz primary vessel service power. Each generator is capable of providing 110 percent of the necessary at sea load. The generators may be operated in parallel. However, normal operation has one generator on line and the other in reserve.

Figure 1-33 provides a plan view of the Generator Room.

(a) Diesel Engine for Generator Set. Engine control and monitoring are provided at the individual engine control panel.

1 Engine Instrument and Control Panel (Refer to Figure 1-34). The engine mounted control panel contains the controls and indicators necessary for operation of the engine. An Engine Control Module (ECM) displays service hours (1), system battery voltage (3), engine oil pressure (5), and engine coolant temperature (4) in US units and their metric equivalents. The following fault indicators are also on the control panel: overspeed (6), sea water fault (7), high exhaust temperature (8), low oil level (9), low coolant level (10), high engine temperature (11), and low oil pressure (12). The control panel also contains a three-way toggle switch (2) used to start, run, and stop the generator engine.

2 Fuel System. The fuel oil service system consists of the day tank, connecting lines, fuel injectors, fuel pump, engine mounted fuel filter and fuel supply and return manifolds. Fuel from the day tank is drawn in by the fuel pump to the engine mounted filters. Fuel passes through the filter elements to the fuel manifold in the injector pump housing. The injector pump pushes fuel at very high pressure to the injector. A small amount of fuel is pumped in the cylinder, at very high pressure, through the needle valve and spray tip on the injector. The quantity of the fuel injected depends upon the position of the plunger that is controlled by the injector rack and governor. Excess fuel flows through the fuel return manifold and back to the day tank.

3 Air Intake System. Air entering the engine is thoroughly cleaned by passing through the air intake filter to protect the engine from abrasive materials and to protect the lubricating oil from contaminants. When the engine is running, each time a piston moves through the intake stroke, it pulls air into the cylinder. The airflow passes through the air filter, inlet manifold, passages in the cylinder head and past the open intake valve into the cylinder.

4 Electric Starting System. The 24VDC starter motor is used to turn the engine flywheel fast enough to start the engine. The starter motor has a solenoid and when the start switch is activated, the solenoid moves the starter pinion to engage it with the ring gear on the flywheel of the engine. The starter pinion engages with the ring gear before the electric contacts in the solenoid close the circuit between the battery and the starter motor. The pinion turns the engine flywheel and a clutch gives protection for the starter motor so that the engine cannot turn the starter motor too fast. When the start switch is released, the start pinion moves away from the ring gear.

5 Lubricating Oil System. The lubricating oil system for the generator diesels is a wet-sump, forced-feed system. A lube oil pump within the engine draws oil from the oil pan. The oil flows to the engine oil filters and then to the individual lubrication points within the engine.

6 Cooling System. Figure 1-35 provides a plan view of the generator engine cooling system. The generator engines (1) are coupled to the fresh water grid coolers (2). The grid coolers are recessed into the vessel's hull. Fresh water from the engines is pumped

through the grid exchanger by the engine fresh water pump. It is cooled by the surrounding seawater, and re-circulated through the engine.

7 Engine Exhaust System. Figure 1-36 provides a plan view of the generator engine exhaust system. Exhaust gases from the diesel generator engines are piped upwards to silencers (1) located in the exhaust stack on the rear of the 01 Deck and finally released into the atmosphere. The engine exhaust silencers also have condensate drain lines (2) located in the stack.

b. Shore Power System. Figure 1-37 provides a plan view of the shore power system. In port, the ST is capable of receiving shore power (450 VAC) through a shore power cable terminating at connection shore power box located on the Main Deck on the aft bulkhead. If available shore power is 450 Volts AC, the power is selected at the main switchboard through a circuit breaker and stepped down to 240 VAC by three shore power transformers, prior to main switch board entry. Shore power of 240 VAC is selected at the main switchboard by circuit breaker, and bypasses the 450 VAC transformers. A mechanical interlock is available on the main switchboard to prevent paralleling between the shore power and the generator. The two connection shore power box provides a cable connection (1) for shore power and another cable connection (2) for providing shore power to another vessel in tandem.

c. DC System. Figure 1-38 provides plan views of the DC System. A 12/24-volt DC system is provided for powering the electronic control system and miscellaneous DC services as well as for starting the generators and diesel engines. This system consists of two separate subsystems, one operating from the generator set battery banks and the other operating from the diesel engine battery banks.

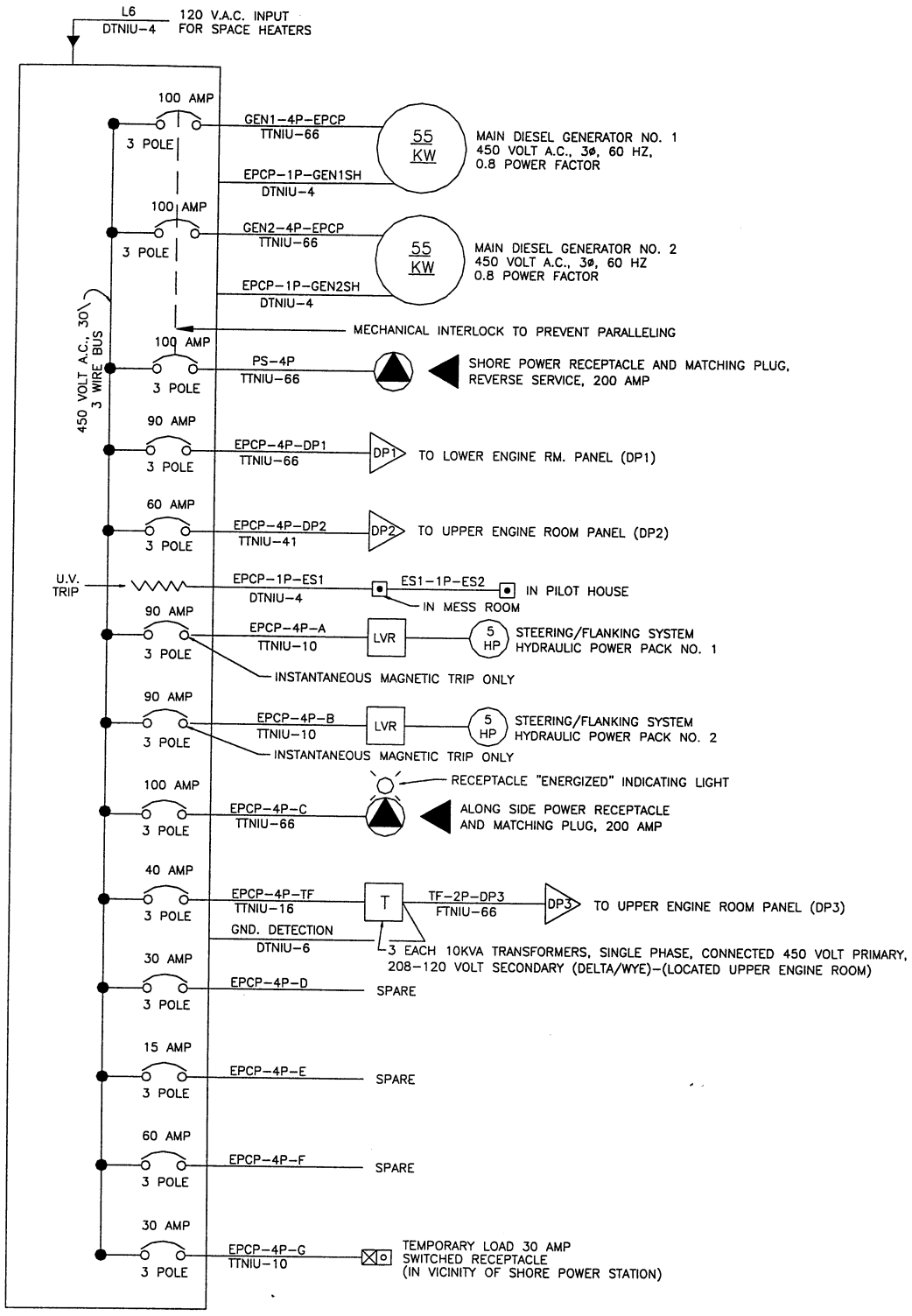


Figure 1-32. Electric Plant, Sheet 1 of 2

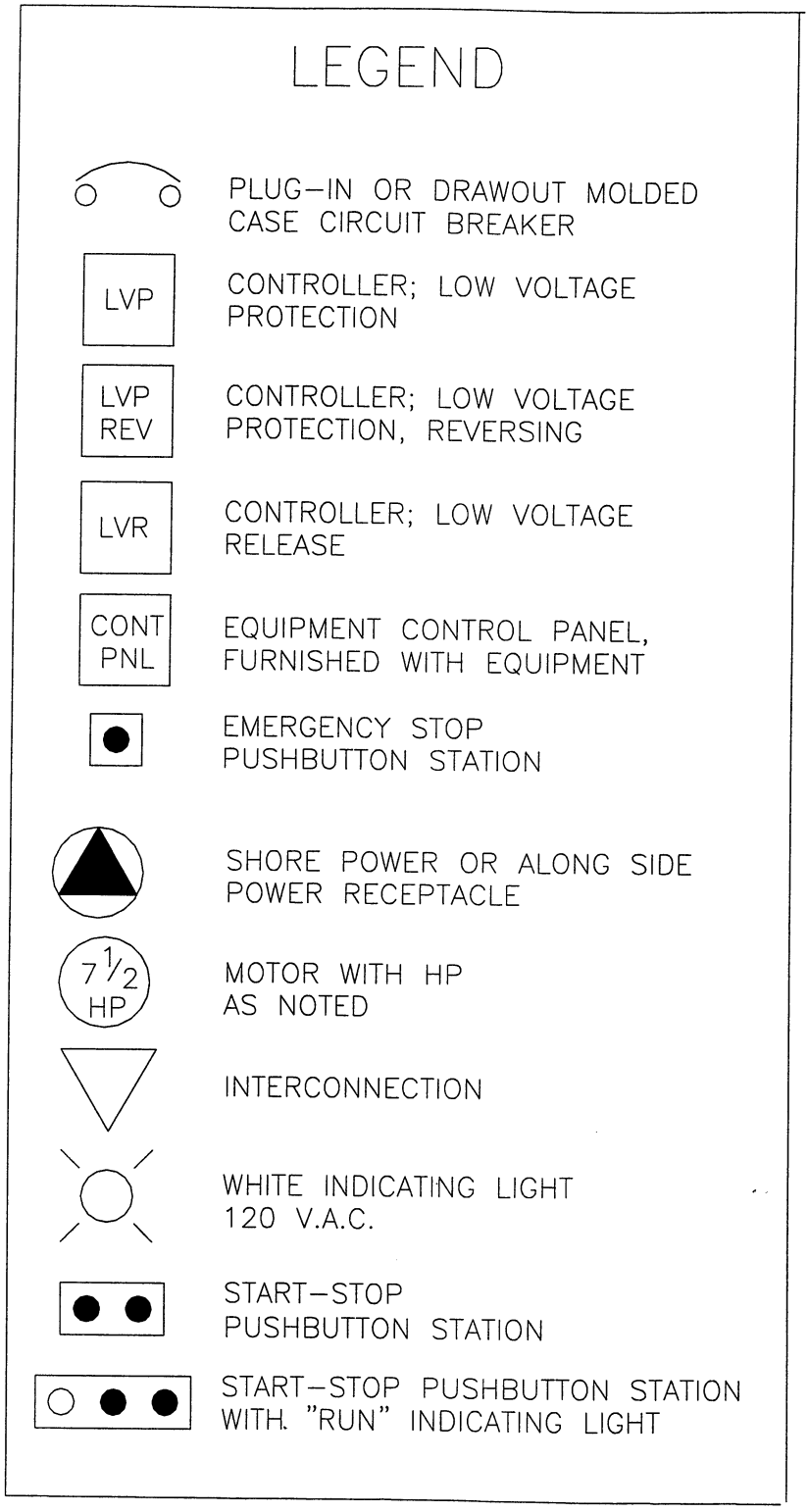


Figure 1-32. Electric Plant, Sheet 2 of 2

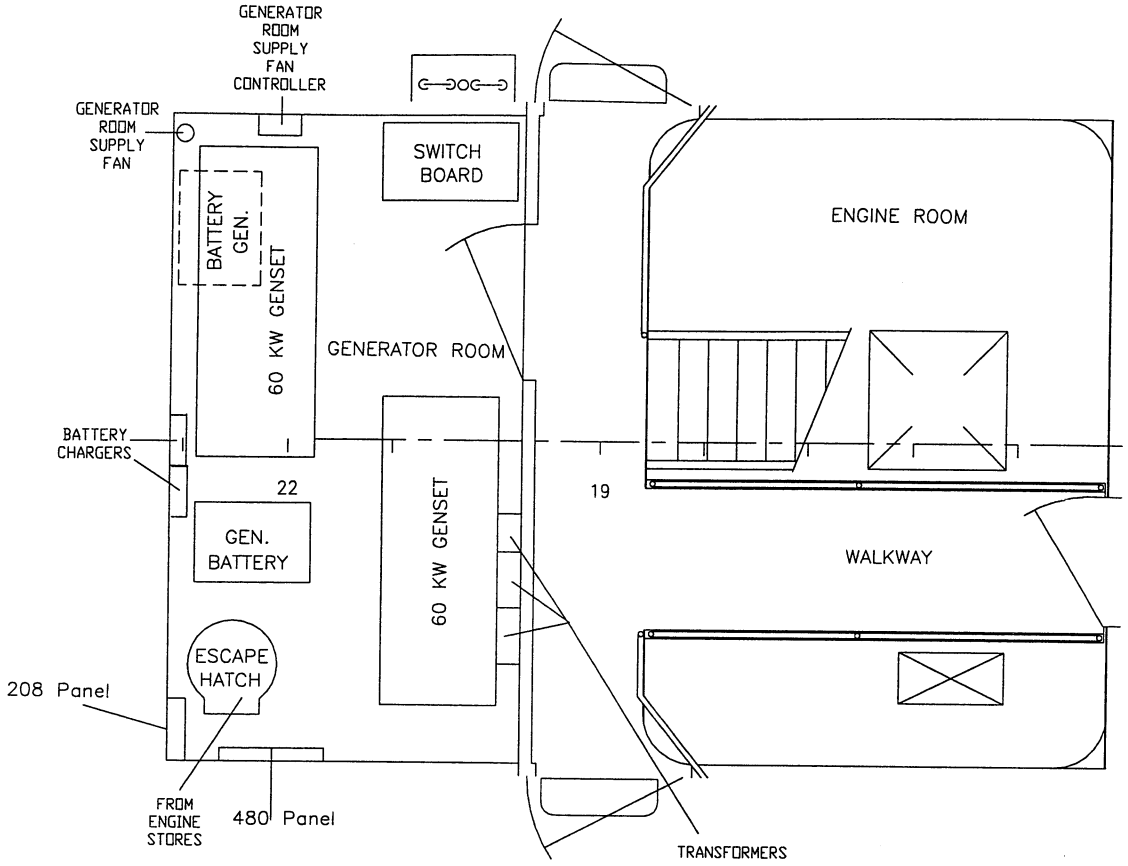


Figure 1-33. Generator Room

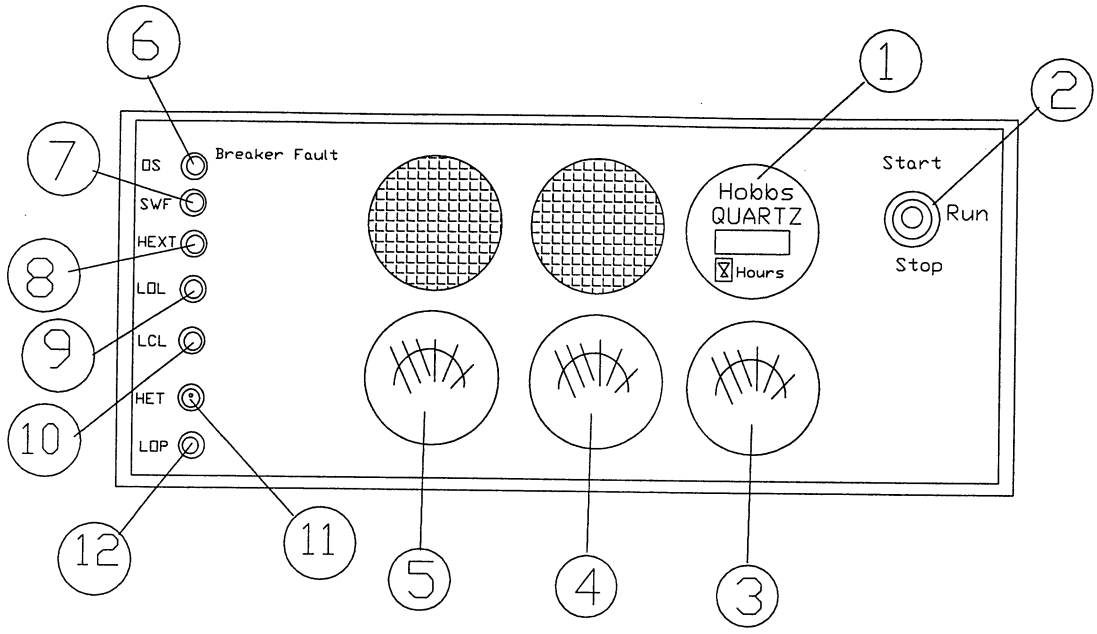


Figure 1-34. Generator Engine Instrument and Control Panel

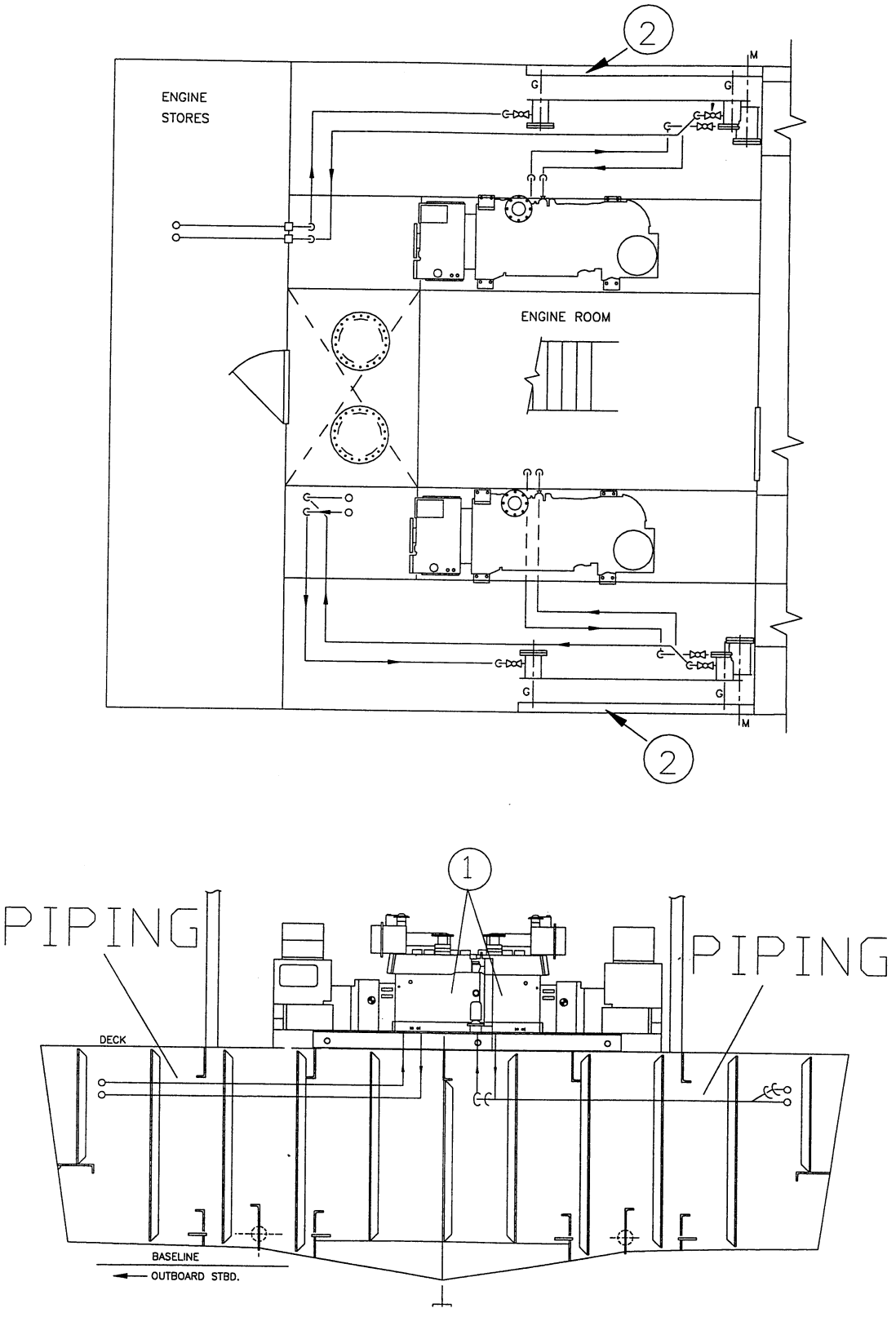


Figure 1-35. Generator Engine Cooling System

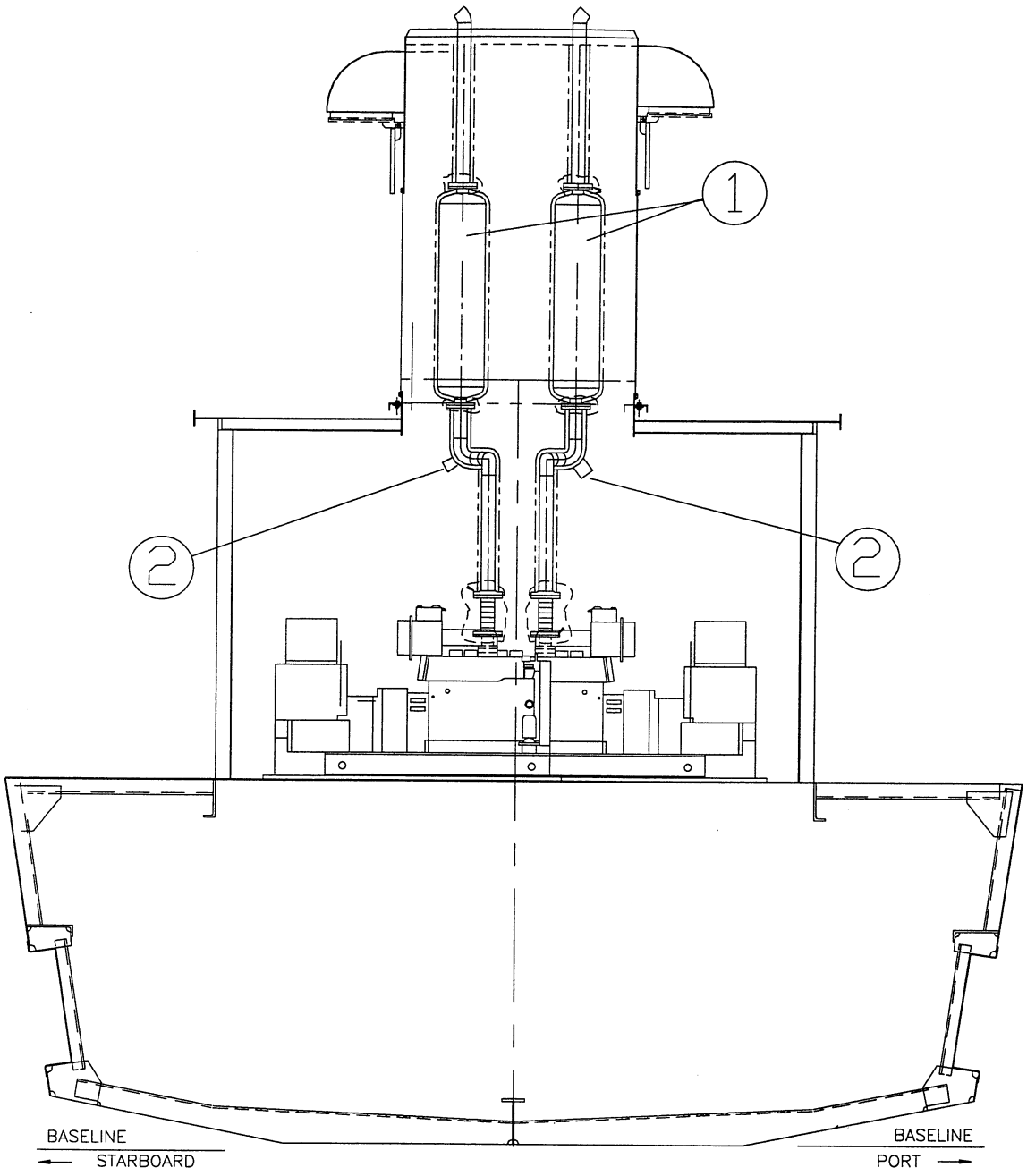


Figure 1-36. Generator Engine Exhaust System

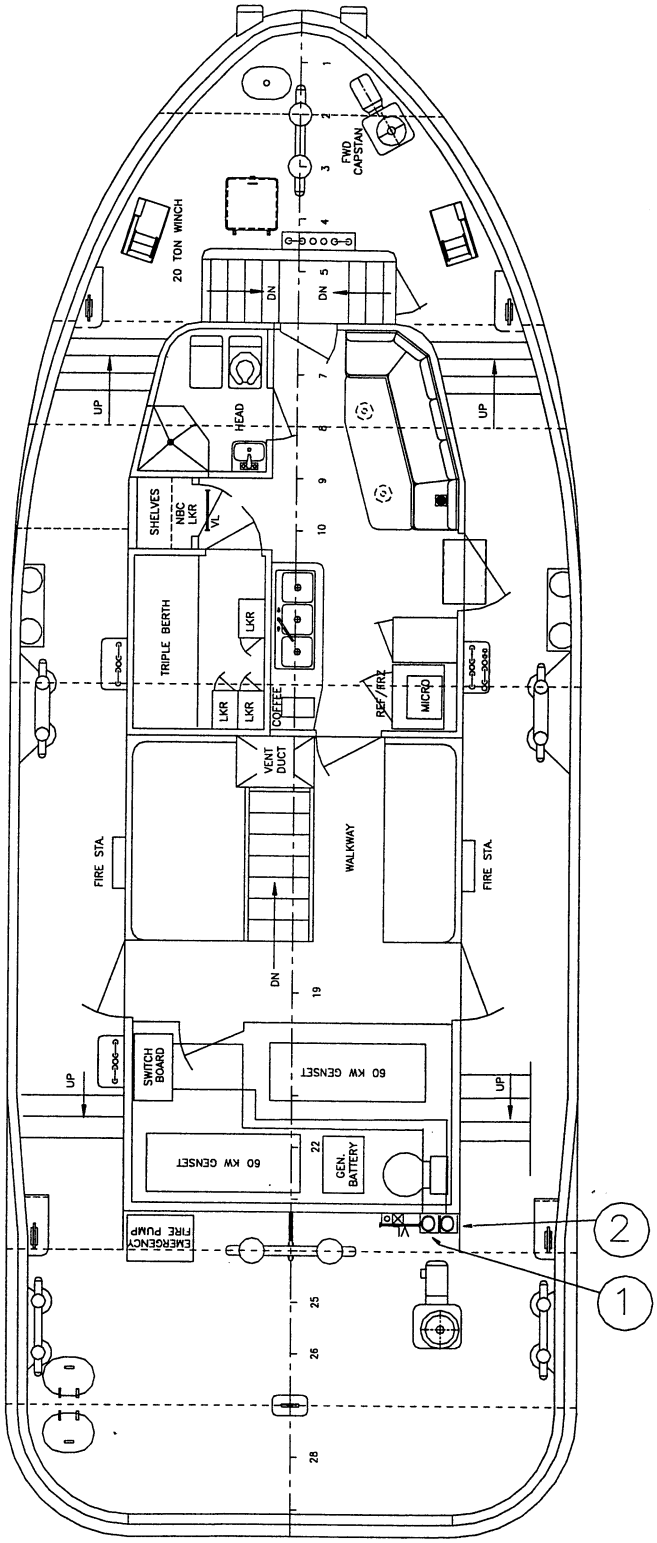
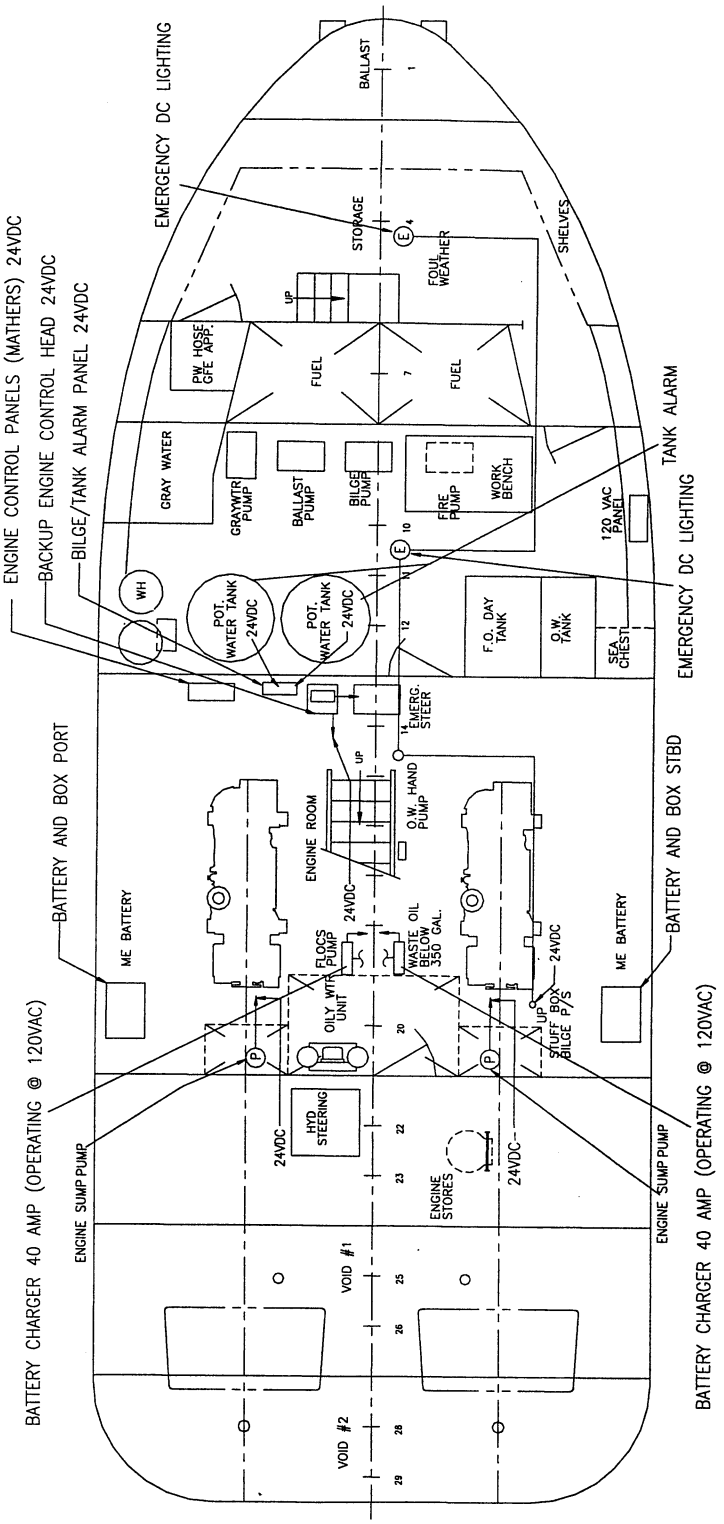
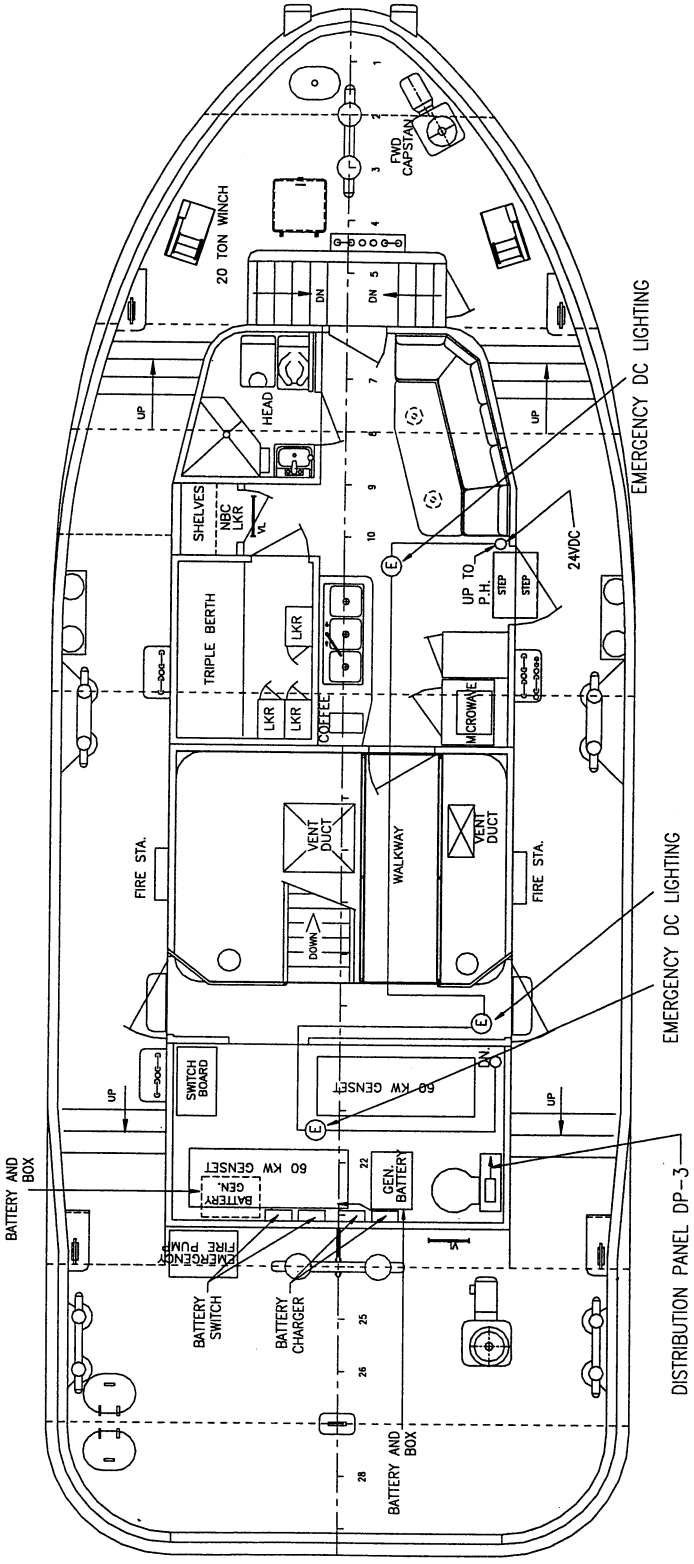


Figure 1-37. Shore Power System



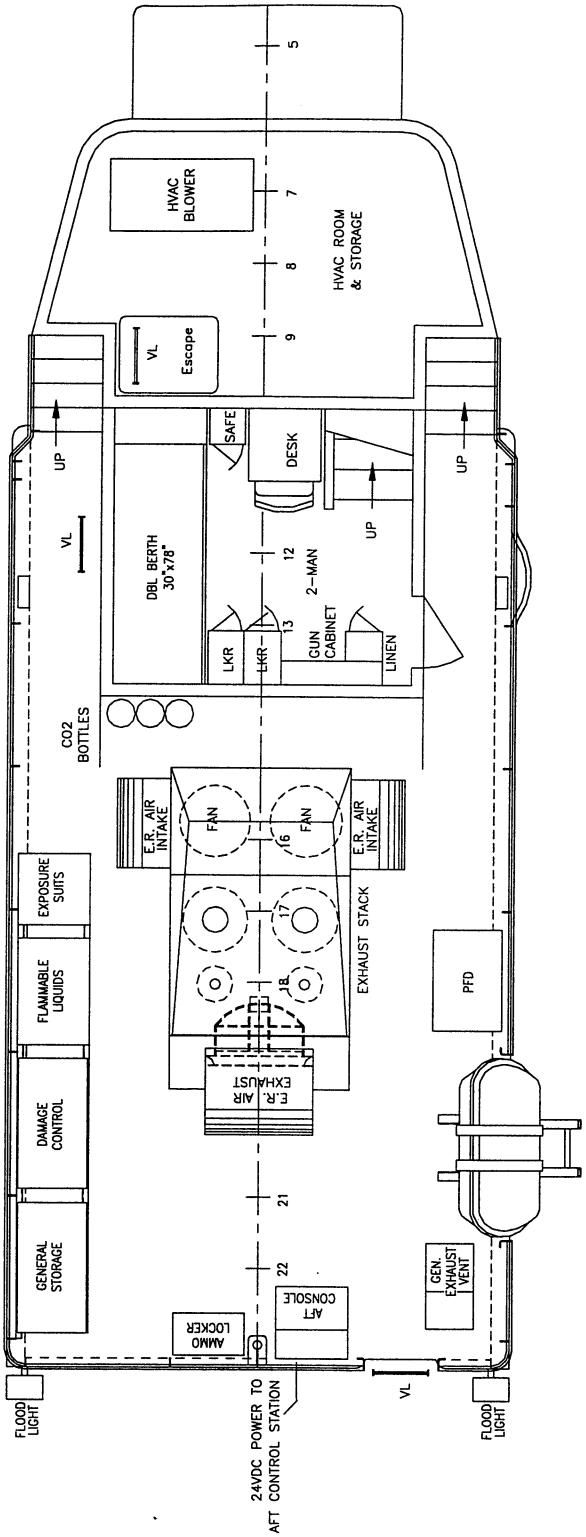
Hold Deck

Figure 1-38. DC System, Sheet 1 of 4.



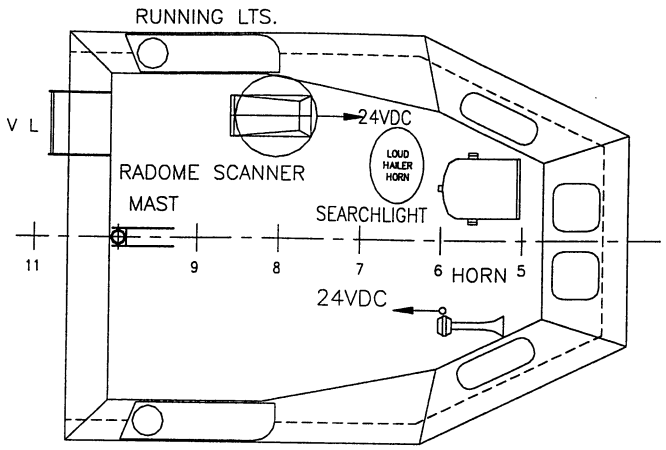
Main Deck

Figure 1-38. DC System, Sheet 2 of 4.

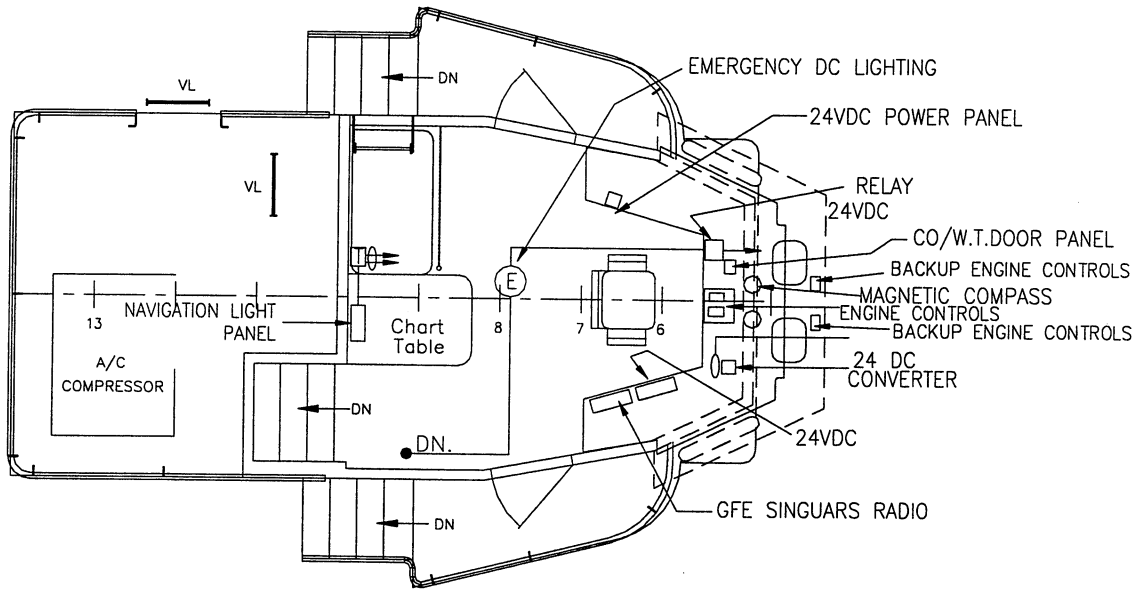


01 Deck

Figure 1-38. DC System, Sheet 3 of 4.



PILOT HOUSE OVERHEAD



PILOT HOUSE DECK

Pilot House Overhead and Pilot House Deck

Figure 1-38. DC System, Sheet 4 of 4.

(1) Generator Battery Banks. The generator alternator and self-regulating battery chargers provide for charging each of the generator battery banks. Two selector switches allow for selecting power from either the port generator or starboard generator battery. This system consists of two separate battery banks, each of which consists of two 12-volt batteries (Series 4000, Size 8D, lead acid type) connected in series.

The DC system is powered by the generator battery banks and provides power to the following components through the DC distribution panel located port side in the Pilot House:

(a) Starboard Sump Pump

(b) Port Sump Pump

(c) Emergency DC Lights

(d) Navigational Light Panel

(e) Magtronic Compass

(f) Singuars Radio (GFE)

(g) Radar

(h) VHF #1

(i) VHF #2

(j) Carbon Monoxide Panel

(k) Compass

(l) Horn

(m) Bilge and Tank Alarm Panel

(n) Mathers Starboard

(o) Mathers Port

(2) Diesel Engine Battery Banks. Diesel engine starting is accomplished via a 24VDC system. This system consists of two separate battery banks, each of which consists of two 12-volt batteries (Series 4000, Size 8D, lead acid type) connected in series. Two self-regulating battery chargers are provided for charging the diesel engine battery banks.

d. Power Distribution System. The power distribution system consists of the generator control and distribution switchboard, transformers, power distribution panels (six), motor controllers (for hydraulic steering/flanking system), and related wiring. Primary power (450 VAC, 3-phase, 3-wire, 60 Hz) is received from the power generation system (or the shore power receptacle) and routed via the generator control and distribution switchboard to distribution panels and selected equipment. Secondary power (208V/120V, 3-phase, 4-wire, 60 Hz) is supplied by the main system or shore power through a step-down service transformer.

(1) Generator Control and Distribution Switchboard. The generator control and distribution switchboard, located port outboard in the generator room, provides generator selection, shore power selection, and power distribution for vessel service 450 Volt AC primary and 208-120 VAC (Secondary) power. Distribution of 120 VAC is accomplished through three-vessel service 120 Volt AC transformers located in the generator room. Power selection is provided by closing circuit breakers on the switchboard. Power monitoring is provided by ammeters, voltmeters, frequency meters, and a synchronization meter. Controls are provided for manual and automatic generator

voltage regulation and generator engine speed regulation. An interlock system is incorporated into the switchboard to prevent shore power from being applied to the switchboard while generator power is applied (prevents paralleling of shore power with either generator). Figure 1-39 provides a plan view of the Power Distribution System. See also Controls and Indicators section, Figure 2-32.

The generator control and distribution switchboard provides for the following:

(a) Input from Main Diesel Generator #1

(b) Input from Main Diesel Generator #2

(c) Input from along side power receptacle (200 amp)

(d) Input from shore power receptacle (200 amp)

(e) Output to DP1 Distribution Panel – Lower Engine Room

(f) Output to DP2 Distribution Panel – Upper Engine Room

(g) Inputs from emergency STOP pushbutton stations (Mess room; Pilothouse)

(h) Output to Steering Flanking System Hydraulic Power Pack #1 motor controller

(i) Output to Steering Flanking System Hydraulic Power Pack #2 motor controller

(j) Output to DP3 Distribution Panel – Upper Engine Room (via three 10KVA transformers – single phase, 450V primary/208-120V secondary)

(k) Three spare circuits are provided

(l) Output to Temporary Load Switched Receptacle (30 amp)

(2) Distribution Panels. Power from the vessel service switchboard is distributed to systems/equipment via the following six panels:

(a) DP1 – Lower Engine Room Panel. The DP1 panel specifications include: 480 VAC, 3 phase, 3 wire, 36 poles, 100 amp main lugs only, drip-proof, surface mounted, and 50° centigrade breakers. Figure 1-40 provides details for Panel DP-1.

The DP1 panel provides power to:

1 Fire Pump. Power is provided to the 20-hp fire pump through a low voltage protection controller. A START/STOP pushbutton station with RUN indicator light is provided in the PilotHouse. [(4P-A) 30 amp, 3 pole]

2 Bilge/Ballast Pump #2. Power is provided to the 1.5-hp pump through a low voltage protection controller. [(4P-C) 15 amp, 3 pole]

3 Forward Capstan. Power is provided to the 3-hp capstan through a low voltage protection controller located in the forward storage. A START/STOP pushbutton station is provided locally at the capstan. [(4P-E) 15 amp, 3 pole]

4 Aft Capstan. Power is provided to the 10-hp capstan through a low voltage protection controller located in the engine stores compartment. A START/STOP pushbutton station is provided locally at the capstan. [(4P-G) 30 amp, 3 pole]

5 Gray Water Pump. Power is provided to the 1-hp pump through a low voltage protection controller. [(4P-J) 15 amp, 3 pole]

6 Bilge/Ballast Pump #1. Power is provided to the 1.5-hp pump through a low voltage protection controller. [(4P-B) 15 amp, 3 pole]

7 Port Towing Winch. Power is provided to the 7.5-hp winch through a low voltage protection controller located in the forward storage. A START/STOP pushbutton station is provided locally at the winch. [(4P-D) 20 amp, 3 pole]

8 Starboard Towing Winch. Power is provided to the 7.5-hp winch through a low voltage protection controller located in the forward storage. A START/STOP pushbutton station is provided locally at the winch. [(4P-F) 20 amp, 3 pole]

9 Potable Water Pressure Pump. Power is provided to the 1.5-hp pump through a low voltage release controller. A pressure switch is provided for automatically actuating the pump to control the pressures within the system. [(4P-H) 15 amp, 3 pole]

10 Lower Engine Room Space Heater Panel (DP6). Power is provided to the DP6 panel through 30 amp, 3 pole circuit. [(4P-K)]

11 Spares. Two spare circuits are provided. [(4P-L) 15 amp, 3 pole], [(4P-M) 15 amp, 3 pole]

(b) DP2 – Upper Engine Room Panel. The DP2 panel specifications include: 480 VAC, 3 phase, 3 wire, 36 poles, 100 amp main lugs only, drip-proof, surface mounted, and 50° centigrade breakers. Figure 1-41 provides details for panel DP2.

The DP2 panel provides power to:

1 Engine Room Supply Fan #1. Power is provided to the 3-hp supply fan through a low voltage protection controller. [(4P-A) 15 amp, 3 pole]

2 Engine Room Exhaust Fan. Power is provided to the 2-hp exhaust fan through a low voltage protection controller. [(4P-C) 15 amp, 3 pole]

3 Engine Room Supply Fan #2. Power is provided to the 3-hp supply fan through a low voltage protection controller. [(4P-B) 14 amp, 3 pole]

4 Fuel Oil Transfer Pump. Power is provided to the 3-hp pump through a low voltage protection controller. [(4P-D) 15 amp, 3 pole]

5 Generator Room Vent Fan. Power is provided to the 3-hp vent fan through a low voltage protection controller. [(4P-F) 15 amp, 3 pole]

6 Air Conditioning Condenser Unit. Power is provided to the condenser unit through a disconnect switch and through the air handler control panel. The unit is controlled by thermostat. [(4P-H) 30 amp, 3 pole]

7 Air Handler Control Panel. Power is provided to the air handler control panel through a 15 amp, 3 pole circuit. [(4P-K) 15 amp, 3 pole]

8 Duct Heater. Power is provided to the duct heater through a 20 amp, 3 pole circuit and through the air handler control panel. The unit is controlled by thermostat. [(4P-M)]

9 Spares. Four spare circuits are provided. [(4P-G) 15 amp, 3 pole], [(4P-J) 15 amp, 3 pole], [(4P-L) 15 amp, 3 pole], [(4P-E) 15 amp, 3 pole]

(c) DP3 – Upper Engine Room Panel. The DP3 panel specifications include: 208/120 VAC, 3 phase, 4 wire, with separate ground bus, 42 poles, 100 amp main lugs only, 50° centigrade breakers, drip-proof, and surface mounted. Figure 1-42 provides details for panel DP3.

The DP3 panel receives power from the transformers and provides power to:

1 DP4 – Lower Engine Room Panel. Power is provided through a 60 amp, 3 pole circuit. [(1P-A)]

2 Pilot House Panel. Power is provided through a 60 amp, 3 pole circuit. [(1P-B)]

3 Generator Room and Upper Engine Room Receptacles. Power is provided through a 20 amp, 1 pole circuit. [(1P-C)]

4 Generator Room and Upper Engine Room Light Circuit #1. Power is provided through a 15 amp, 1 pole circuit. [(1P-D)]

5 Coffee Maker. Power is provided through a 20 amp, 1 pole circuit. [(1P-E)]

6 Generator Room and Upper Engine Room Light Circuit #2. Power is provided through a 15 amp, 1 pole circuit. [(1P-F)]

7 Microwave Oven. Power is provided through a 15 amp, 1 pole circuit. [(1P-G)]

8 Generator and Switchboard Space Heaters. Power is provided through a 15 amp, 1 pole circuit. [(1P-H)]

9 Refrigerator/Freezer. Power is provided through a 15 amp, 1 pole circuit. [(1P-J)]

10 Galley, Messroom, Stateroom, and Head Lights. Power is provided through a 15 amp, 1 pole circuit. [(1P-K)]

11 Port Generator Battery Charger. Power is provided through a 20 amp, 1 pole circuit. [(1P-L)]

12 Galley and Messroom Receptacles. Power is provided through a 20 amp, 1 pole circuit. [(1P-M)]

13 Starboard Battery Charger. Power is provided through a 20 amp, 1 pole circuit. [(1P-N)]

14 Stateroom and Head Berth Lights and Receptacles. Power is provided to the space heaters through a 20 amp, 1 pole circuit. [(1P-P)]

15 Main Deck Exterior Lights. Power is provided through a 15 amp, 1 pole circuit. [(1P-Q)]

16 Forward Compartment Fan. Power is provided through a 15 amp, 1 pole circuit. [(1P-R)]

17 Main Deck Exterior Receptacles. Power is provided through a 20 amp, 1 pole circuit. [(1P-S)]

18 Electric Toilet Main Deck. Power is supplied to the electric toilet through a 20 amp, 2 pole circuit. [(1P-T)]

19 Jacket Water Heater Generator #2. Power is supplied through a 15 amp, 1 pole circuit. [(1P-U)]

20 Electric Urinal Main Deck. Power is supplied to the electric urinal through a 20 amp, 2 pole circuit. [(1P-V)]

21 Spare. [(1P-W) 15 amp, 1 pole]

22 Jacket Water Heater Generator #1. Power is supplied through a 15 amp, 1 pole circuit. [(1P-X)]

23 Spare. [(1P-Y) 15 amp]

24 Spare. [(1P-Z) 15 amp]

25 Spare. [(1P-AA) 20 amp]

26 Spare. [(1P-BB) 15 amp]

27 Spare. [(1P-CC) 20 amp]

28 Spare. [(1P-DD) 20 amp]

(4) DP4 – Lower Engine Room Panel. The DP4 panel specifications include: 208/120 VAC, 3 phase, 4 wire, with separate ground bus, 30 poles, 100 amp main lugs only, 50° centigrade breakers, drip-proof, and surface mounted. Figure 1-43 provides details for panel DP4.

The DP4 panel receives power from DP3 panel and provides power to:

(a) Lower Engine Room Lights Circuit #1. Power is provided through a 15 amp, 1 pole circuit. [(1P-A)]

(b) Lower Engine Room Lights Circuit #2. Power is supplied through a 15 amp, 1 pole circuit. [(1P-C)]

(c) Lower Engine Room Receptacles. Power is supplied through a 20 amp, 1 pole circuit. [(1P-G)]

(d) Steering Compartment Receptacles. Power is supplied through a 20 amp, 1 pole circuit. [(1P-J)]

(e) Forward Machinery Space and Forward Storeroom Lights. Power is supplied through a 15 amp, 1 pole circuit. [(1P-L)]

(f) Forward Machinery Space Receptacles. Power is supplied through a 20 amp, 1 pole circuit. [(1P-N)]

(g) Forward Storeroom Receptacles. Power is supplied through a 20 amp, 1 pole circuit. [(1P-Q)]

(h) Port Main Engine Battery Charger. Power is supplied through a 15 amp, 1 pole circuit. [(1P-W)]

(i) Sound Powered Telephone. Power is supplied through a 15 amp, 1 pole circuit. [(1P-W)]

(j) Oily Water Separator. Power is supplied to the oily water separator through a 15 amp, 1 pole circuit. The control panel then supplies power to the 0.5-hp oily water separator. [(1P-B)]

(k) Water Heater. Power is supplied to the 1.5 kW water heater through a 20 amp, 1 pole circuit. [(1P-D)]

(l) Bench Grinder. Power is supplied to the 0.33-hp bench grinder through a 15 amp, 1 pole circuit. [(1P-H)]

(m) Engine Stores Lights. Power is supplied through a 15 amp, 1 pole circuit. [(1P-K)]

(n) FLOCS Pump. Power is supplied to the 0.75-hp pump through a 20 amp, 1 pole circuit. [(1P-M)]

(o) Emergency Rudder Angle Indicator. Power is supplied through a 15 amp, 1 pole circuit. [(1P-P)]

(p) Steering System Rudder Angle Indicator. Power is supplied through a 15 amp, 1 pole circuit.

[(1P-R)].

(q) Loudhailer/Blue Strobe Lights. Power is supplies through a 15 amp, 1 pole circuit. [(1P-X)]

(r) Starboard Main Engine Battery Charger. Power is supplied through a 20 amp, 1 pole circuit. [(1P-V)]

(s) Spares. Ten spare circuits are provided. [(2P-E 15 amp, 2 pole)], [(1P-S) 15 amp, 1 pole], [(1P-Y) 15 amp, 1 pole], [(1P-AA) 20 amp, 1 pole], [(1P-CC), 20 amp, 1 pole], [(2P-F) 20 amp, 1pole], [(1P-T) 15 amp, 1 pole], [(1P-Z) 15 amp, 1 pole], [(1P-BB) 15 amp, 1 pole), [(1P-DD) 20 amp, 1 pole)

(5) DP5-Pilot House Panel. The DP5 panel specifications include: 208/120 VAC, 3 phase, 4 wire, with separate ground bus, 24 poles, 100 amp main lugs only, 40° centigrade breakers, drip-proof, and recessed. Figure 1-44 provides details for panel DP5.

The DP5 panel receives power from the DP3 Panel (Generator Room) and provides power to:

(a) Deck Stateroom and Storage Lights. Power is provided through a 15 amp, 1 pole circuit. [(1P-A)]

(b) Deck Stateroom and Storage Receptacles and Stateroom Berth Lights. Power is provided through a 20 amp, 1 pole circuit. [(1P-C)]

(c) Clearview Heater (Clearview Screen). Power is provided through a 15 amp, 1 pole circuit. [(1P-E)]

(d) Pilot House Lights. Power is provided through a 15 amp, 1 pole circuit. [(1P-G)]

(e) Pilot House Receptacles. Power is provided through a 20 amp, 1 pole circuit. [(1P-J)]

(f) Steering Amplifiers. Power is provided through a 15 amp, 1 pole circuit. [(1P-L)]

(g) Wheelhouse Distribution Junction Box (Alarms and Emergency Steering). Power is provided through a 15 amp, 1 pole circuit. [(1P-N)]

(h) Emergency Lighting Relay. Power is provided through a 15 amp, 1 pole circuit. [(1P-Q)]

(i) Spare. [(1P-S) 15 amp, 1 pole]

(j) Spare. [(1P-U) 15 amp, 1 pole]

(k) Searchlight. [(1P-W) 20 amp, 1 pole]

(l) Spare. [(1P-Y) 20 amp, 1 pole]

(m) Deck Exterior Lights. Power is provided through a 15 amp, 1 pole circuit. [(1P-B)]

(n) Loudhailer/Public Address/General Alarm System. Power is provided through a 15 amp, 1 pole circuit. [(1P-D)]

(o) Clearview Wipers (Screen). Power is provided through a 15 amp, 1 pole circuit. [(1P-F)]

(p) Spare. [(1P-H) 15 amp, 1pole]

(q) Aft 01 Deck Floodlights. Power is provided through a 15 amp, 1 pole circuit. [(1P-K)]

(r) Forward Main Deck Floodlights. Power is provided through a 15 amp, 1 pole circuit. [(1P-M)]

(s) Depth Sounder/Fluxgate Compass Power Supply. Power is provided through a 15 amp, 1 pole circuit. A transformer converts from 120 VAC to 12VDC. [(1P-P)]

(t) Fire Detection Panel. Power is provided through a 15 amp, 1 pole circuit. [(1P-R)]

(u) Intercom System. Power is provided through a 15 amp, 1 pole circuit. [(1P-T)]

(v) Spare. [(1P-V) 15 amp, 1pole]

(w) Spare. [(1P-X) 20 amp, 1 pole]

(x) Spare. [(1P-Z) 20 amp, 1 pole]

(4) DP6 – Lower Engine Room Panel (Heaters). The DP6 panel specifications include: 450 VAC, 3 phase, 3 wire, 24 poles, 100 amp main lugs only, 50^0 centigrade breakers, drip-proof, and surface mounted. Figure 1-45 provides details for panel DP6.

The DP6 panel receives power from DP1 panel and provides power to:

(a) Engine Room Forward Heater. Power is provided through a 15 amp, 3 pole circuit. [(4P-A)]

(b) Engine Room Aft Heater. Power is provided through a 15 amp, 3 pole circuit. [(4P-C)]

(c) Generator Room Heater. Power is provided through a 15 amp, 3 pole circuit. [(4P-E)]

(d) Forward Storage Heater. Power is provided through a 15 amp, 3 pole circuit. [(4P-B)]

(e) Tank Space Heater. Power is provided through a 15 amp, 3 pole circuit. [(4P-D)]

(f) Spare. One spare circuit is provided. [(4P-F) 15 amp, 3 pole]

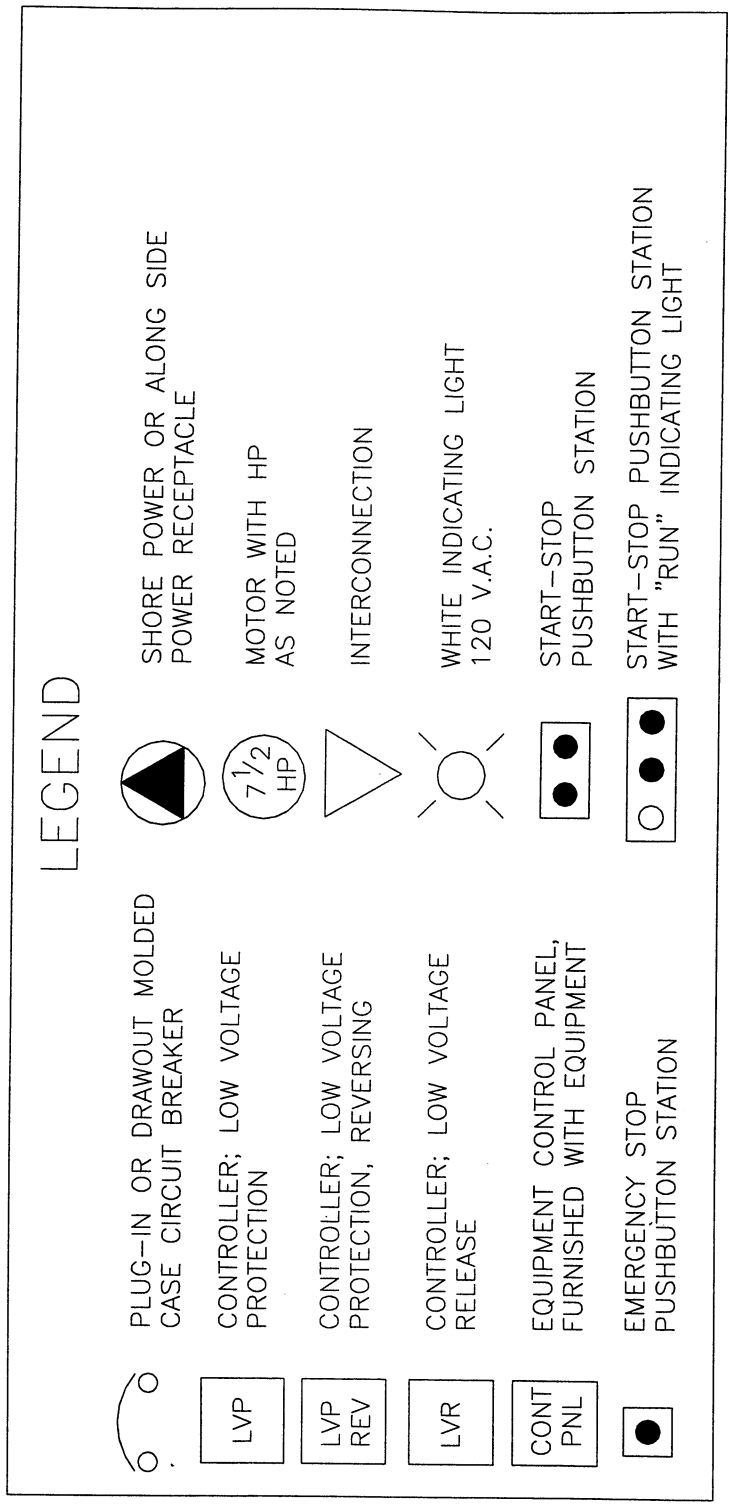


Figure 1-39. AC One Line Diagram, Sheet 1 of 2

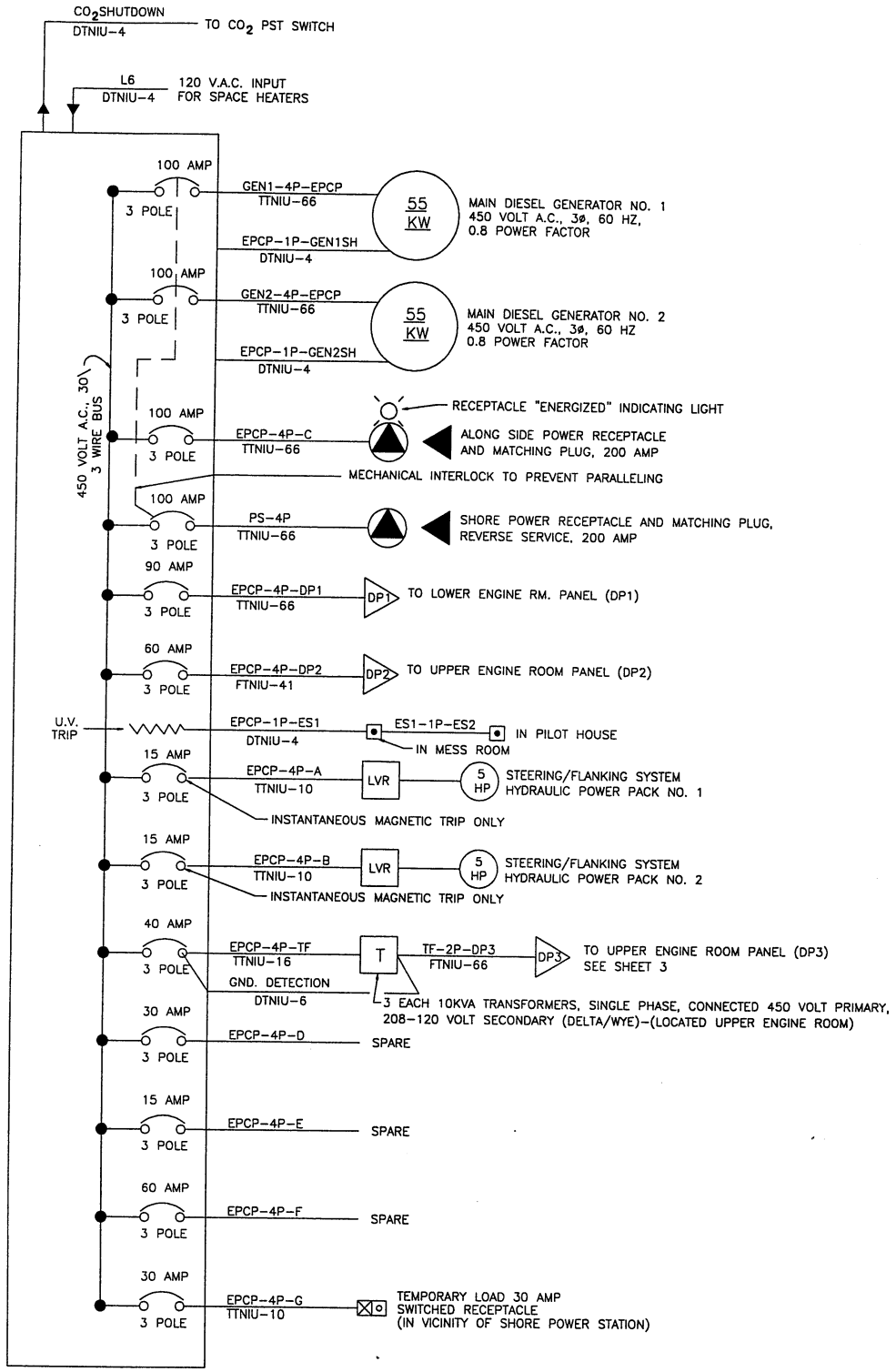


Figure 1-39. AC One Line Diagram, Sheet 2 of 2

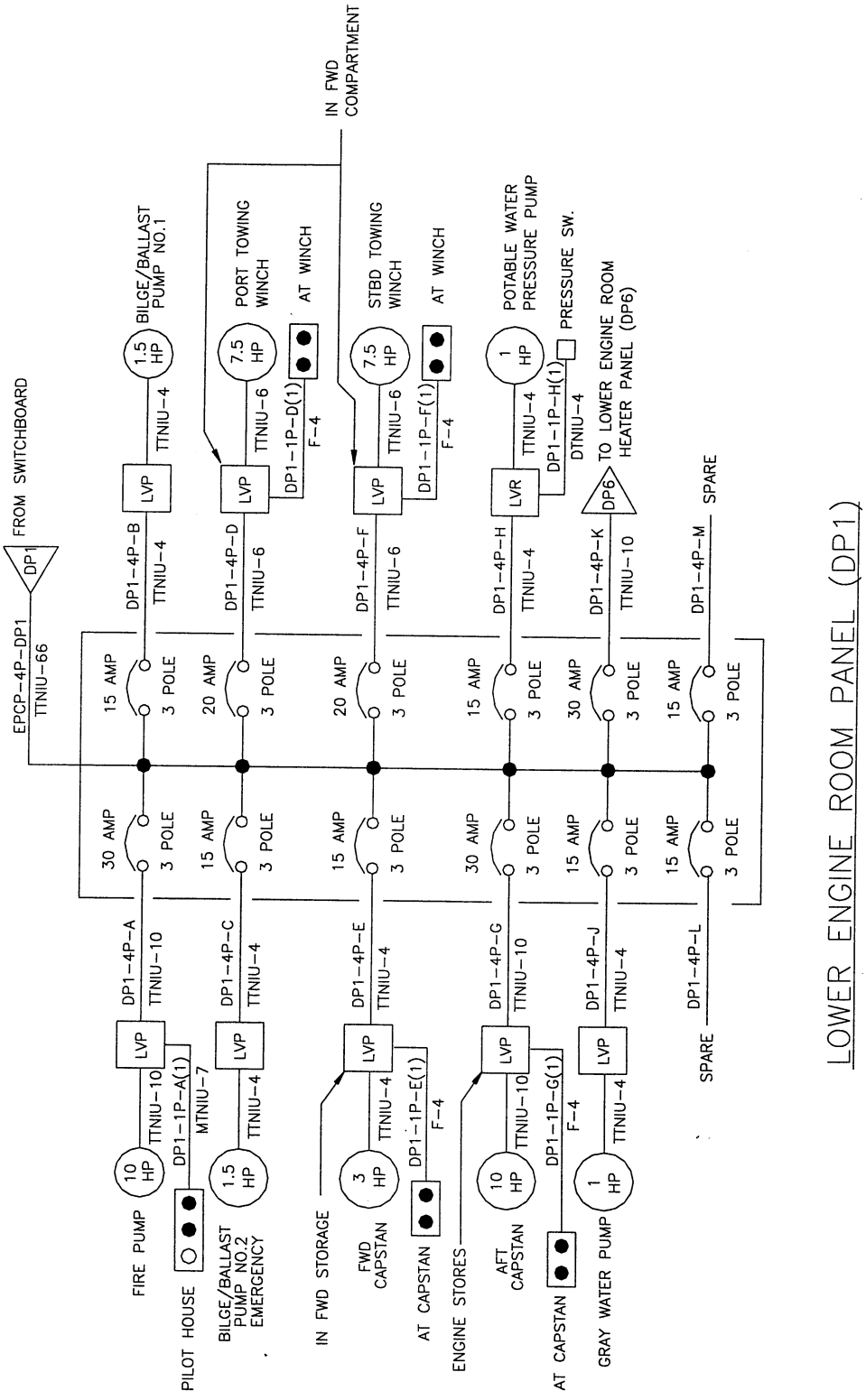


Figure 1-40. Distribution Panel DP-1

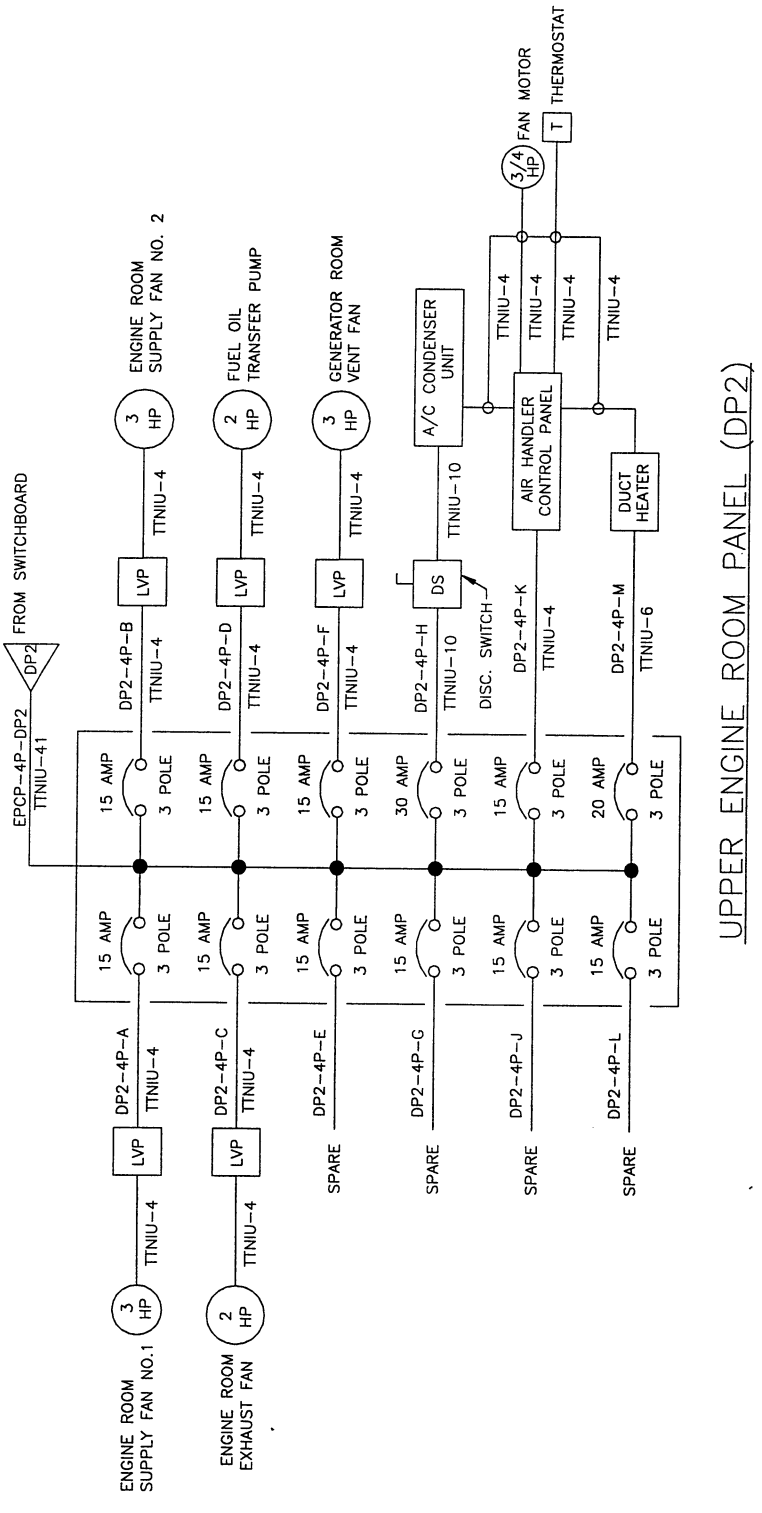


Figure 1-41. Distribution Panel DP-2

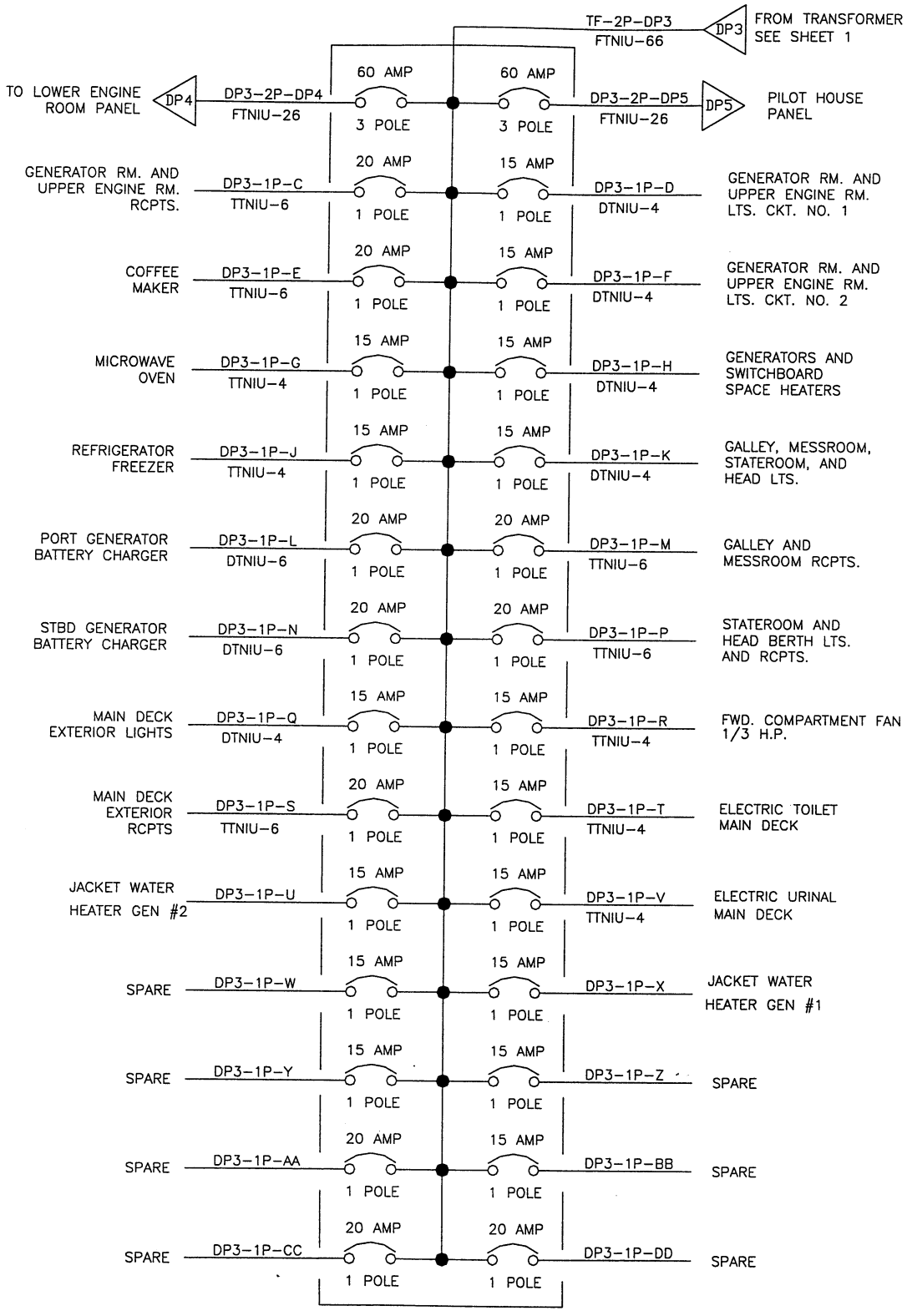


Figure 1-42. Distribution Panel DP-3

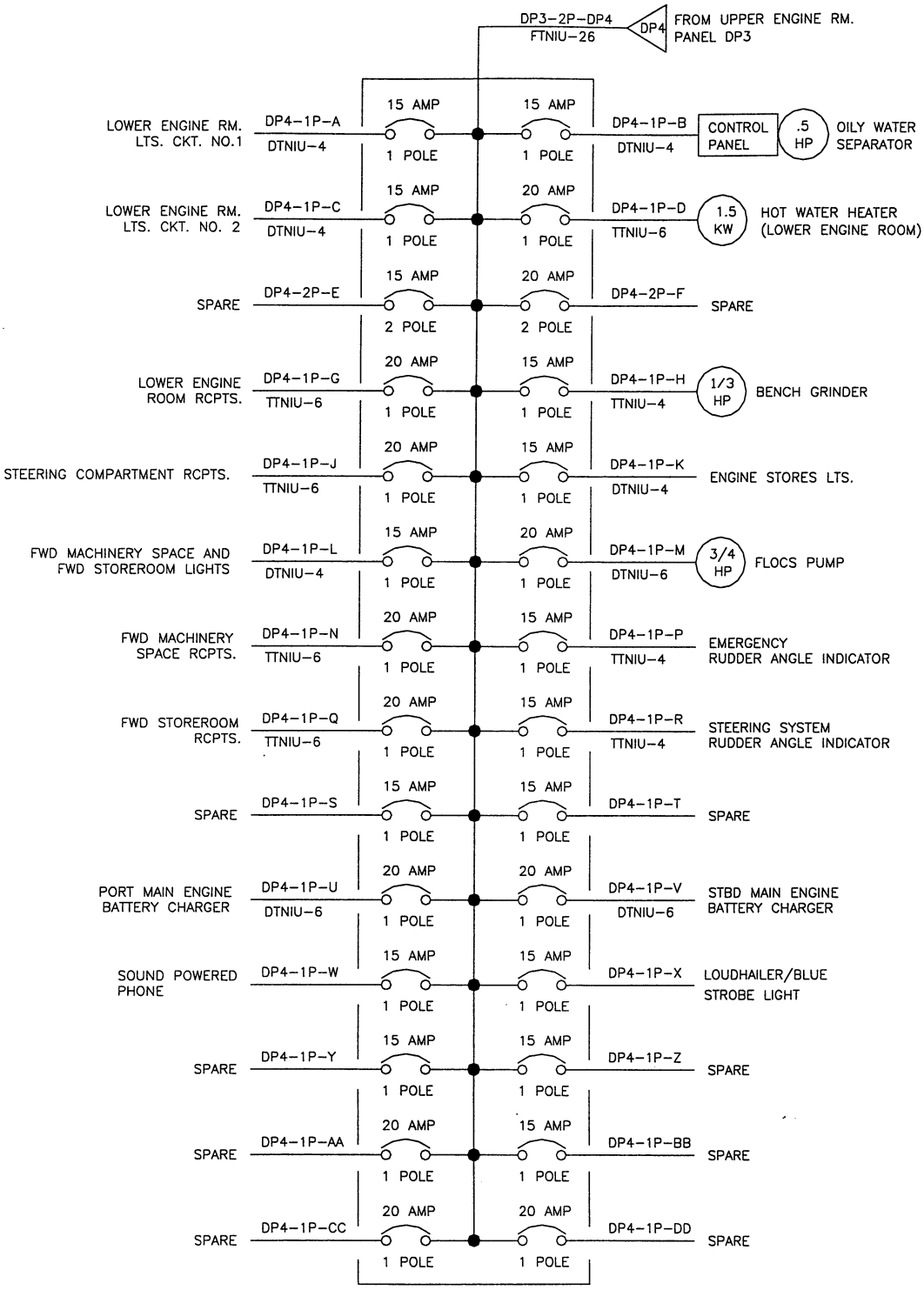


Figure 1-43. Distribution Panel DP-4

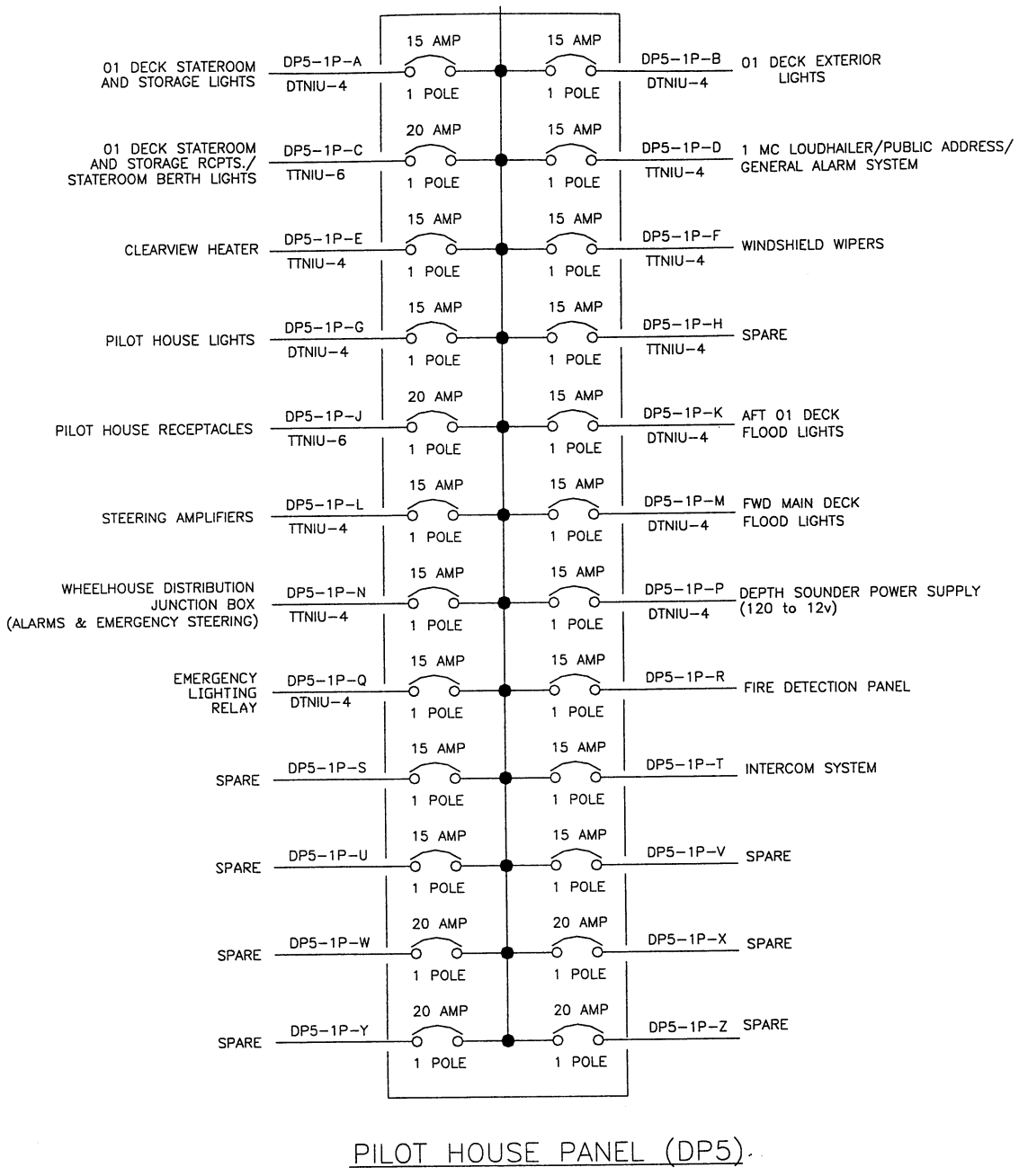


Figure 1-44. Distribution Panel DP-5

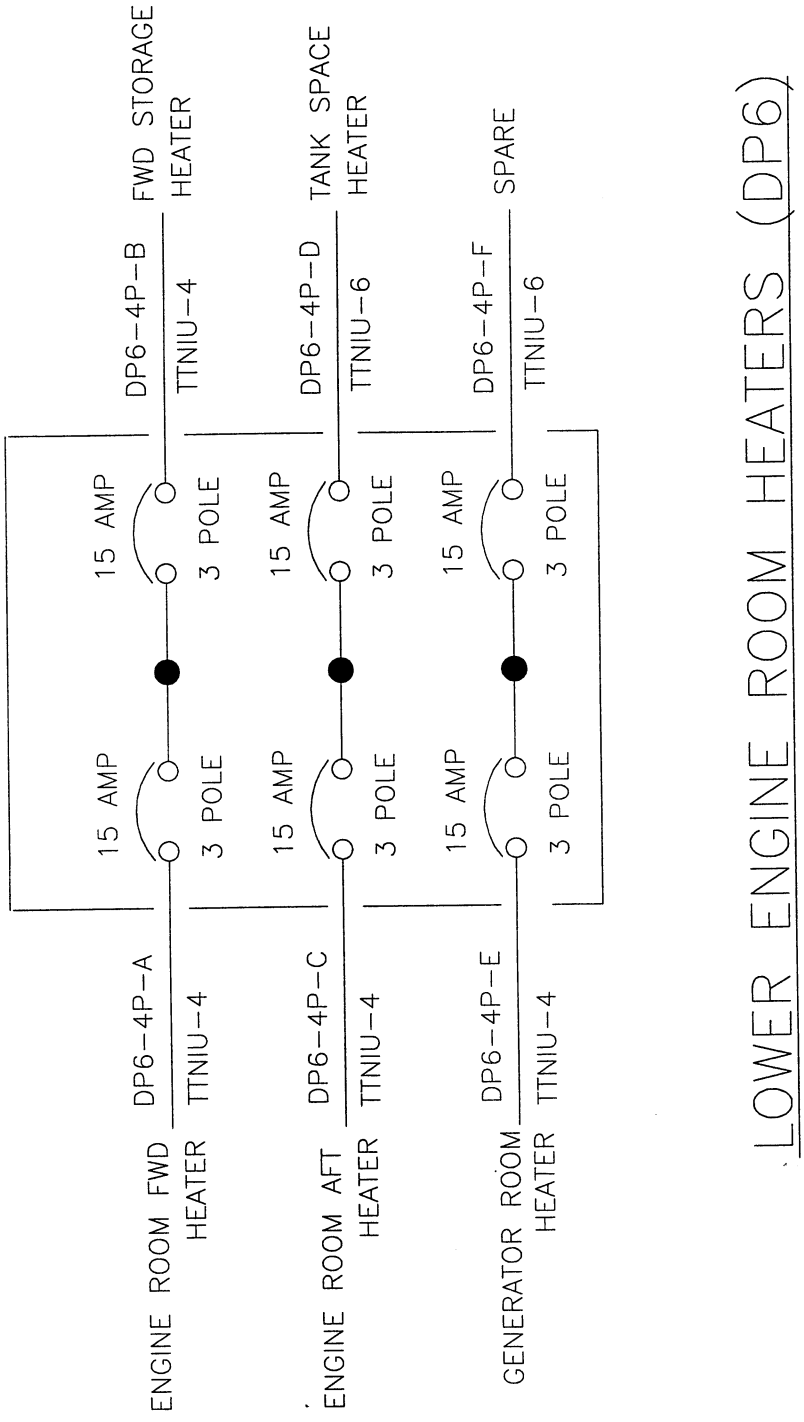


Figure 1-45. Distribution Panel DP-6

e. Lighting Systems. The following sub-paragraphs describe the ST's navigational and general lighting systems. Lighting fixtures are installed in compartments and spaces throughout the craft to provide the levels of general illumination necessary for the tasks to be carried out in each location. All interior fixtures are fluorescent, except for emergency DC lighting, which is incandescent.

For detailed illustrations of the lighting system by deck level, see Figure 1-46, Sheets 1 through 5.

(1) Detail Illumination. Detail illumination is provided for the following:

(a) Mirror Light. A 16-watt fluorescent mirror light is installed on the mirror in the head. The switch controlling the general lighting controls the light.

(b) Berths. Each of the five berths is provided with a separately controlled 16-watt fluorescent light.

(c) Chart Table. The chart table is provided with a special 25-watt fluorescent light fixture with a red diffuser.

CAUTION

Do not use a bulb exceeding 60 watts.

(2) Low Level Red Illumination. Red low-level lighting fixtures provide overhead illumination necessary for safe movement throughout the ST affording the least practicable interference with dark-adapted vision. These fixtures are installed as follows:

(a) Pilot House. A low level red light fixture is installed on the starboard side of the PilotHouse. This fixture includes two 20-watt fluorescent tubes on each side and a 20-watt red center fluorescent tube.

(b) Engine Room. Two low level red light fixtures are installed in the engine room, one forward port and one starboard aft. These fixtures include two 40-watt fluorescent tubes on each side and a 40-watt red center fluorescent tube.

(c) Generator Room. A low level red light fixture is installed at centerline between Frames 21 and 22. This fixture includes two 40-watt fluorescent tubes on each side and a 40-watt red center fluorescent tube.

(d) Galley and Mess Area. A low level red light fixture is installed on the starboard side. This fixture includes two 40-watt fluorescent tubes on each side and a 40-watt red center fluorescent tube.

(e) Forward Storage. A low level red fixture is installed on the starboard side of the forward storage in the Hold Deck. This fixture includes two 20-watt fluorescent tubes on each side and a 20-watt red center fluorescent tube.

(3) General Illumination. General Illumination is provided as follows:

(a) Engine Room. Four overhead fluorescent fixtures are provided in opposing corners of the engine room. Each of these drip-proof fixtures includes two 40-watt fluorescent bulbs.

(b) 01 Deck. An overhead fluorescent fixture is provided at centerline between Frames 12 and 13 in the 2-person berth. The drip-proof fixture includes two 40-watt fluorescent bulbs. Two overhead fixtures are provided in the HVAC room, one each port and starboard. These drip-proof fixtures include two 20-watt fluorescent bulbs.

(c) Tankage Space. Three overhead fluorescent fixtures are provided between Frames 10 and 11, with one each port and starboard and one at centerline. Each of the drip-proof fixtures

includes two 40-watt fluorescent bulbs. An additional overhead fluorescent fixture is located above the workbench. This fixture includes two 20-watt fluorescent bulbs.

(d) Galley and Mess Area. Two overhead fluorescent fixtures are provided, one at centerline and one on the starboard side. Each of the drip-proof fixtures includes two 40-watt fluorescent bulbs.

(e) Berthing Areas. An overhead fluorescent fixture is provided in each of the berthing areas. The drip-proof fixtures include two 40-watt fluorescent bulbs.

(f) Generator Room. Two overhead fluorescent fixtures are provided, one each port and starboard. The drip-proof fixtures include two 40-watt fluorescent bulbs.

(g) Upper Engine Room Walkway. Two overhead fluorescent fixtures are provided between Frames 18 and 20, one each port and starboard. The drip-proof fixtures include two 40-watt fluorescent bulbs.

(h) Forward Storage. Four overhead fluorescent fixtures are provided. Two fixtures are located between Frames 6 and 8, one each port and starboard. Two fixtures are located between Frames 3 and 6, one at centerline and one on the port side. The drip-proof fixtures include two 20-watt fluorescent bulbs.

(i) Engine Stores. Three overhead fluorescent fixtures are provided between Frames 22 and 23, with one each port and starboard and one at centerline. The drip-proof fixtures include two 20-watt fluorescent bulbs.

(j) Head. An overhead fluorescent fixture is provided in the head. The drip-proof fixture includes two 20-watt fluorescent bulbs.

(k) Pilot House. An overhead fluorescent fixture is provided port side in the Pilot House. The drip-proof fixture includes two 20-watt fluorescent bulbs.

(4) Emergency DC Lights. A 24VDC Emergency DC Lighting system, consisting of 25-watt light fixtures, automatically provides general illumination in manned spaces when AC power becomes unavailable. One fixture is installed in each of the following areas:

(a) Pilot House Deck.

(b) Mess Area.

(c) Upper Engine Room.

(d) Generator Room.

(e) Lower Engine Room.

(f) Tankage Space.

(g) Forward Storage.

(5) Weather Deck Lighting. Incandescent white lighting fixtures are installed to provide the necessary illumination for safe passage of personnel on main walkways, ladders, hatches, as well as for mooring fittings and capstans. These fixtures are located as follows:

(a) Main Deck. Ten bulkhead mounted 100-watt incandescent fixtures (white) are located around the perimeter of the deckhouse. Four bulkhead mounted 60-watt red incandescent fixtures are located around the perimeter of the deckhouse as well.

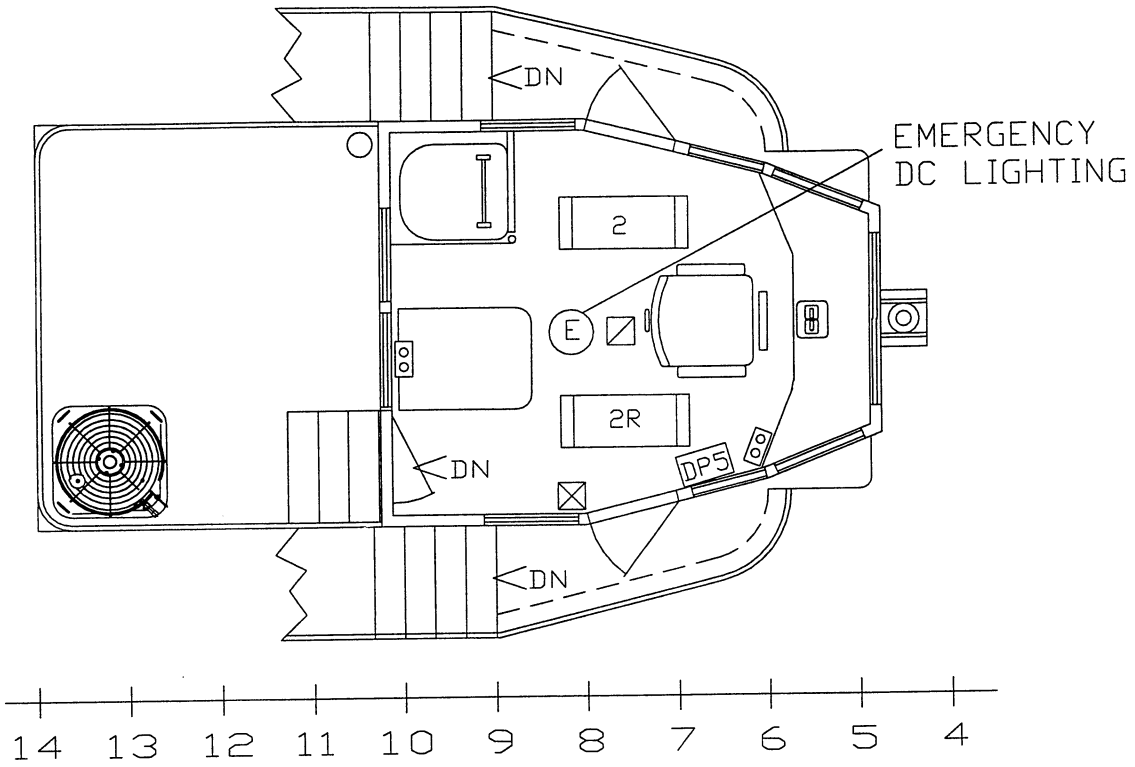
(b) 01 Deck. Four bulkhead mounted 100-watt incandescent fixtures (white) are located around the perimeter of the deckhouse.

(6) Floodlights. Three halogen floodlights are located on the 01 Deck to provide illumination of the forward and aft main deck work areas. Two are located on the aft section of the deckhouse railing, one each port and starboard outboard. One is located forward centerline.

(6) Searchlight. The Searchlight, which is remotely controlled from a panel on the Pilot House console, provides lighting for towing and navigation.

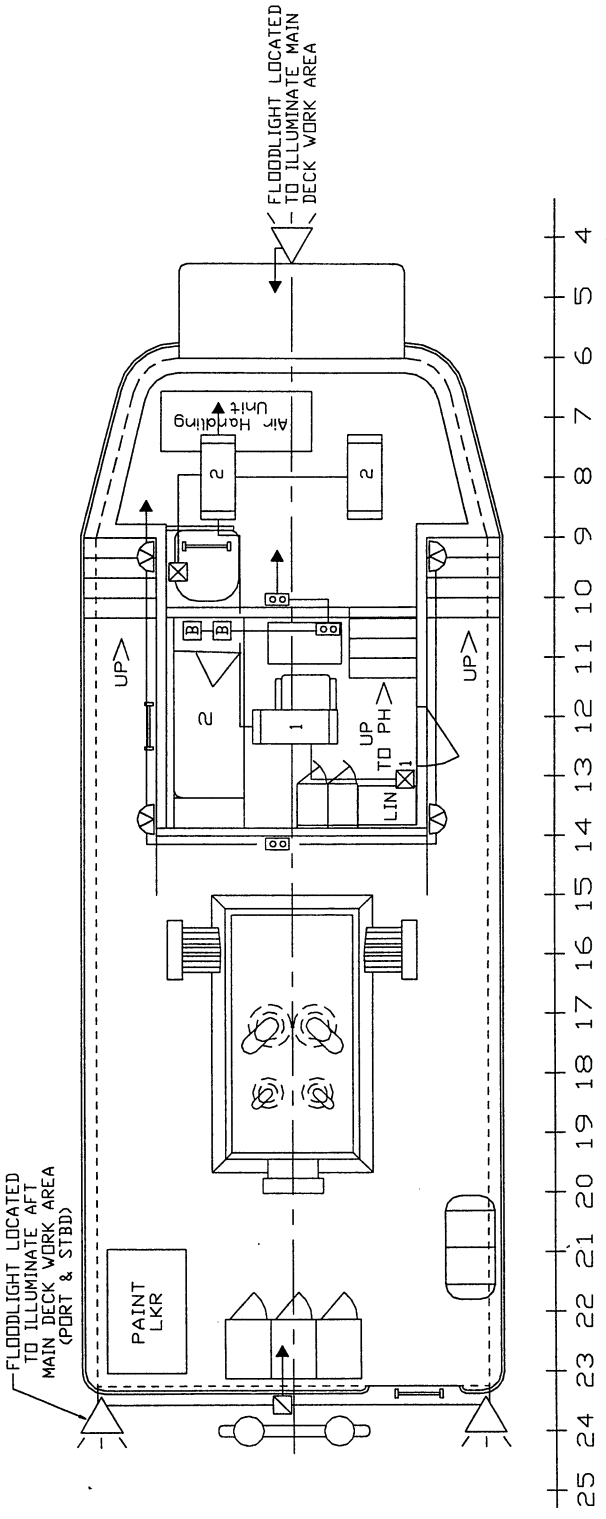
(7) Portable Lanterns. Portable lanterns provide a limited amount of illumination when other lighting sources fail. They are located one each in the Upper Engine Room, Lower Engine Room, Forward Stores, Pilot House, Void 1 and Void 2.

(8) Navigation Lights. The navigation lights are discussed in Paragraph 1.16.3, Command and Controls.

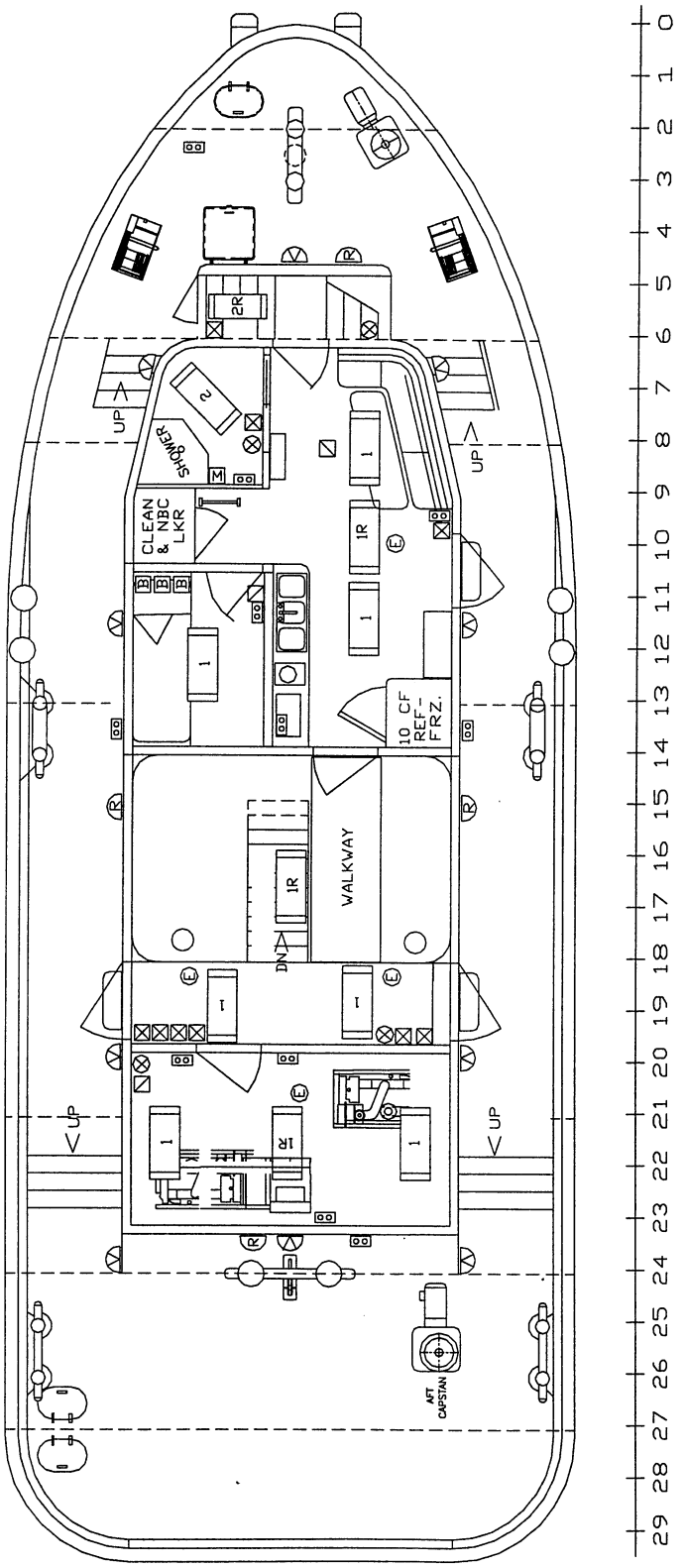


Pilot House Deck Lighting Arrangement

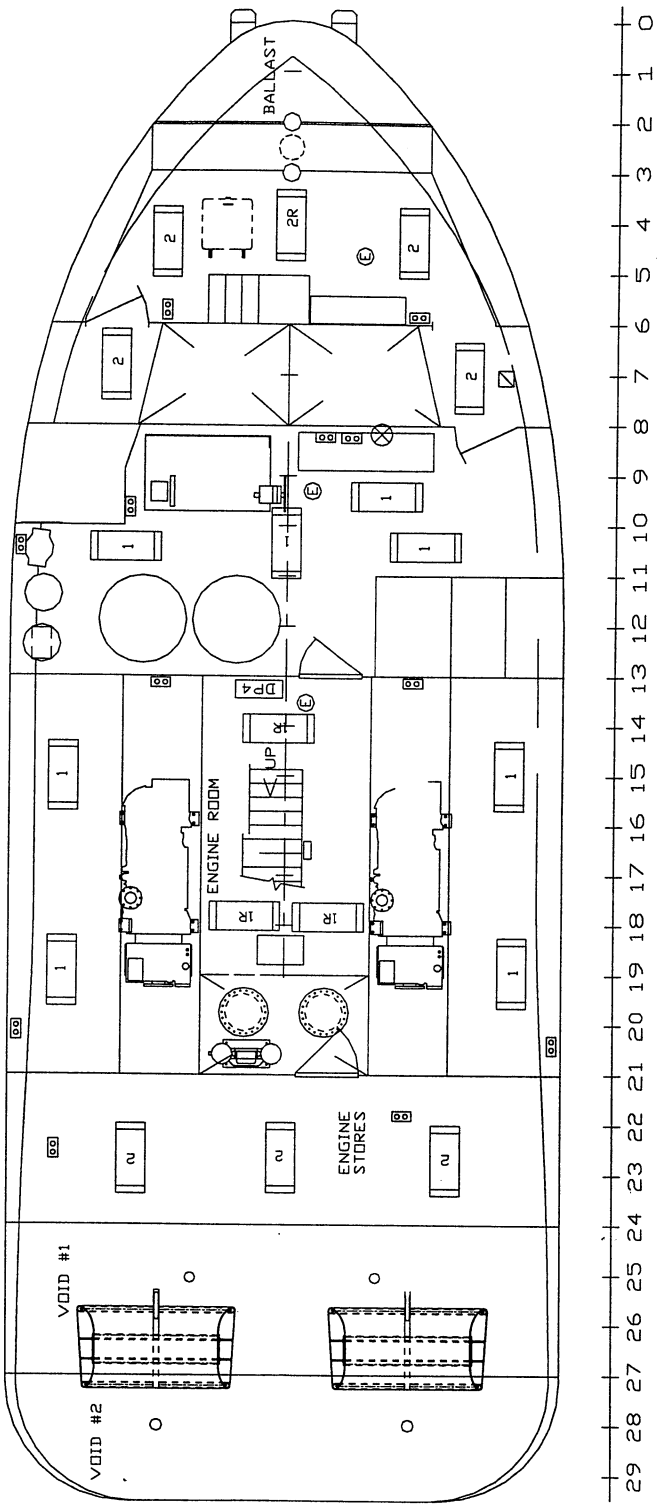
Figure 1-46. Lighting Arrangement, Sheet 1 of 5



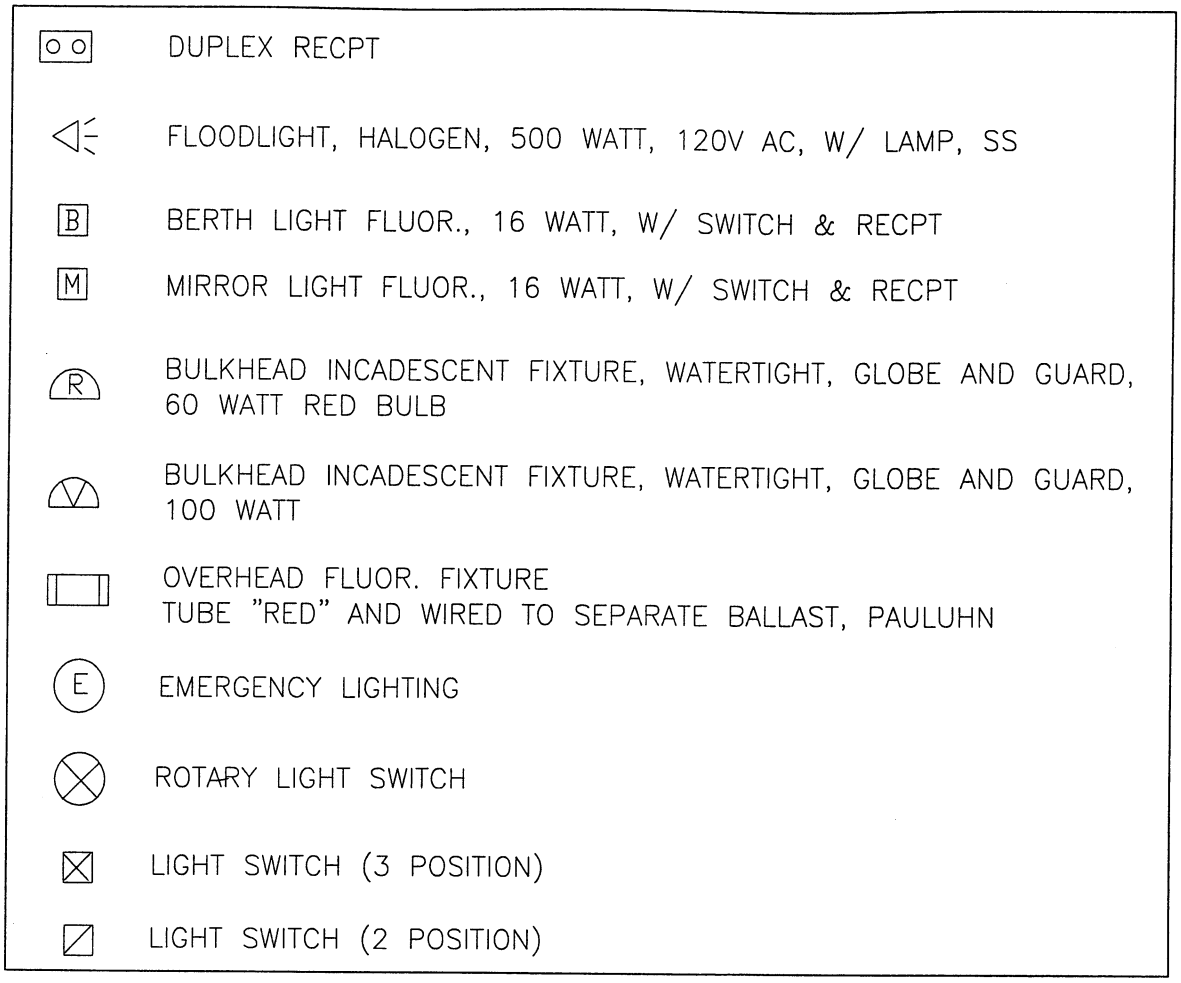
01 Deck Lighting Arrangement
Figure 1-46. Lighting Arrangement, Sheet 2 of 5



Main Deck Lighting Arrangement.
Figure 1-46. Lighting Arrangement, Sheet 3 of 5



Hold Deck Lighting Arrangement.
Figure 1-46. Lighting Arrangement, Sheet 4 of 5



Lighting Arrangement Drawing Key

Figure 1-46. Lighting Arrangement, Sheet 5 of 5.

1.16.3. Command and Controls. The following sub-paragraphs describe the navigational, communication, and alarm systems installed on the ST.

a. Navigational System/Equipment. The ST is outfitted with the following navigational equipment:

(1) Radar. The ST's radar consists of a Raytheon Model R40XX with 24 nautical mile (44.472 Meters) range and a 24-inch (0.6096 Meters) domed scanner with rotational motor. The display unit is located in PilotHouse. Key operational features are outlined below:

(a) Multi-screen capability, which allows for viewing of various windows.

(b) Target wakes can be displayed on screen.

(c) Pressure sensitive track pad facilitating access to various areas on the screen.

(d) Ability to track up to five waypoints in a route sequence.

(e) Automatic tuning.

(f) Compass stabilized presentation, allowing for true magnetic North display heading changes.

(g) Man-overboard features which allow for quick activation and instantaneous readouts for a fast return to the point of origin of the event.

(2) Global Positioning System. The ST's GPS system consists of an AN/PSN-11 (Lightweight GPS receiver with external antenna). The display unit is located in PilotHouse. The basic function of the GPS is to provide the position of the vessel with a high degree of accuracy utilizing satellite transmissions. This equipment is provided as Government Furnished Equipment.

(3) Depth Sounder. The ST's depth sounder is an Autohelm Model ST50 Plus with a display unit mounted on the Pilot House console. The depth sounder is a multi-function instrument that employs an echo sounder enabling various alarms. These include deep, shallow, or anchor watch alarms which may be set to provide visual and audible warnings whenever the depth of the water reaches the selected parameters. Essential system components include ST50 Plus Depth Control Head, power cable, and depth transducer (located in transducer tube in Forward Stores compartment).

(4) Magnetic Compass. The magnetic compass is a Ritchie Model YB 500. The unit is installed on the console in the PilotHouse.

(5) Fluxgate Compass. The fluxgate compass is a Ritchie Model MS100 providing heading information to the PilotHouse. The magnetic compass senses the earth's magnetic field, with a microprocessor compensating for deviations within the ST and feeds this information to the display and other navigation instruments.

(6) Navigation Light System. The navigation light system consists of the navigation light panel and the navigation lights. Each of these is discussed in the paragraphs that follow.

(a) Navigation Light Panel. The navigation light panel located in the Pilot House facilitates operation and/or monitoring of the ST's navigation lights. Key features of the panel are outlined below:

(1) Receives navigation light power from the 24VDC panel located in the PilotHouse.

(2) The panel will not be disabled by a failure of any alarm circuit.

(3) Alarm circuitry provides an audible and visual identification of specific navigation light failure.

(b) Navigation Lights. The navigation light panel distributes power to the navigation lights. Figure 1-47 provides a plan view of the Navigation Lights. The navigation lights are housed on the forward or aft mast.

(1) Forward Mast. The forward mast contains the following lights:

(a) Anchor Light (Item 6) (white)

(b) Masthead Light (Item 5) (white)

(c) Restricted in Ability to Maneuver (RIAM) Light (Item 9) (red)

(d) Towing Light #1(Item 3) (white)

(e) Restricted in Ability to Maneuver (RIAM) Light (Item 7) (white)

(f) Towing Light #2 (Item 4) (white)

(g) Restricted in Ability to Maneuver (RIAM)/Not Under Command (NUC) Light (Item 8) (red)

(h) Running Lights (Item 1 and 2); Starboard (green), Port (red)

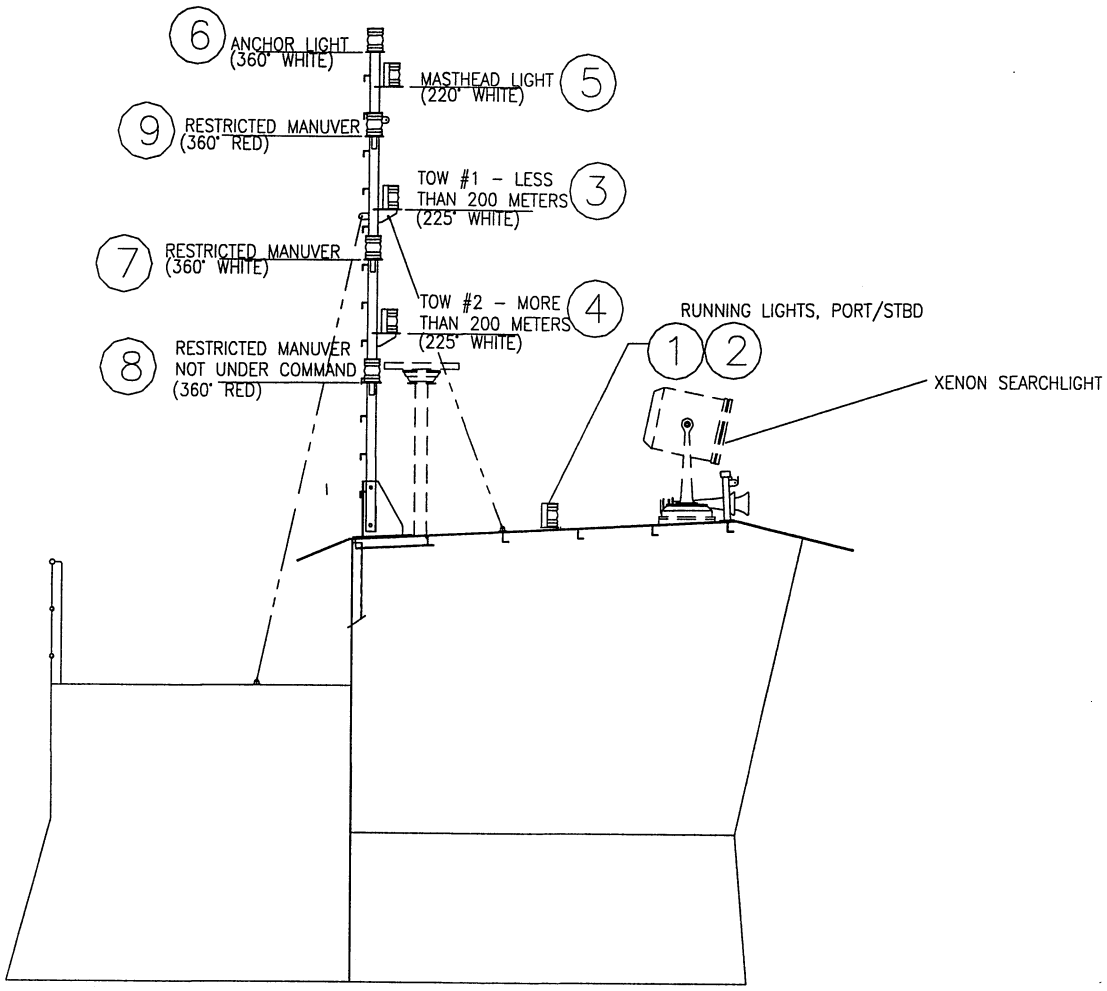
(2) Aft Mast. The aft mast contains the following lights:

(a) Bilge Alarm Light (Item 1) (blue)

(b) Stern Towing Light #1(Item 2) (yellow)

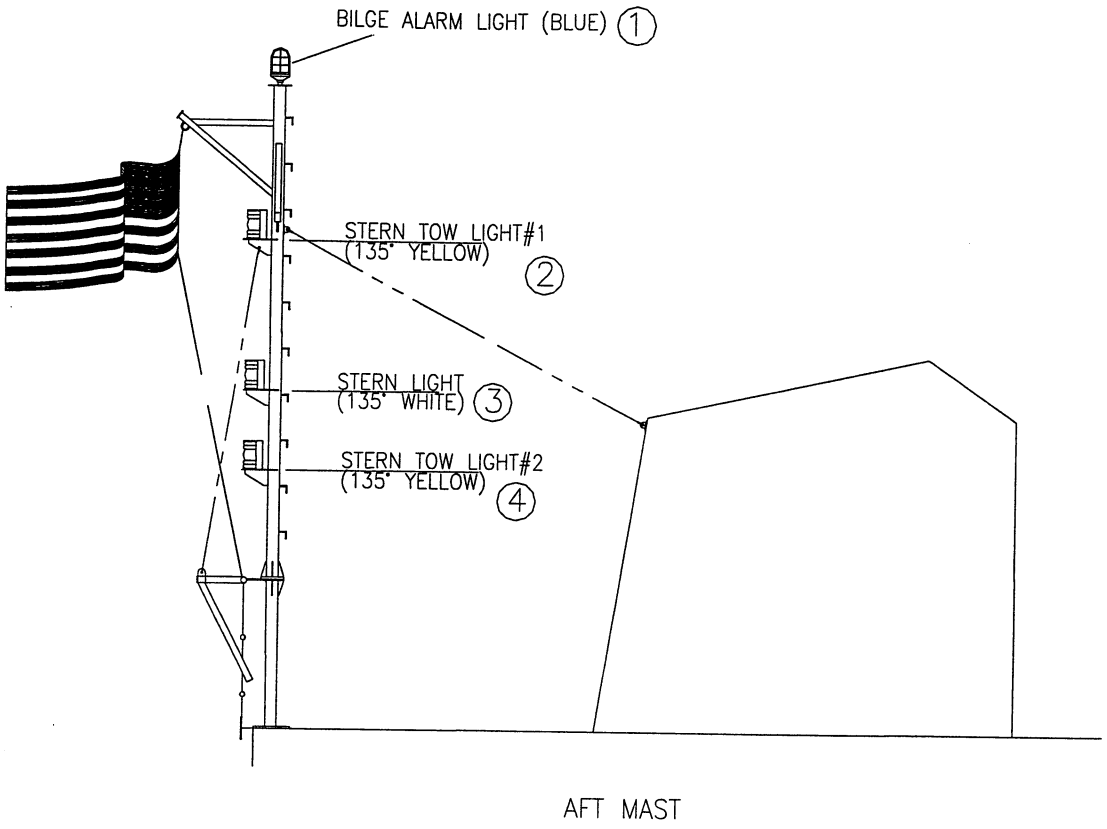
(c) Stern Light (Item 3) (white)

(d) Stern Towing Light #2 (Item 4) (yellow)



Navigation Light Arrangement, Forward Mast

Figure 1-47. Navigation Lights Arrangement, Sheet 1 of 2



Navigation Light Arrangement, Aft Mast

Figure 1-47. Navigation Lights Arrangement, Sheet 2 of 2

b. Internal Communication System. The ST is outfitted with the following internal communication equipment:

(1) Integrated Communication System. The system installed on the ST is a United Marine System that includes a 1MC System, a 21MC System, and a General Alarm System. A marine integrated control cabinet and an intelligent digital controlhead facilitate essential system interfaces and operations. Figure 1-48 provides a schematic view of the integrated communication system. See TM# 55-1925-255-14&P for additional reference. System components are described below:

(a) Public Address Talkback Rack Monitor Panel. The public address talkback rack monitor panel (United Marine Model HMUM-RACK-1338) is a central control station for the public address system. The unit is located in the HVAC room.

(b) Marine Integrated Control Cabinet. The marine integrated control cabinet (United Marine Model 1388-ICSC) serves as a distribution panel for the integrated communication system. The unit is located in the HVAC room.

(c) Digital Control Head/Loudhailer/General Alarm. The digital control head (United Marine Model UM-IDCH-7200) provides a base of operation for the 1MC System, 21MC System, and General Alarm. The control head is a microprocessor controlled station unit providing Pilot House users with access to public address, loudhailer, and talkback.

(d) Loudhailer Speaker Horn. The loudhailer speaker horn (United Marine Model HMUM-HSWR-20) is a 20-inch (0.508 Meters) weatherproof speaker mounted on the Pilot House Overhead. The unit provides public address, general alarm, and loudhailer capabilities.

(e) Public Address Horn Loudspeakers. The public address horn loudspeakers (United Marine Model HMUM-HSIS-15/8 and JMUM-CJSW) are 8-inch (0.2032 Meters) weatherproof speakers mounted at various points on the ST to include the generator room, engine stores compartment, forward stores, engine room, and tankage space. The units provide public address and general alarm capabilities.

(f) Public Address Talkback Speakers. Public address talkback speakers (United Marine Model HMUM-USSR-TB-J) provide public address reception and talkback capabilities. These speakers are mounted at various points on the ST to include the forward main deck, aft main deck (starboard), and main deck (port).

(g) Surface Mount Interior Loudspeakers. The compact single coil surface mount interior loudspeakers (United Marine Model HMUM-SFIS-S-6) are high efficiency loudspeakers which overcome ambient noise. These speakers are mounted at various points on the ST to include the upper engine room, HVAC room, and mess area.

(f) Remote Intercom Stations. The remote intercom stations (United Marine Model UM-RIMI) provide multi-purpose intercom calling. Remote intercom stations are provided in the Pilot House, engine room, generator room, tankage space, mess area, double berthing area, and triple berthing area. Rotating beacons (United Marine Model 200-E) are provided for the engine room station and for the tankage space station.

(2) Sound Powered Telephone. The sound powered telephone system (Figure 1-49) provides voice communication throughout the ST by means of fixed phone stations and portable units (head/chest sets). Since the system is voice powered only, it is operational even with the loss of vessel power. Three main stations are provided: one each in the Pilot House, Engine Room, and Mess Area. The engine room station has a call light on the phone to indicate an incoming call as well as a bell and a rotating blue beacon. Jack boxes for operation with head/chest sets are provided as well. The jack boxes are functional when coupled to the head/chest sets located one each port and starboard in the upper engine room. Jack boxes are also located on the forward main deck, aft main deck, and in the lower engine room. For additional information, see TM# 55-1925-255-14&P.

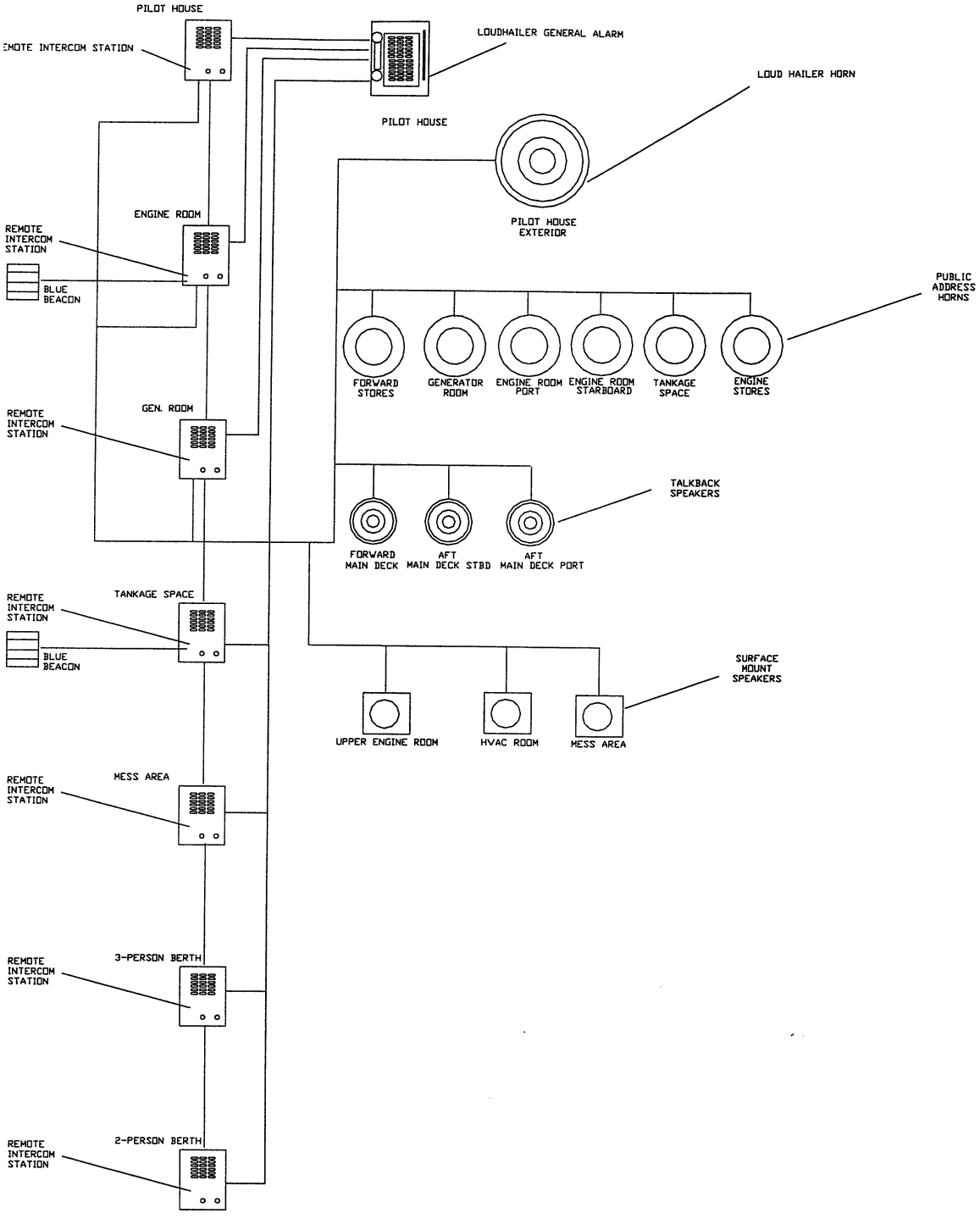


Figure 1- 48. Integrated Communication System

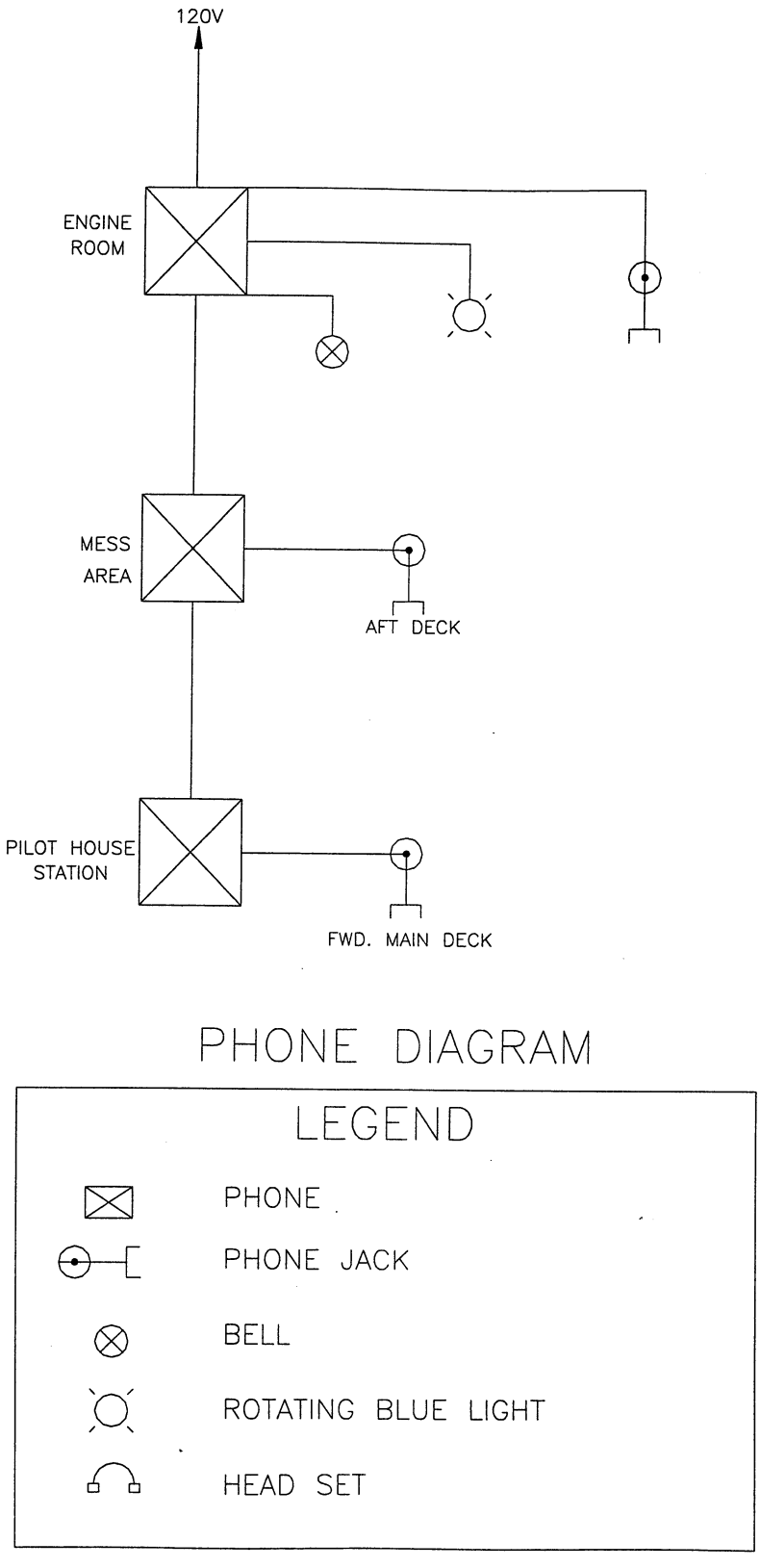


Figure 1-49. Sound Powered Telephone Arrangement

c. External Communication System. The ST is outfitted with the following external communication equipment:

(1) Hand Held VHF Radio. A Bendix/King E-Series handheld two-way VHF transceiver is used for bridge-to-bridge, bridge-to-deck or dock and general ship-to-shore communication. The unit has 15 channels with 14 programmable groups for each channel. Features of the transceiver include scanning, priority scanning, low battery indicator and a transmit time out timer.

(2) Digital Selective Calling VHF Radios. Two Ross Engineering Digital Selective Call (DSC) Radio Sets, Model DSC500, marine VHF transceivers are provided. The unit is an all-channel DSC FM Transceiver operating in the VHF marine frequency range. The antenna for the unit is a reinforced Fiberglass vertical whip antenna, Shakespeare Model 396-1. The antenna is used with the DSC500 for both transmitting and receiving over VHF frequencies.

Essential system characteristics include the following:

(a) Compact transceiver with microphone.

(b) Power output is 25 watts high power and 1 watt low power.

(c) 57 standard transmitter communication channels and 42 expansion channels.

(d) 57 standard receiver communication channels and 10 weather channels.

(e) Weather proof.

(f) Ability to monitor any two channels, ten weather channels, or user selected channels.

(g) Dedicated power converter (from 115 VAC to 12 VDC) with automatic switchover to battery operation.

(3) VHF-FM (AN/VRC-90A) (with Imbedded COMSEC) Radio. The ST's VRC radio consists of an AN/VRC-90A Sincgars system providing short-range, two-way, radio telephone communication in the 30.00 to 75-95 MHz range using frequency modulated (FM) transmission and reception. The transmitter power output is 0.5 – 8.0 watts in the low power mode, 35 watts in the high power mode. Power input requirements are 10 amps at 25.5 VDC. The system includes a RT-1523/VRC Receiver/Transmitter, an AM-7239/VRC Amplifier Adapter, an AM-3238/VRC Power Amplifier, an AM-6352/VRC Mounting Base, an AS-3900/VRC Antenna base and a MK-2332 Installation Kit. A Model 4242-MK1 antenna is provided for use with VRC-90A Mobile Radio Set.

(4) Emergency Position Indicating Radio Beacon (EPIRB). The Emergency Positioning Indicating Radio Beacon (EPIRB) located in a special bracket mounted forward of the air conditioning Compressor on the 01 Deck. The EPIRB is capable of automatically floating out of its bracket and activating if the vessel sinks or is capsized.

When turned on, the Class 406 EPIRB transmits tone modulated signals on VHF 406.025 and 121.5 MHz simultaneously. Rescue aircraft or vessels equipped with suitable direction finding equipment can "home" to the transmitting unit. Another means of detection is by Search and Rescue Satellite-Aided Tracking (SARSAT) or COSPAS emergency surveillance systems.

d. Alarm Systems. The ST is outfitted with the following alarm and monitoring equipment:

(1) Fire and Smoke Alarm System. The fire and smoke alarm system provides visual and audible indication of high temperatures and smoke in all crew rest areas, storage and machinery compartments. The ST is divided into five fire zones: Zone 1 is in the Pilot House and HVAC room; Zone 2 is in the 2-person berth on the Hold deck; Zone 3 is the mess area, the head, 3-person

berth and generator room; Zone 4 is the Hold deck; and Zone 5 is the CO_2 pressure switch which is actuated when the CO_2 system is manually actuated. This system may be actuated in any of the following methods: automatically by five detectors; automatically by heat probes; and automatically by actuation of the CO_2 system. Figure 1-50 provides a plan view of the fire and smoke alarm system. Key components of the system are identified below:

(a) Fire Alarm Control Panel. A Pyrotronics System 3 Fire Control Panel, Model CP-35, is located in the PilotHouse on the starboard side. This unit serves as the central control for the fire and smoke alarm system.

(b) Photoelectric Smoke Detectors. Four Model PE-3T photoelectric smoke detectors are located on the ST as follows:

1 HVAC Room. A detector is located at centerline in the HVAC room between Frames 8 and 9.

2 2-Person Berth. A detector is located on the starboard side at Frame 13.

3 Pilot House Deck. A detector is located centerline in the Pilot House at Frame 8.

4 Mess Area. A detector is located starboard inboard in the mess area.

(c) Thermal Detectors. Seven thermal detectors are located on the ST as follows:

1 Main Deck.

(a) A 200°F (92.4°C) thermal detector is located in the upper engine room (starboard) between Frames 17 and 18.

(b) A 200°F (92.4°C) thermal detector is located centerline in the generator room between Frames 21and 22.

(c) A 135°F (56.65°C) thermal detector is located in the head.

2 Hold Deck.

(a) Two 200°F (92.4°C) thermal detectors are located in the lower engine room, one each port and starboard outboard at Frame 17.

(b) A 135°F (56.65°C) thermal detector is located centerline in the forward storage at Frame 4.

(c) A 135°F (56.65°C) thermal detector is located centerline in the tankage space at Frame 11.

(d) Manual Pull Stations. Manual pull stations actuate the fire alarm system. Six manual pull stations are located on the ST as follows:

1 Hold Deck. A station is located starboard outboard in the forward storage at Frame 6.

2 Main Deck.

(a) A station is located in the mess area between Frames 9 and 10.

(b) Two stations are located forward of the generator room, one each port and starboard between Frames 19 and 20. The stations are mounted on the bulkhead, just forward of the exit to the main deck.

3 01 Deck. A station is located starboard outboard at Frame 13 in the 2-person berth.

4 Pilot House Deck. A station is located on the starboard side of the console.

(e) Remote Alarm Indicating Panel. The remote alarm indicating panel is an 8-lamp panel located in the upper engine room just forward of the main deck door on the starboard side.

(f) Horn Strobe Alarm Indicators. Seven horn strobe alarm indicators are located on the ST as follows:

1 Hold Deck. A horn strobe is located on the starboard side of the front storage between Frames 5 and 6. A horn strobe is also located forward centerline at Frame 8 in the tankage space.

2 Main Deck. A horn strobe is located in the mess area between Frames 9 and 10; one is located centerline aft in the walkway at Frame 19 and one is located on the forward port side of the generator room.

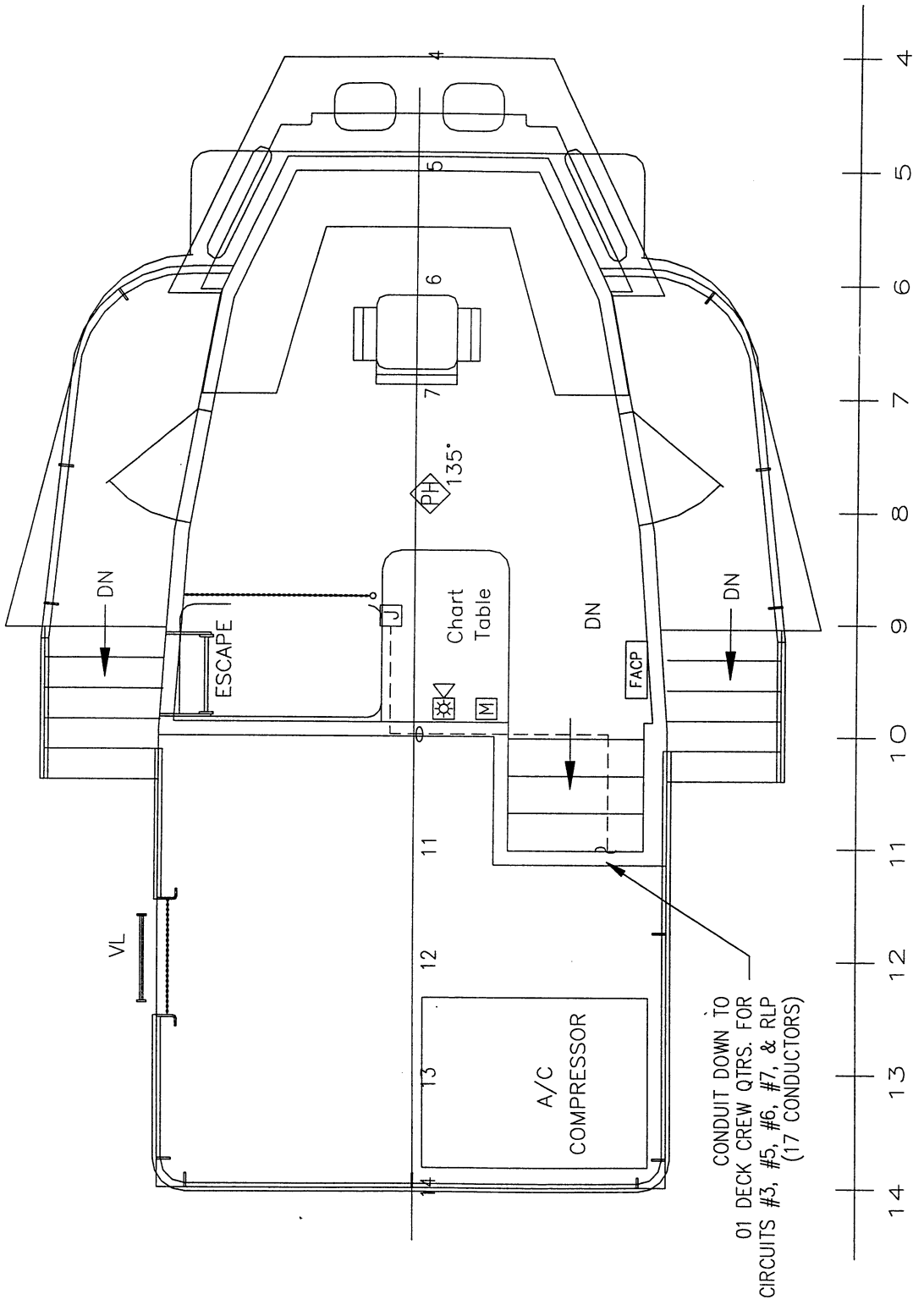
3 01 Deck. A horn strobe is located on the forward of the linen locker on the starboard side at Frame 13.

4 Pilot House Deck. A horn strobe is located forward of the fire alarm control panel on the port side at Frame 8.

(2) Flooding Alarm. This system provides visual/audio indication of water levels in monitored compartments reaching a level above prescribed limits. Sensors are installed in the bilges of all spaces below the waterline and subject to flooding resulting from damage, improper operation, malfunction, or failure of equipment. Flooding in any compartment is indicated on alarm panel located on the forward bulkhead of the engine room. The system supports both manned and unmanned monitoring of the ST. High and low alarm lights are independently wired in each watertight space. An alarm light (blue) is mounted on the aft mast located topside.

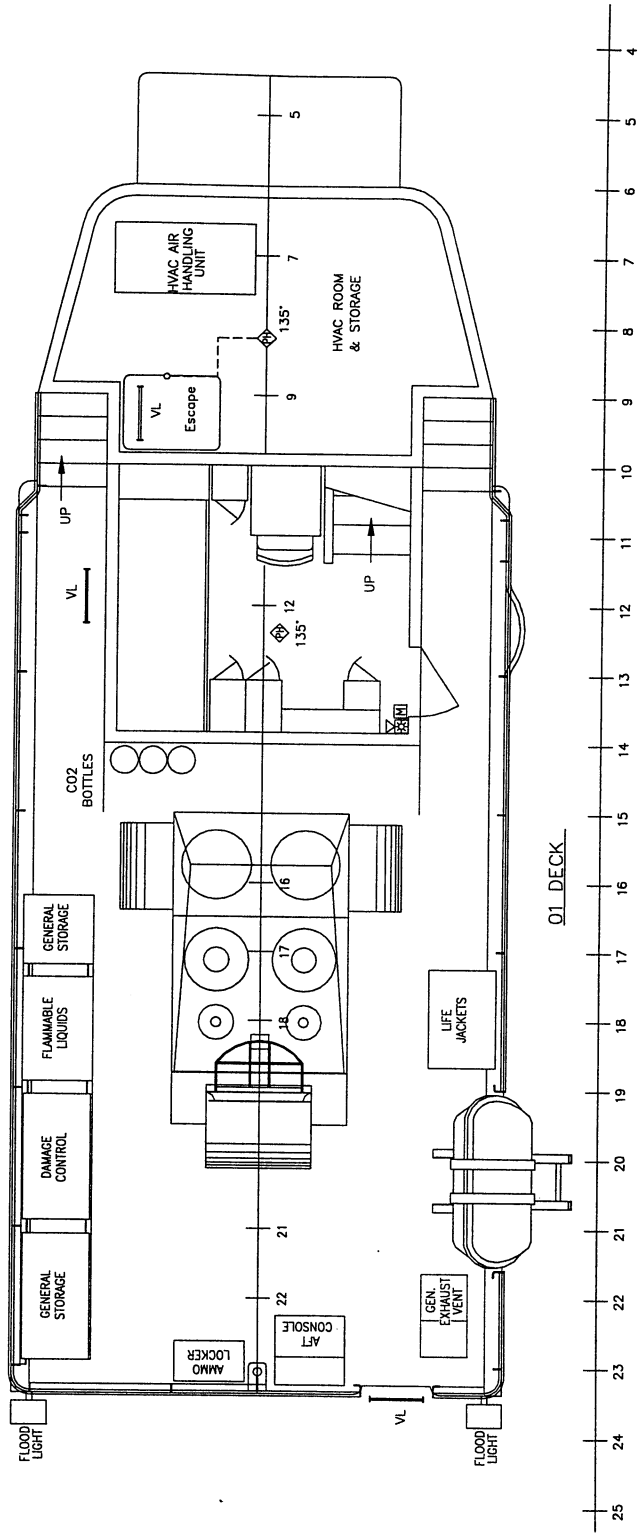
(3) Carbon Monoxide Indicators. Carbon monoxide indicators are installed in the generator room, the engine room, and berthing areas. The carbon monoxide alarm panel is located on the starboard side of the Pilot House console. Audible and visual alarms indicate warning and danger levels of Carbon Monoxide concentration in the air. Remote alarms are provided outside of the monitored spaces.

(4) Rotating Beacons (Blue). A rotating beacon (United Marine Model 200-E) is located port of centerline in the engine room to indicate a general alarm.



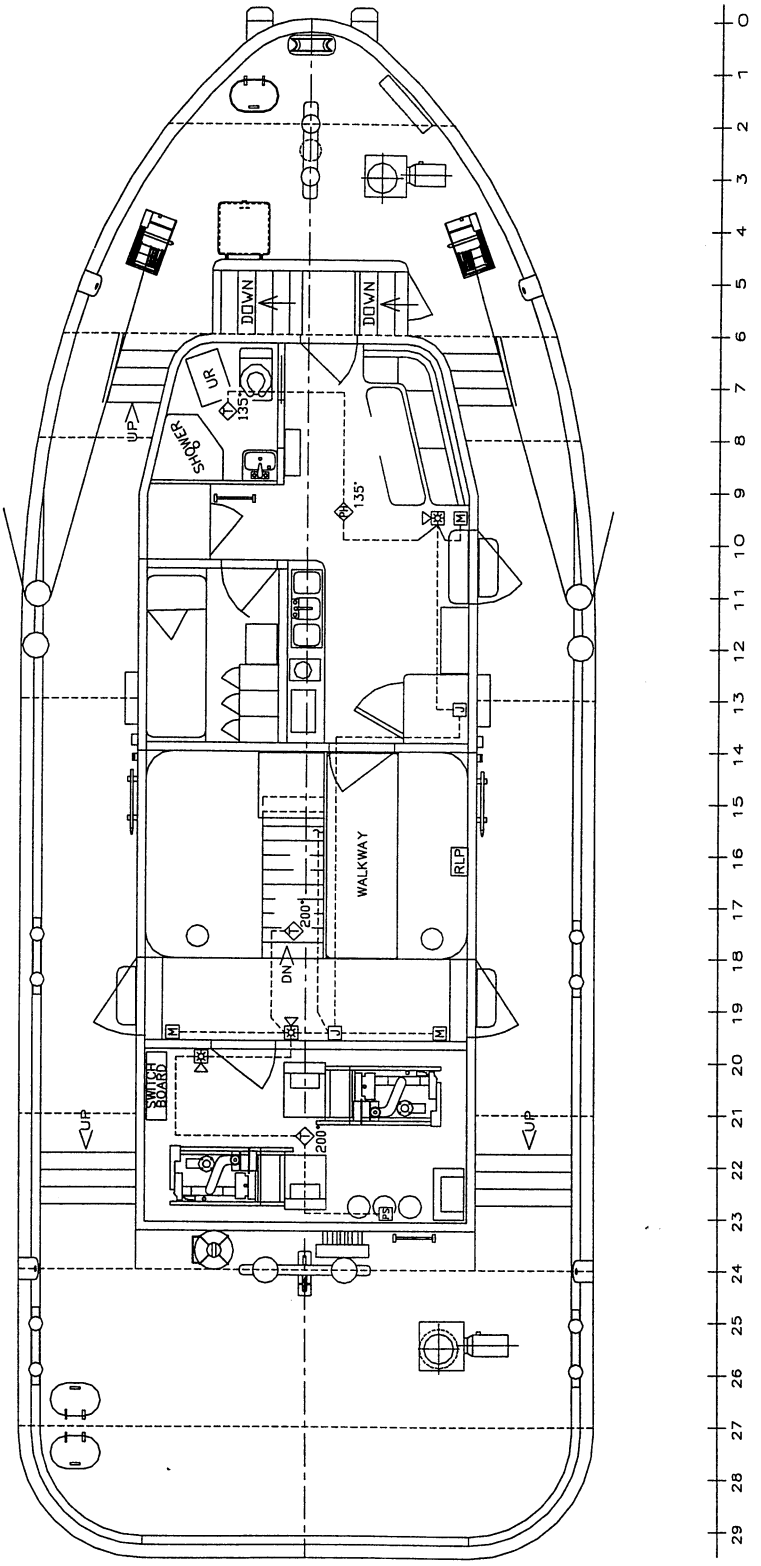
Pilot House Deck

Figure 1-50. Fire Detection System, Sheet 1 of 5.



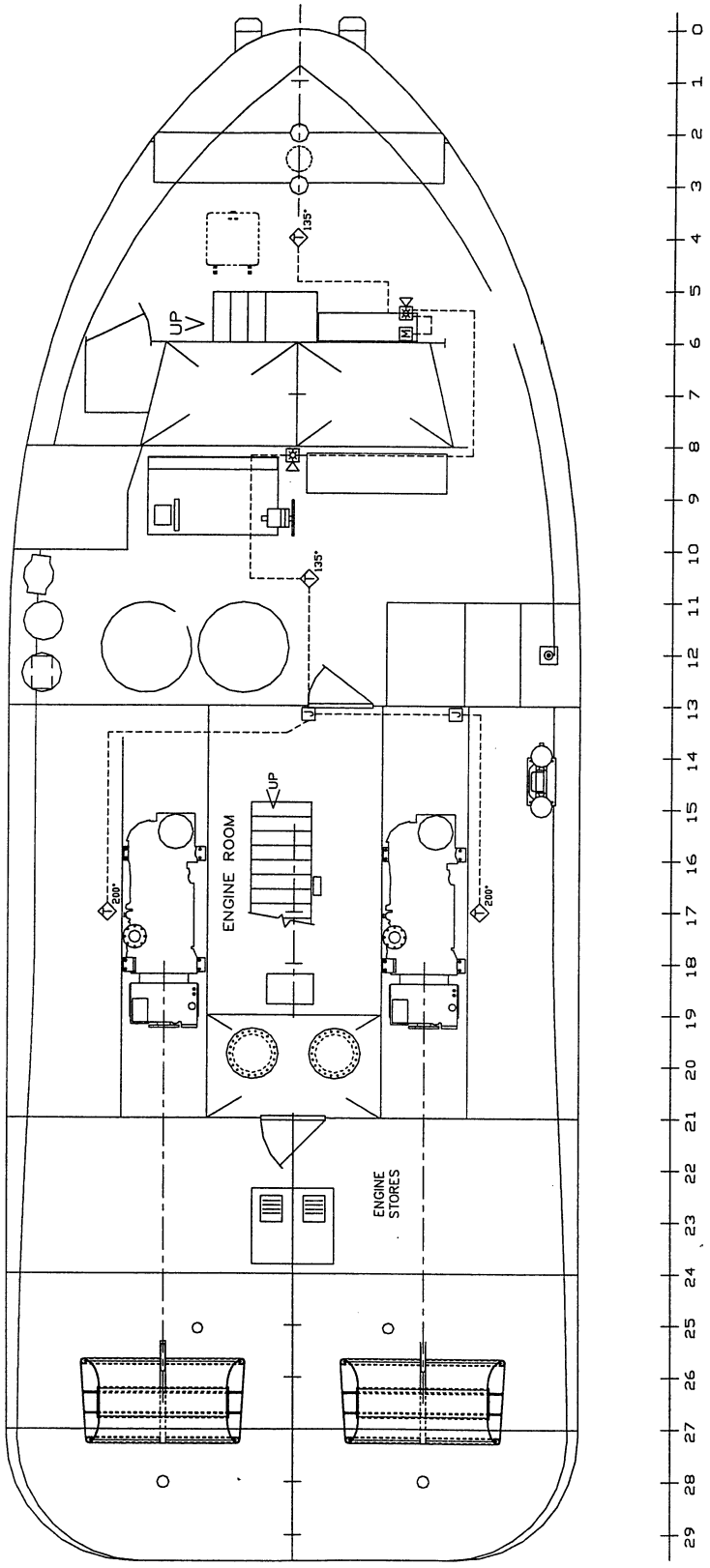
01 Deck

Figure 1-50. Fire Detection System, Sheet 2 of 5.



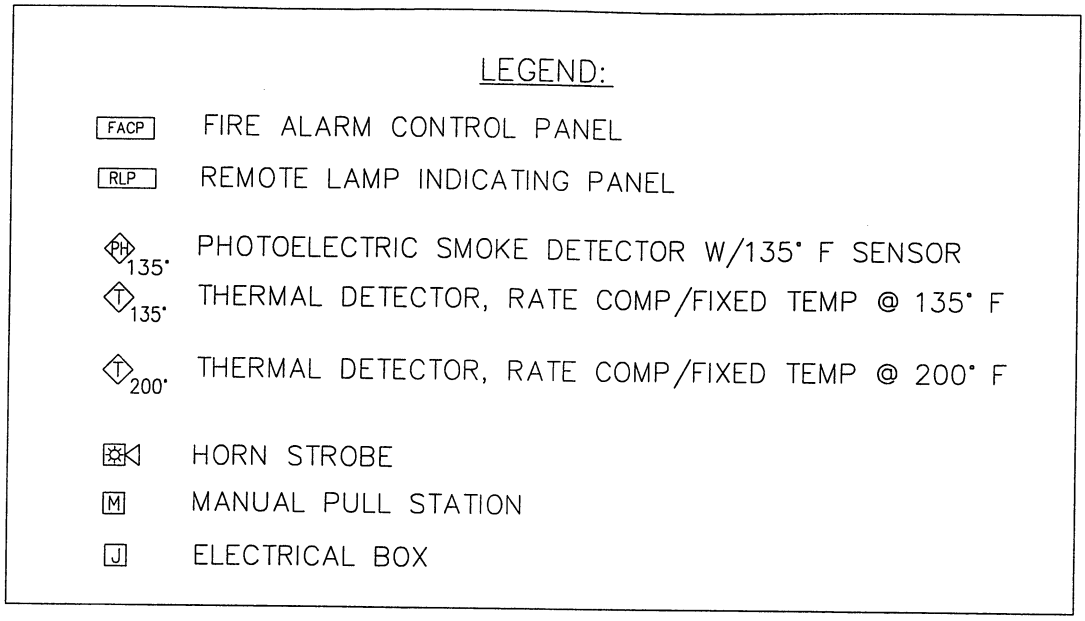
Main Deck

Figure 1-50. Fire Detection System, Sheet 3 of 5.



Hold Deck

Figure 1-50. Fire Detection System, Sheet 4 of 5.



Drawing Key

Figure 1-50. Fire Detection System, Sheet 5 of 5.

1.16.4. Steering System. A plan view of the steering system is provided in Figure 1-51. The system installed on the ST is a Control General Corporation electro-hydraulic, ram type steering system. The system operation is such that a selected electric motor driven pump or pumps on a hydraulic power unit supplies hydraulic oil to a solenoid-operated directional control valve (four-way valve). Electrical signals from one of the rudder command input devices (e.g. follow up lever/amp, non-follow up lever) are used to energize the left or right solenoid of a directional control valve(s) and the solenoid of a divert/unloading valves. Hydraulic oil is then ported to hydraulic steering cylinders to position the rudder in the desired angle.

Key components of the system include hydraulic components and electronic components. Each of these is described in the paragraphs that follow.

a. Electronic Components. The electronics components of the steering system include the following:

(1) Pilot House Control/Alarm Panel. The pilothouse control/alarm panel (Model A0051N) consists of the following components:

(a) Steering Motor Selector Switch. The steering motor selector switch is used to select the desired pump, directional control valve, divert/unloading valve, and amplifier to be used for steering.

(b) Steering Mode Selector Switch. The steering mode selector switch is used to select the desired steering mode (e.g. follow up, non-follow up, or aft deck).

(c) Lamp Dimmer Control. The lamp dimmer control provides adjustment of the intensity of all indicator lamps on the Pilot House control/alarm panel.

(2) Follow Up Levers. Two full follow up levers (Model 301147) are provided. The follow up lever unit is used to select a desired rudder position as indicated by the rudder angle indicator. The full follow up lever unit consists of a helm, lever, a rudder angle indicator, gearing, and a potentiometer.

(3) Dual Non Follow Up Lever. A dual non-follow up lever (Model A0054C) is provided. The non-follow up lever is used to move the rudder to a desired position. The operator handle is spring centered to the center "OFF" position. Movement left or right will cause the rudder to move in the appropriate direction.

(4) Rudder Angle Indicator. A rudder angle indicator (Model 303180) is provided. The rudder angle indicator works in concert with the feedback units to indicate rudder position. The face is illuminated via back lighting.

(5) Triple Pot Feedback Units. Two triple pot feedback units (Model 300393-1) are provided. The feedback units perform various functions. They contain potentiometers that send electronic signals to the rudder angle indicators and the follow up amplifier in relation to the position of the rudder. In addition, the feedback units contain limit switches that are used to stop the rudder from moving beyond a pre-determined angle.

(6) Pilot House Distribution Panels. A Pilot House distribution panel (Model A0071J) is provided. The panel is mounted in the HVAC room and provides a mechanism for consolidating wires.

(7) Steering Amplifiers. Two steering amplifiers (Model 30112) are provided. The full follow up steering system incorporates two independent, single speed amplifier and power supply systems. This serves to provide rudder positioning in response to the operator's command in follow up mode. When the operator moves the full follow up steering lever to a position corresponding to a desired rudder angle as indicated by the rudder angle indicator, the steering amplifier, located in the HVAC room, causes the rudder to move exactly that angle and stop.

(8) Emergency Steering and Transfer Switch Panel. An engine room panel with emergency steering control (Model A0072H) is provided. The junction box is used to consolidate wiring in the steering flat. The box also serves as a means for transferring steering to the emergency steering station

mounted on the unit. A two position switch is used to select the proper mode (Normal or Emergency) of control of the steering system.

b. Hydraulic Components. The hydraulic components of the steering system include the following:

(1) Hydraulic Power Unit. The hydraulic power unit, located in the Engine Stores, is one of the essential components of the steering system. The dual pump unit and its associated components convert electrical rudder orders into hydraulic fluid flow that moves and holds the rudders at an ordered angle. The hydraulic vane pumps a fixed flow rate. Each vane pump is driven by a 5hp, 1800 rpm, electric motor operating at 440VAC, 3 phase, 60hZ. The pilot operated directional control valve ports hydraulic fluid from the pumps to the proper ram or cylinder ports upon receipt of electrical commands. In a normal steering condition with no electrical commands, the entire fluid flow from the pump is returned to the reservoir via the four-way valve. When the directional control valve receives a rudder command it will port the fluid from the pump out to the cylinder rams.

The hydraulic power unit consists of the following equipment mounted on a dual 28-gallon (105.9884 Liters) hydraulic reservoir:

(a) Two 5hp totally enclosed fan closed (TEFC) electric motors.

(b) Two vane type hydraulic pumps.

(c) Two check valves.

(d) Two directional control valves.

(e) Return line filter.

(f) Two suction strainers.

(g) Relief valve.

(h) Two filler breathers.

(i) Two temperature/level gauges.

(j) Pressure gauge.

(2) 18-inch (0.4572 Meters) and 24-inch (0.6096 Meters) Stroke Hydraulic Steering Cylinders. The hydraulic cylinders are used to directly position the rudders. The body of each hydraulic cylinder is attached to the structure of the vessel on one end. The piston rod, which extends from the other end of the hydraulic cylinder, is attached to the rudder tiller arm. Hydraulic fluid, under pressure, flows into one end of the hydraulic cylinder and out of the other end forcing the piston within the cylinder to move either into or out of the cylinder. The piston is attached to the piston rod, and when the piston is forced to move, the piston rod moves and causes the rudder to move as well. When fluid is not flowing into or out of the hydraulic cylinder, the piston, piston rod, and therefore the rudder, cannot move. The flow of hydraulic fluid into and out of the hydraulic cylinders is provided by the dual hydraulic power unit under the control of the solenoid valves.

(3) Dual Cylinder Crossover Relief Valve. The cylinder relief valves are used to relieve high cylinder pressure in case the cylinders are acted upon by an outside force.

c. Modes of Operation. The steering modes available include single speed non-follow up mode, single speed full follow up mode, and emergency steering mode. Each of these is discussed in the paragraphs that follow.

(1) Single Speed Non-Follow Up Mode. The single speed non-follow up mode of steering facilitates directional movement of the rudder by directly controlling the solenoid operated 4-way valve via contacts on the non-follow up lever. Movement of the non-follow up lever handle to the left of its

spring centered position closes the left circuit. The rudder will then move to the left until the circuit is opened. Movement of the non-follow up lever handle to the right of its spring centered position closes the right circuit. The rudder will then move to the right until the circuit is opened. If the hydraulic or electrical power should fail during this mode, the rudder will hold its last position.

The circuits for the left/right non-follow up levers may be opened by any of the following means:

(a) The lever is released (it is spring centered to the "OFF" position).

(b) The rudder limit switch is activated.

(c) The pump switch is turned to the "OFF" position.

(2) Single Speed Full Follow Up Mode. The follow up mode of steering facilitates rudder position control from the follow up lever unit. When the follow up lever is moved to a desired rudder position, the rudder will follow this command by moving to that position. In this mode, the follow up amplifier receives signals from the follow up lever unit (the ordered rudder position) and the feedback unit (the actual rudder position). The amplifier then compares the ordered rudder position to determine which direction the rudder must be moved. The amplifier moves the rudder by controlling the solenoid operated four-way valve via solid state relays in the amplifier. If hydraulic or electrical power should fail during this mode, the rudders will hold the last position.

(3) Emergency Steering Mode. The emergency steering mode is engaged when a switch on the emergency steering and transfer switch panel and junction box in the engine room is switched from the "NORMAL" position to the "EMERGENCY" position. All power to the PilotHouse is disconnected and transferred to the emergency steering station non-follow up push buttons. The emergency rudder angle indicator is powered by a separate source, isolating it from the PilotHouse.

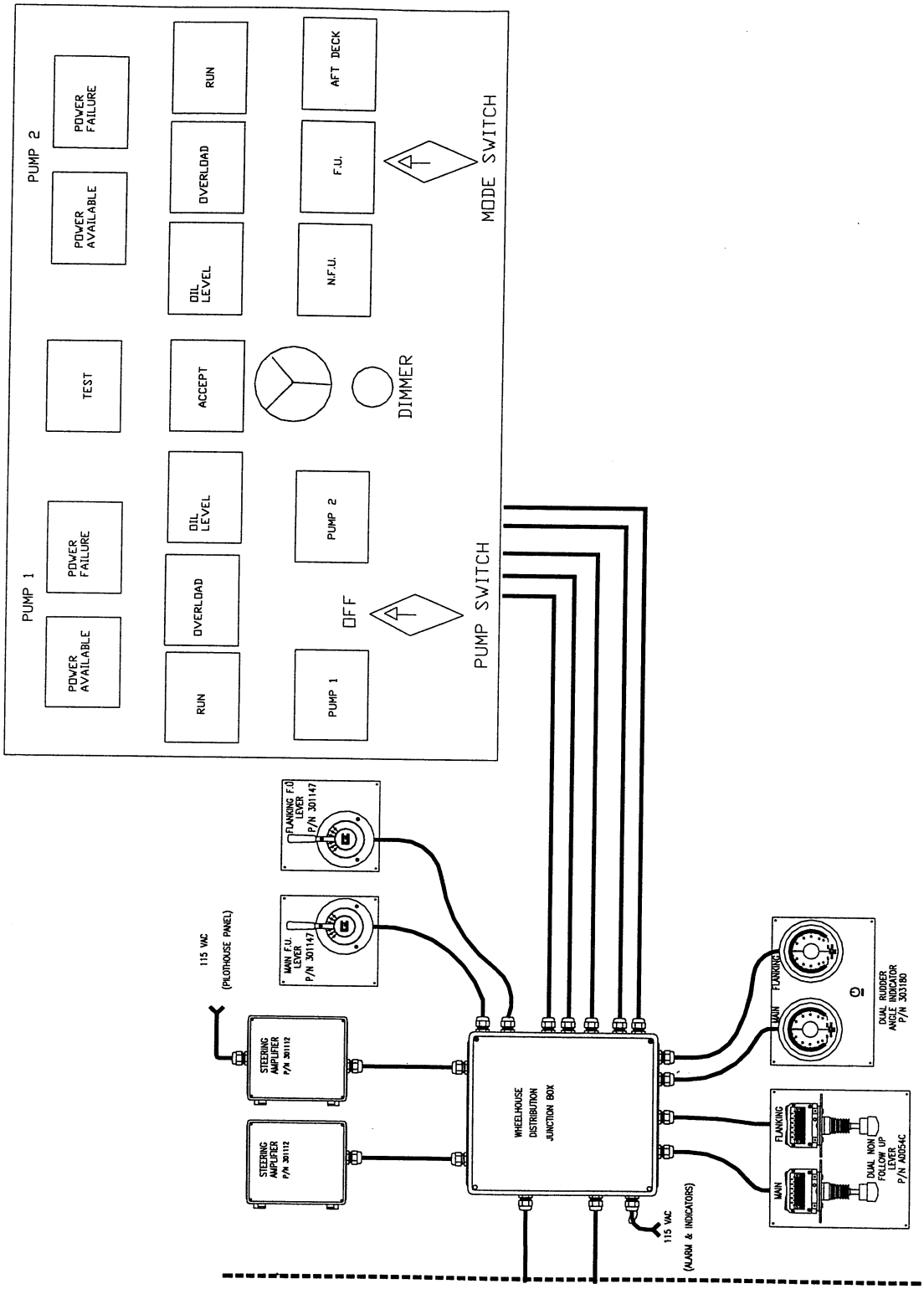


Figure 1-51. Steering System, Sheet 1 of 2

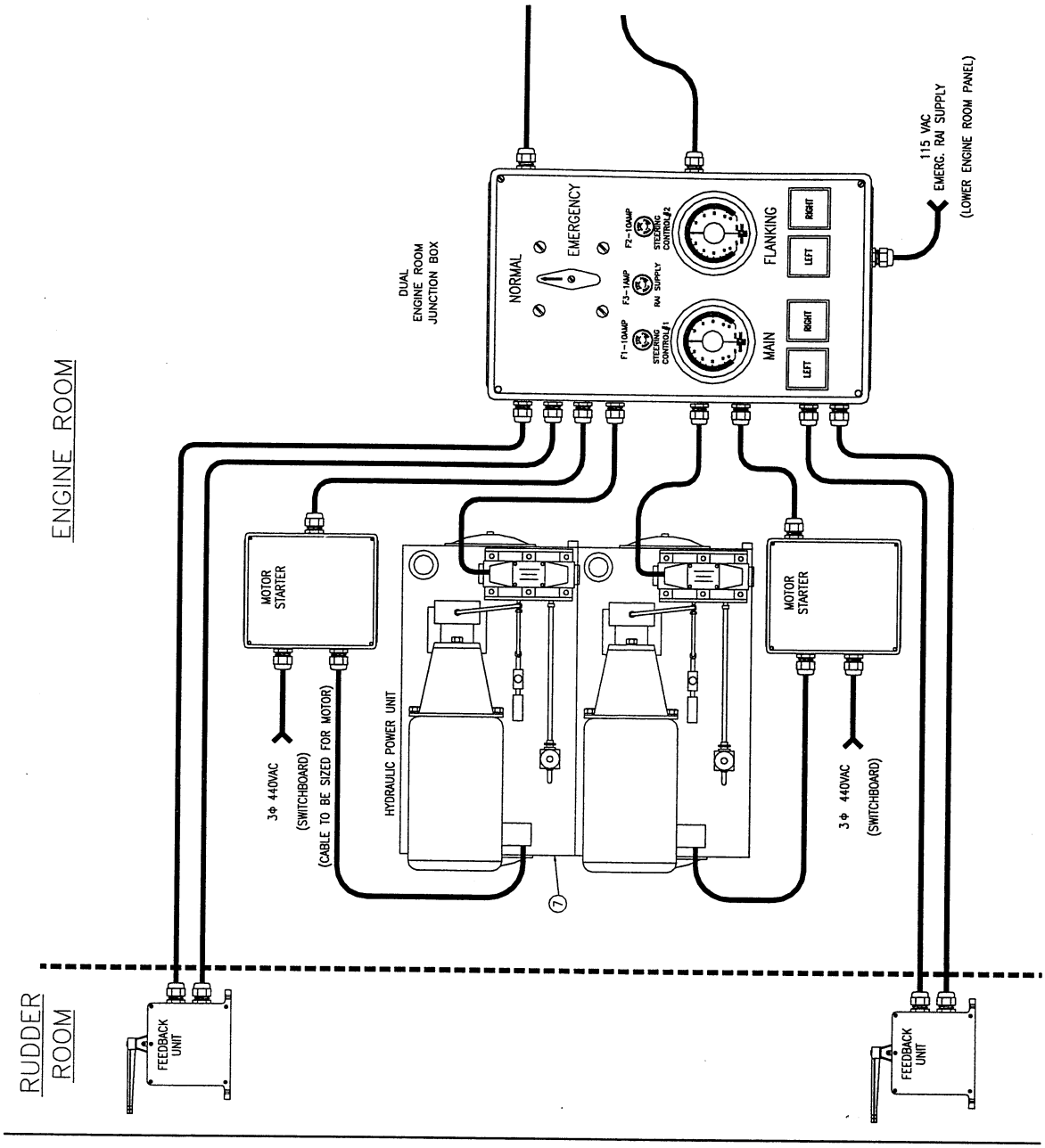


Figure 1-51. Steering System, Sheet 2 of 2

1.16.5 HVAC System. The ST is equipped with an Air Comfort type HVAC system. A plan view of the HVAC system is provided in Figure 1-52. The following sub-paragraphs describe the ST's heating, ventilation, and air conditioning systems.

a. Heating. The heating system consists of a 460VAC/3 phase/60 Hz duct heater (11.8 kW). The duct heater is thermostatically controlled from the PilotHouse. In addition, two electric zone heaters are provided in the generator room, one for each generator. The air handling unit disseminates the heated air throughout the ST as set on the Pilot House thermostat.

b. Ventilation. Mechanical ventilation, using vaneaxial fans for supply and/or exhaust, designed for marine application is used to supply/exhaust air to/from the engine room, generator room, and forward storeroom. The ventilation system is designed to carry away the radiated heat of the machinery space equipment. The head is fitted with an exhaust fan having a capacity of two air changes per minute. The storeroom is provided with a ventilation supply fan having a capacity of one air change per six minutes.

c. Air Conditioning. The air conditioning system installed on the ST has two functioning units. The compressor is located aft of the Pilot House, while the air handling unit is positioned within the HVAC Room. The two units are interconnected by means of refrigerant piping and electrical wiring. Each of these units is described in the paragraphs that follow.

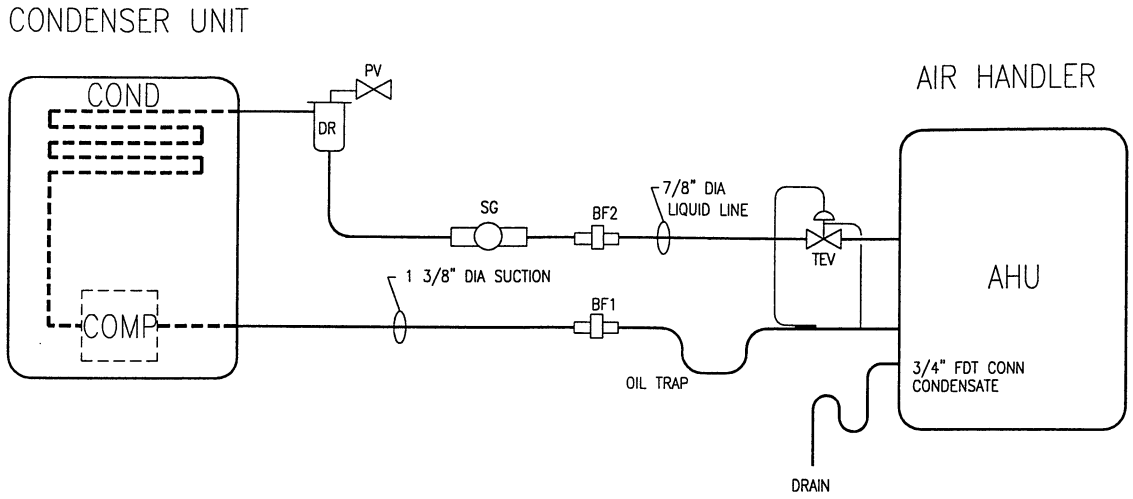
(1) Air Cooled Condensing Unit. The air-cooled condensing unit (Air Comfort Model MACU-060) has a five-ton nominal capacity and is equipped with copper tubing and an aluminum fin epoxy coated condenser coil. Cooled refrigerant from the condenser is routed to the coils in the air-handling unit for dispersal of chilled air.

(2) Air Handling Unit. The air-handling unit (Air Comfort Model MAHU-060) contains a free flow fan which circulates the conditioned air from the coils. The air-handling unit provides conditioned air through ductwork to the following areas:

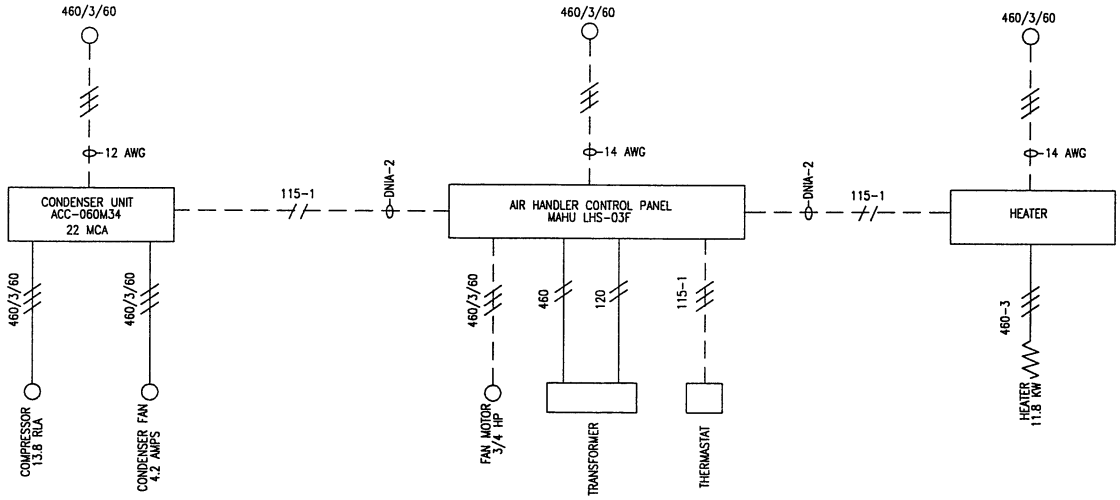
(a) 01 Deck. An air conditioning supply grille is provided in the two-person berth and a supply grille is located in the HVAC room.

(b) Main Deck. An air conditioning supply grille is provided in the three-person berth as well as in the mess area.

(c) Pilot House Deck. Four air conditioning supply grilles are provided in the Pilot House, 2 each port and starboard.

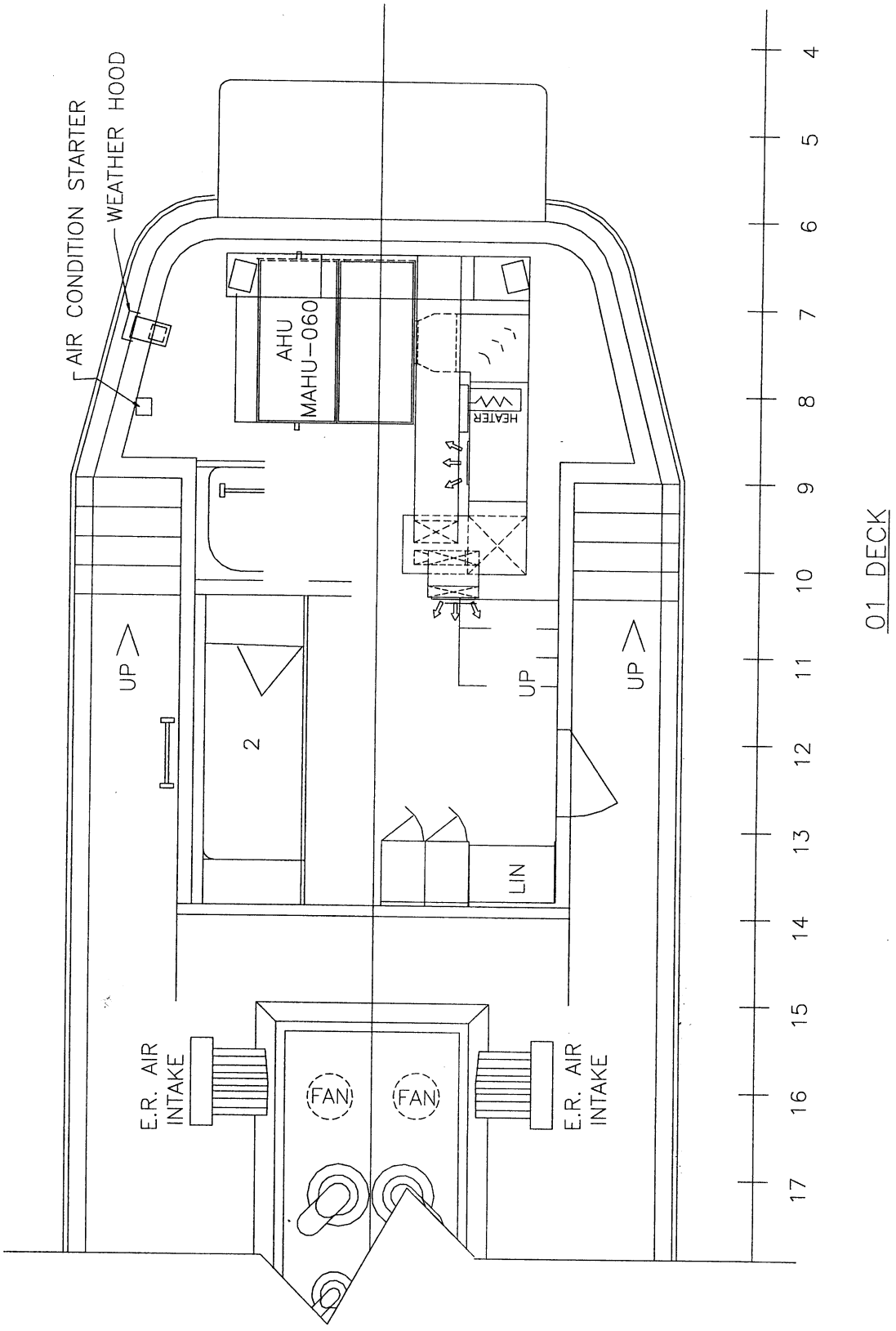


Refrigerant Piping



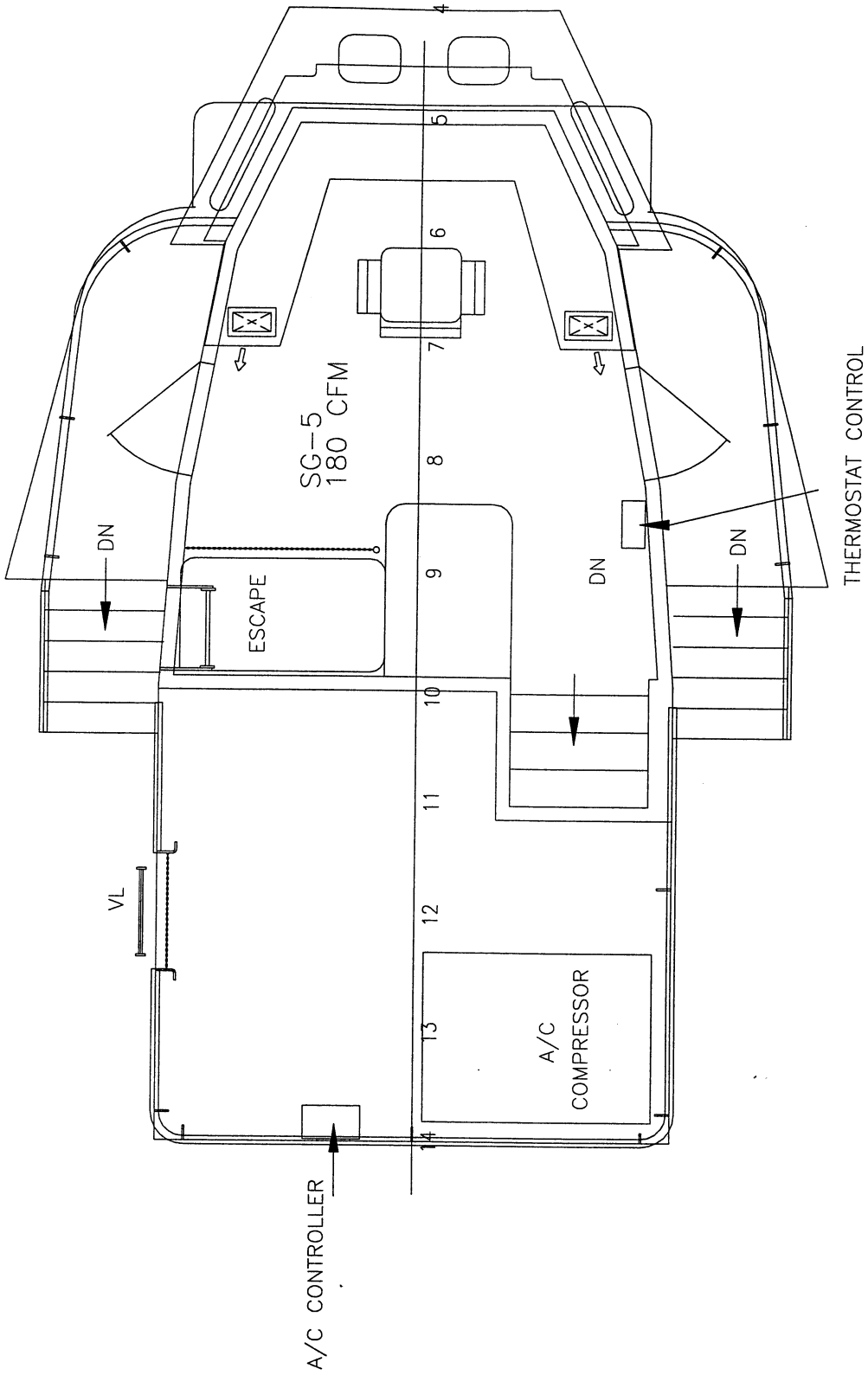
HVAC Schematic View

Figure 1-52. HVAC System, Sheet 1 of 4



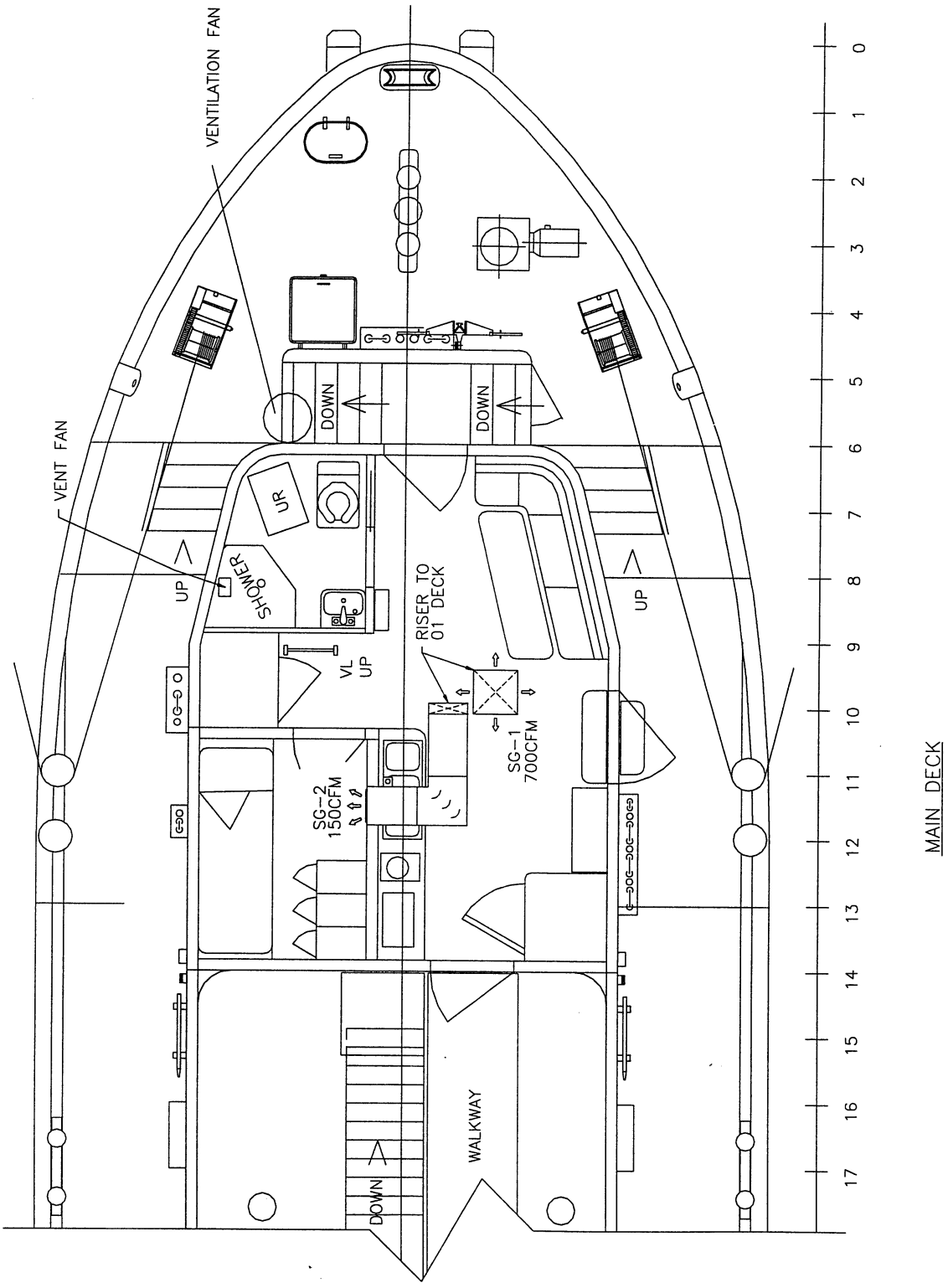
01 Deck Plan View

Figure 1-52. HVAC System, Sheet 2 of 4



Pilot House Deck Plan View

Figure 1-52. HVAC System, Sheet 3 of 4



Main Deck Plan View

Figure 1-52. HVAC System, Sheet 4 of 4.

1.16.6 Potable Water System. A plan view of the potable water system is provided in Figure 1-53. The potable water system consists of two 392 gallon (1,4883.8376 Liters) vented holding tanks, water pump (25 gpm @ 74 Feet (22.5552 Meters) of head, 40 psi cut-in and 60 psi cut-out), 80 gallon (302.824 Liters) pressure tank, water heater, and associated valves, vents, and piping. Holding tanks, located in the tankage space, as supplied from shore via above-deck filling station, provide potable water to various points on the vessel. Both tanks are equipped with level gauges as well as high and low level alarms. The water pump draws from the potable water tanks and supplies water to the pressure tank and water heater, and above deck to shower, lavatory and galley sink.

1.16.7. Bilge/Ballast/Firemain Systems. A plan view of the bilge/ballast/firemain system is provided in Figure 1-54. The following sub-paragraphs describe the ST's integrated bilge, ballast, and firemain systems. The system is designed such that two bilge/ballast pumps are provided and a fire pump is provided. Either of the bilge/ballast pumps may serve as backup to the fire pump.

1.16.8. Bilge System. The bilge system is comprised of pumps, controllers, bilge manifold and associated valves, vents, and piping. Two sump pumps are provided as well. Each of these is discussed below:

a. Bilge/Ballast Pumps. Pumps are designated as Bilge/Ballast Pump #1 and Bilge/Ballast Pump #2. The pumps are 5 HP Burks Model 350G6-2-AB operating at 3500 RPM with a 460VAC, 3 phase, 60 hertz power supply.

b. Bilge Manifold and Associated Valves, Vents, and Piping. The designated bilge pump draws from engine room bilge (and/or bilge manifold) and pumps to Oily Water Tank via 2-inch (0.0508 Meters) piping.

c. Bilge/Ballast Pump Controllers. Motor controllers are designated as Bilge/Ballast Pump #1 Controller and Bilge/Ballast Pump #2 Controller. The controllers facilitate starting of the electric pumps. Pumps are energized and de-energized at the controller.

d. Sump Pumps. Two sump pumps (Rule Model 3700) are provided for pumping out the engine shaft sumps. The pumps are capable of pumping 3700 gallons (14,005.61 Liters) per hour and are submersible with a permanently lubricated ball bearing motor.

1.16.9. Ballast System. The ballast system is comprised of pumps, ballast compartment, and associated valves, vents, and piping. Each of these is discussed below:

a. Bilge/Ballast Pumps. Pumps are designated as Bilge/Ballast Pump #1 and Bilge/Ballast Pump #2. The pumps are designed to be capable of several functions. The pumps can draw from the bilge manifold and pump to the Oily Water Tank; or, they can draw from the sea chest and pump to fire stations, ballast compartment, or to the gray-water tank flushing connection. They can also draw from ballast compartment and pump to overboard discharge.

b. Ballast Compartment. The ballast compartment is located in the Hold Deck between Frames 0 and 2 from centerline, port and starboard.

c. Ballast Compartment Vent and System Valves. A vent for the ballast compartment is located on the starboard side of the forward main deck. This vent provides a mechanism for air to escape from the ballast compartment during filling and for air to return when evacuating the compartment. When the compartment reaches capacity, ballast water will flow from the vent, indicating full capacity. The ballast system valves facilitate the selection of pumping operations to and from the ballast compartment.

e. Bilge/Ballast Pump Controllers. Motor controllers are designated as Bilge/Ballast Pump #1 Controller and Bilge/Ballast Pump #2 Controller. The controllers facilitate starting of the electric pumps. Pumps are energized and de-energized at the controller.

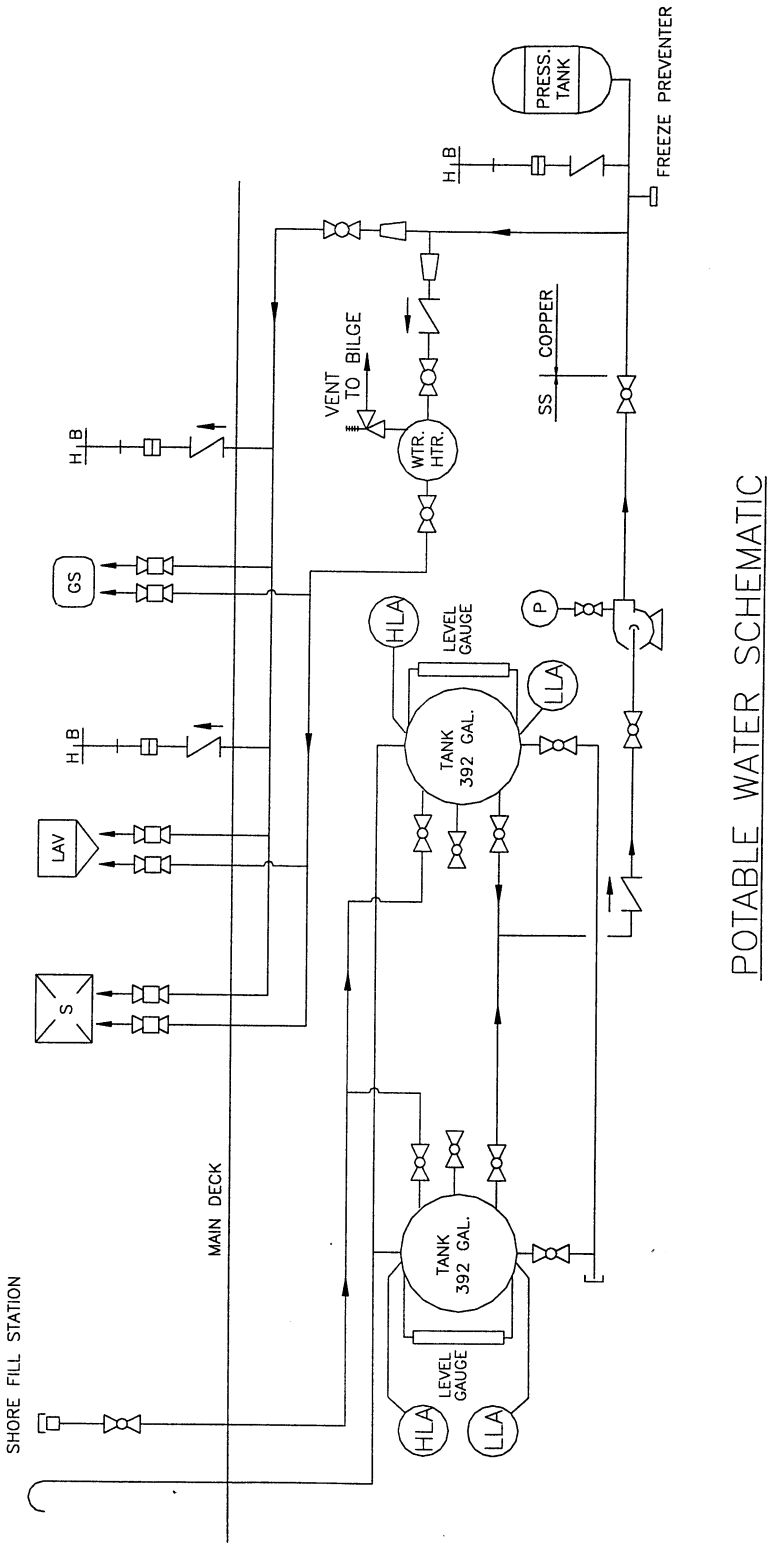
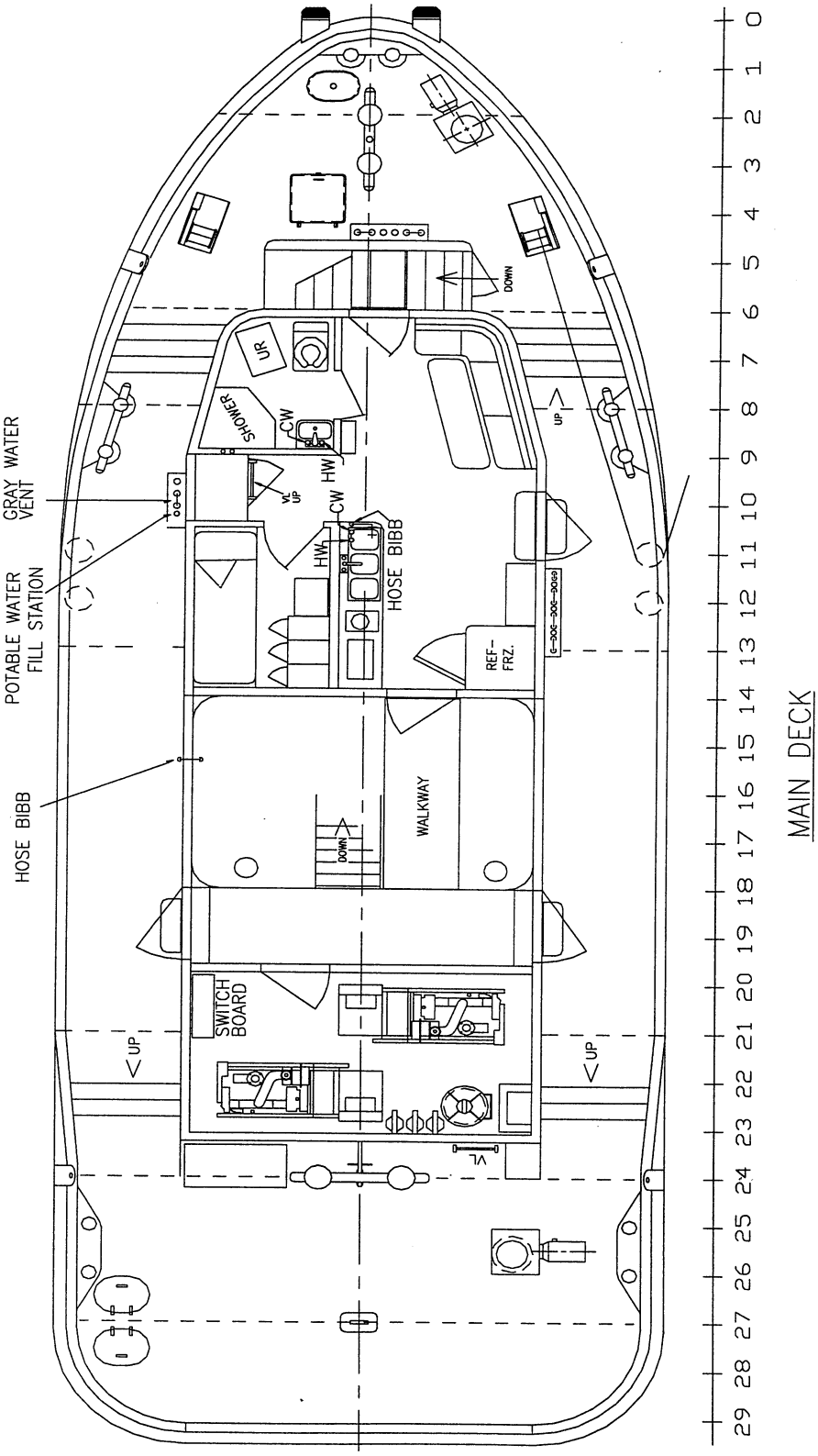
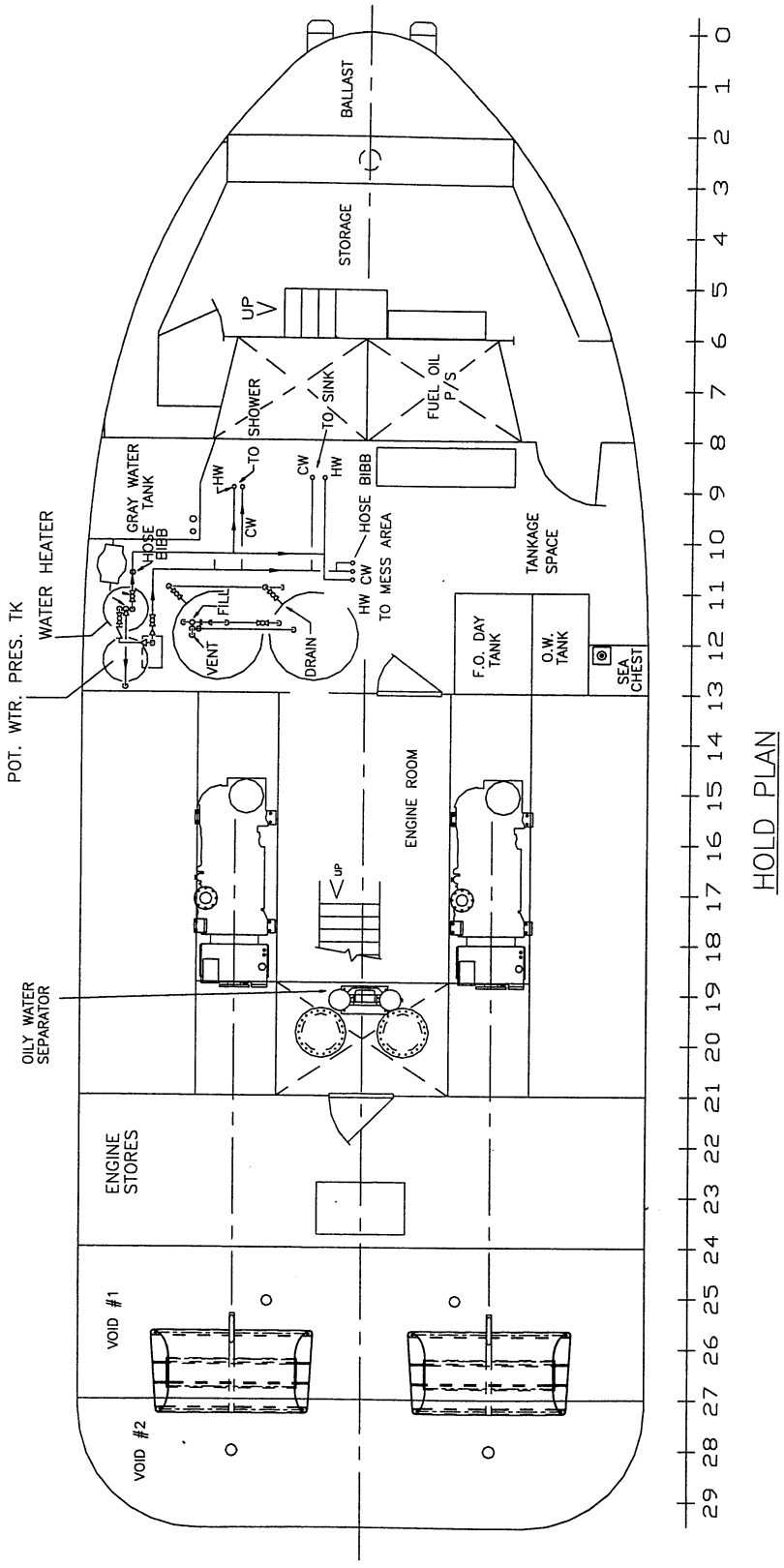


Figure 1-53. Potable Water System, Sheet 1 of 4.



Main Deck Arrangement

Figure 1-53. Potable Water System, Sheet 2 of 4



Hold Deck Arrangement

Figure 1-53. Potable Water System, Sheet 3 of 4

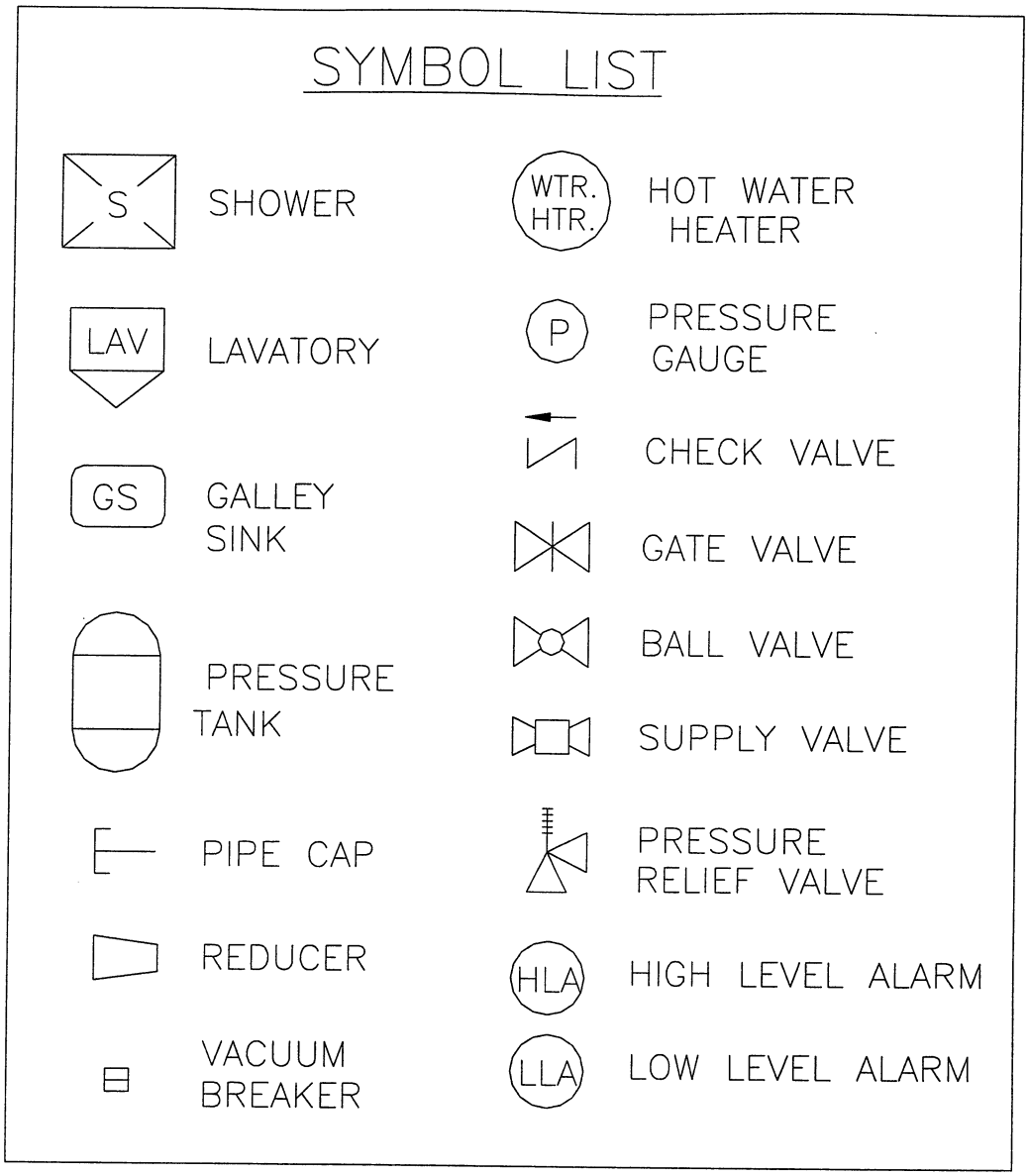
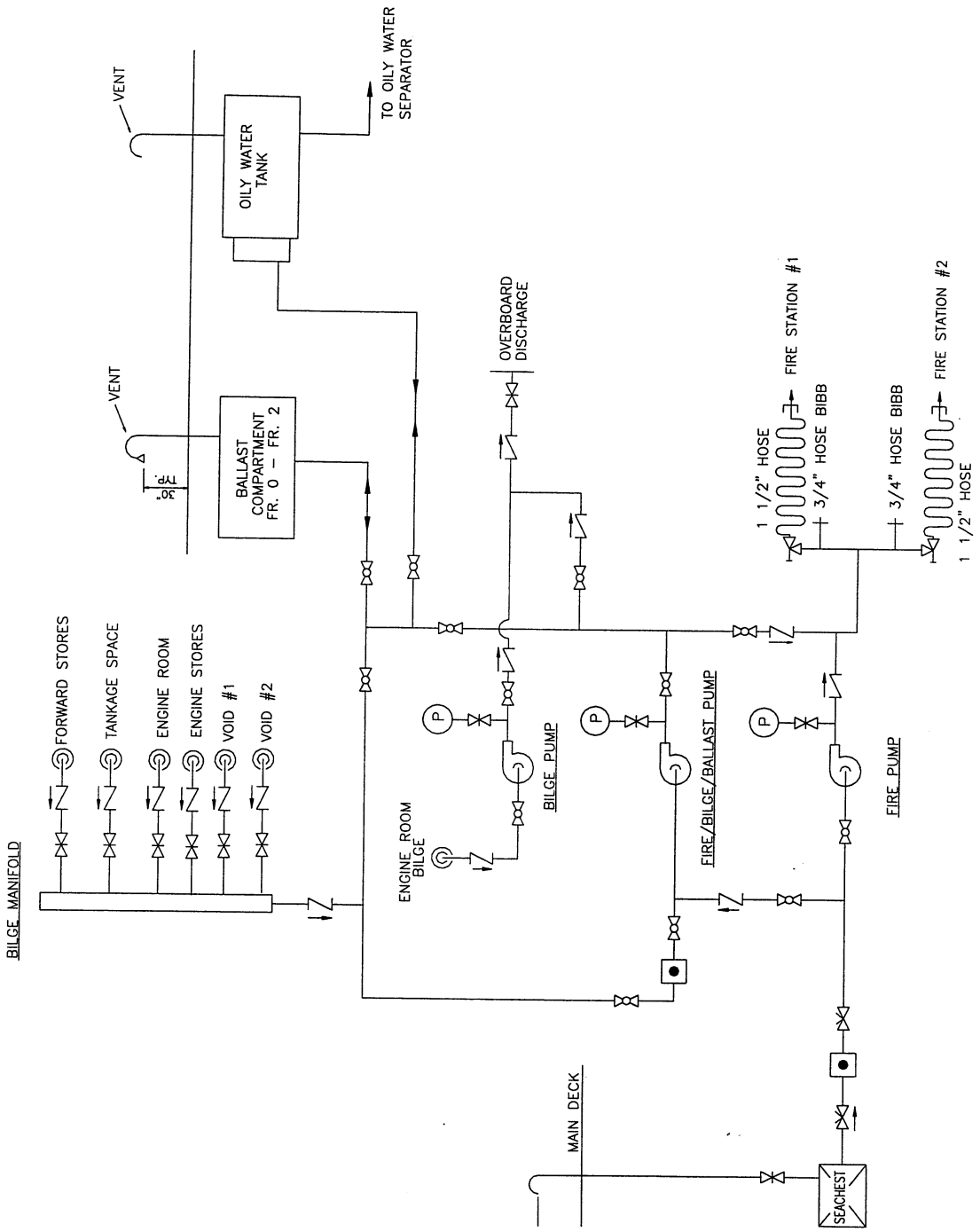
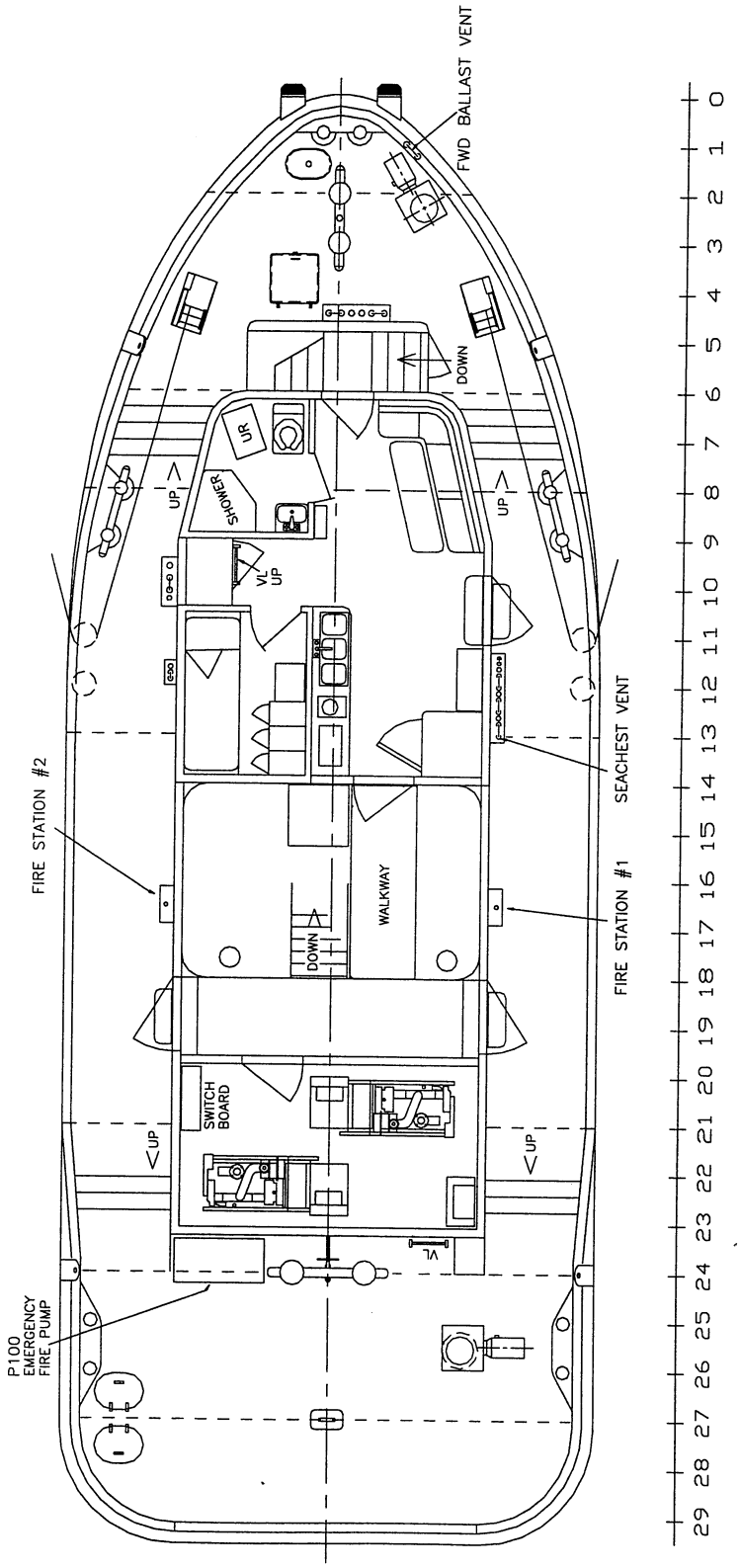


Figure 1-53. Potable Water System, Sheet 4 of 4



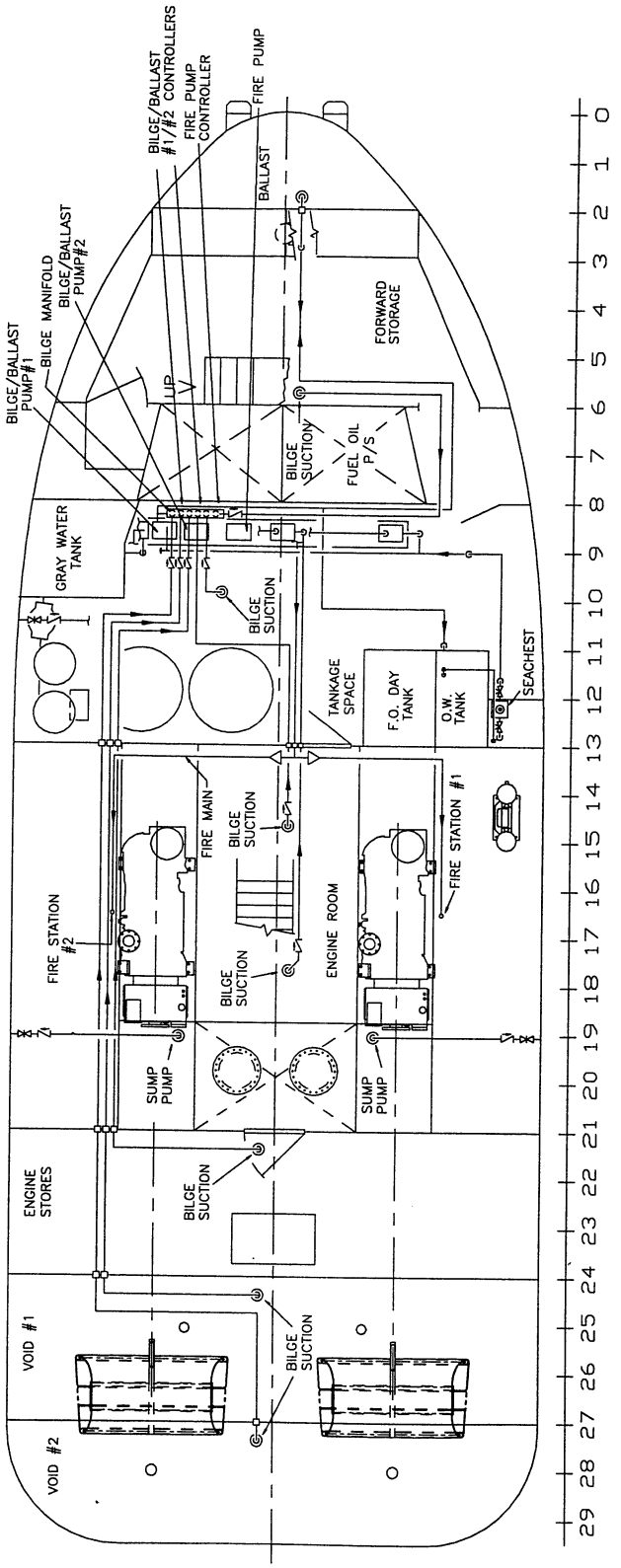
Bilge/Ballast/Firemain Schematic

Figure 1-54. Bilge/Ballast/Firemain System, Sheet 1 of 4.



Main Deck Arrangement

Figure 1-54. Bilge/Ballast/Firemain System, Sheet 2 of 4.



Hold Deck Arrangement

Figure 1-54. Bilge/Ballast/Firemain System, Sheet 3 of 4.

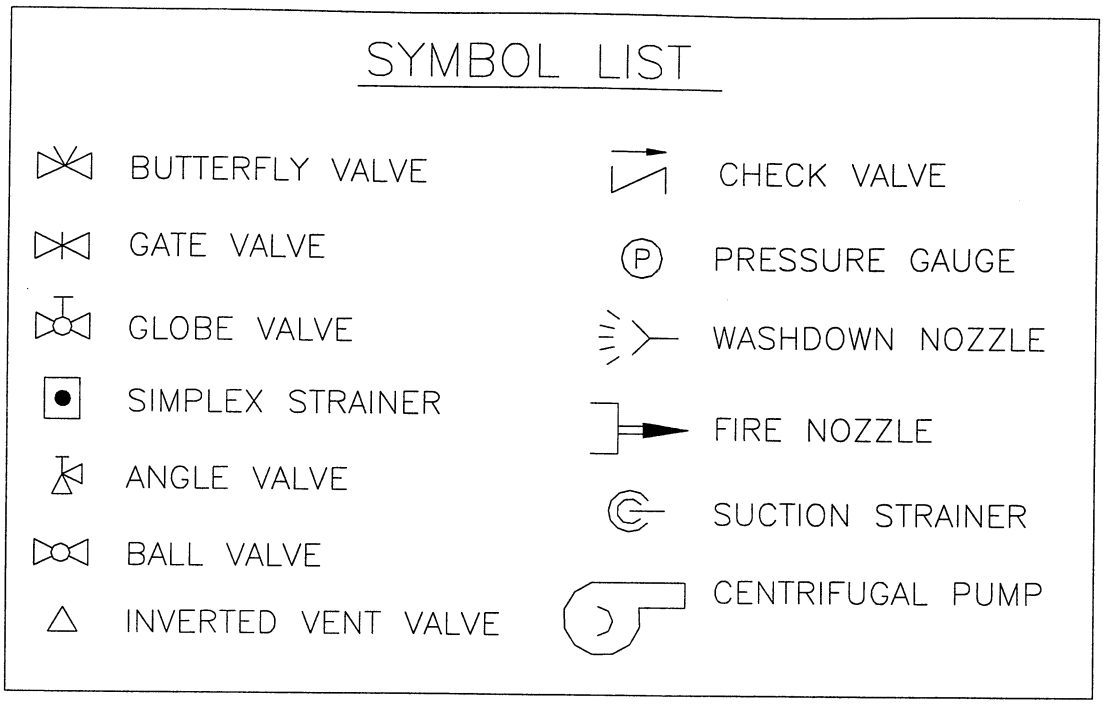


Figure 1-54. Bilge/Ballast/Firemain System, Sheet 4 of 4.

1.16.10. Firemain System. The firemain system is comprised a fire pump, two fire stations and associated valves, vents, and piping. The bilge/ballast pumps may serve as backup to the fire pump. Each of these is discussed below:

a. Fire Pump. The 10 HP Fire Pump is an Ingersoll-Dresser Model D824 operating with a 460VAC, 3 phase, 60-hertz power supply. The pump takes suction from the sea chest and discharges to two 1-$^1/_2$ inch (0.0381 Meters) fire stations on the main deck, port and starboard.

b. Fire Stations. Each fire station is outfitted with a USCG approved fire hose with a dual nozzle, spanner wrench, and all necessary couplings. Hoses are hung from a rack with provisions for easy pay out of fire hose. The fire pump is electric driven. In addition to the 1-$^1/_2$ inch (0.0381 Meters) hose fittings, a $^3/_4$-inch (0.01905 Meters) hose bib is installed on each fire station.

c. Emergency Fire Pump. An emergency fire pump is provided. The P-100 portable fire pump, when stowed, is located on the Main Deck between Frames 23 and 25, port side of centerline. The pump is capable of discharging 100 GPM (378.53 LPM) at 93PSI and comes complete with a wrap-around roll cage.

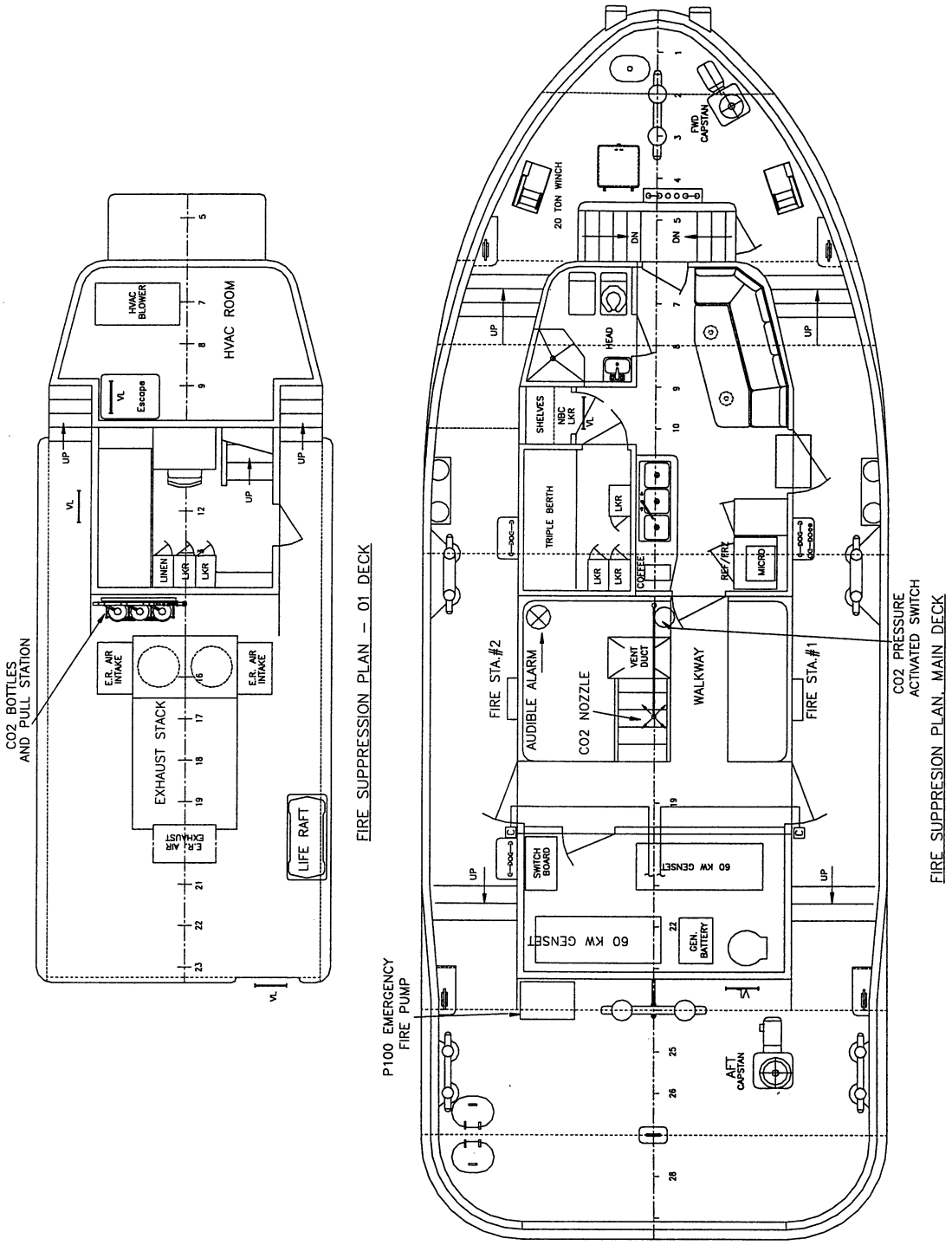
1.16.11. Carbon Dioxide Fire Suppression System. A plan view of the CO_2 system is provided in Figure 1-55. A fixed carbon dioxide (CO_2) fire suppression system has been installed in the engine room. The system utilizes optical sensors for detection. The system is designed to allow remote manual-electric and manual-mechanical carbon dioxide gas release. "FIRE" and "AGENT RELEASE" visual indicators on the control panel and audible alarms are installed in the Pilot House console. A signal from the optical sensors will activate after 45 seconds and release carbon dioxide gas into the diesel engine space. In the manual-electric mode of operation, the carbon dioxide gas is released by actuation of a switch on the fire control and monitoring panel. The manual-mechanical release is accomplished by the activation of a pull handle. The pressurized containers and all associated system components are designed for an ambient temperature of 130° F (53.9°C).

Automatically actuated audible alarms, located in the engine room, provide a warning of the release of fire extinguishing carbon dioxide (CO_2) gas. The system is fitted with an approved delayed discharge arranged so that the alarm will be sounded for at least 45 seconds before the carbon dioxide gas is released in the protected space. When activated, the alarm will automatically shut down the diesel engine and heat exchanger fan motors and close the electrically controlled louvers. The alarm depends on no other source of power, other than pressure from the fire extinguishing carbon dioxide gas.

WARNING

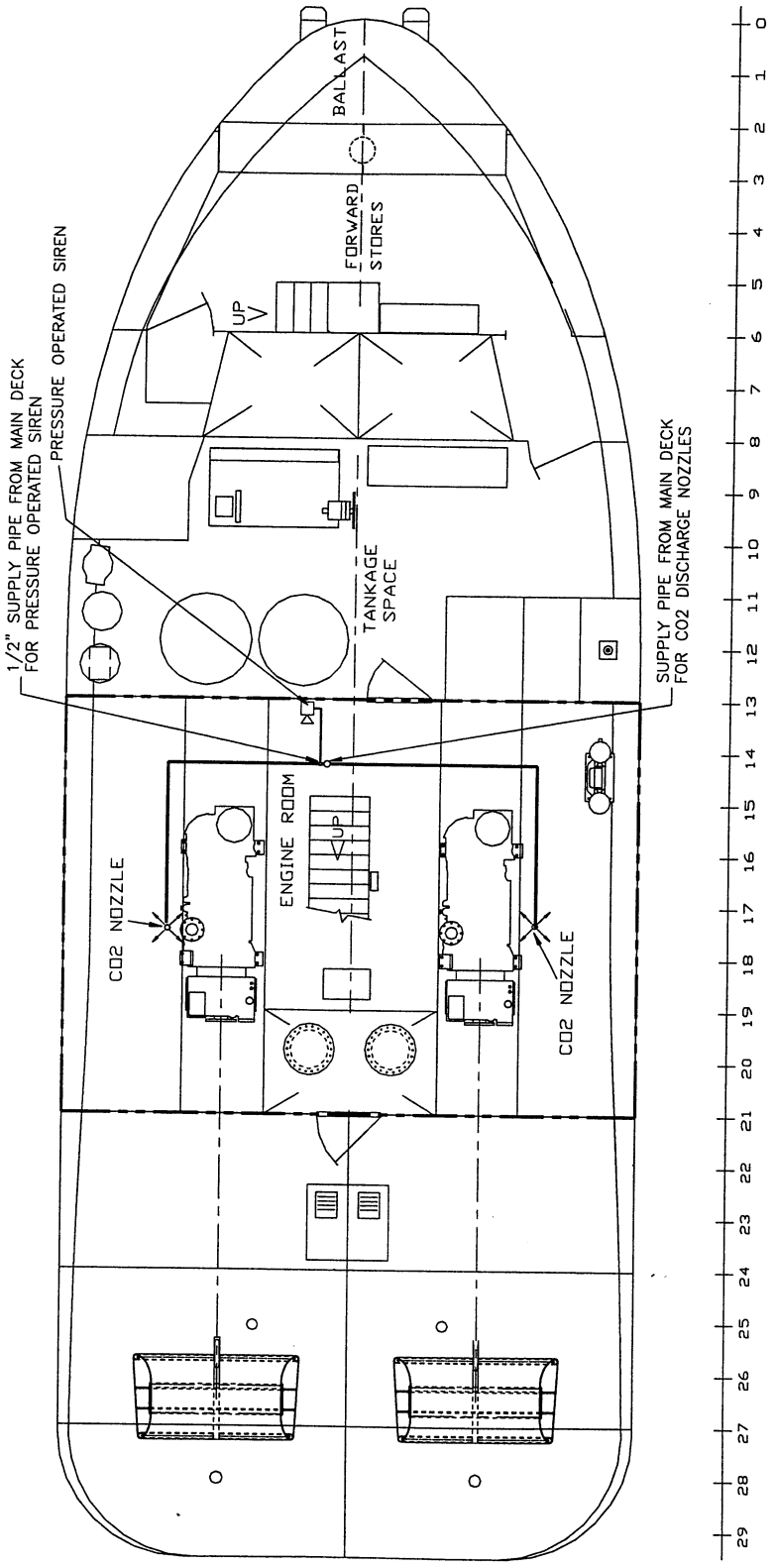
CO_2 FIRE SUPPRESSANT HAZARDS

All personnel must immediately evacuate spaces when CO_2 fire suppressant systems are activated. CO_2 displaces oxygen to smother combustion. It can cause death by suffocation if personnel do not evacuate within 45 seconds after activation handle is pulled.



01 Deck and Main Deck Arrangements

Figure 1-55. Fire Suppression System, Sheet 1 of 2.



Hold Deck Arrangements

Figure 1-55. Fire Suppression System, Sheet 2 of 2.

1.16.12. Oily Water System. A plan view of the oily water system is provided in Figure 1-56. Oily water from the bilge manifold is pumped by the bilge pump to the oily water tank. Oily water is drawn by the oily water separator and, after separation, pumps waste oil into the waste oil tank, located beneath the oily water separator, and waste water is pumped to the overboard discharge.

A Nelson #96504A Model 10025, 15 PPM, 2.5 GPM (9.46325 LPM), oily water separator collects oily water from the bilge and discharges separated oil to waste oil tank and water to overboard discharge. The separator is equipped with an oil content monitor alarm that automatically dumps back to the bilge when an unacceptable concentration of oil is detected.

1.16.13. Grey Water System. A plan view of the grey water system is provided in Figure 1-57. The grey water system consists of a grey-water holding tank (759 gallons; 2,872.34 Liters), a sight level glass, and a grey water transfer pump and controller. Grey water from the galley sink, the lavatory, and the shower drains to the grey-water holding tank and oily water separator.

a. Grey Water Pump. The $^{3}/_{4}$ - HP pump motor is a Teel Model 2P375 operating on a 450VAC, 3 phase, 60 hertz power supply.

b. Grey Water Pump Controller. The controller facilitates starting of the electric pump. The pump is energized and de-energized at the controller.

c. Grey Water Tank. The tank is equipped with a sight glass and high level alarm. Gray water is pumped by the gray water transfer pump to an overboard discharge.

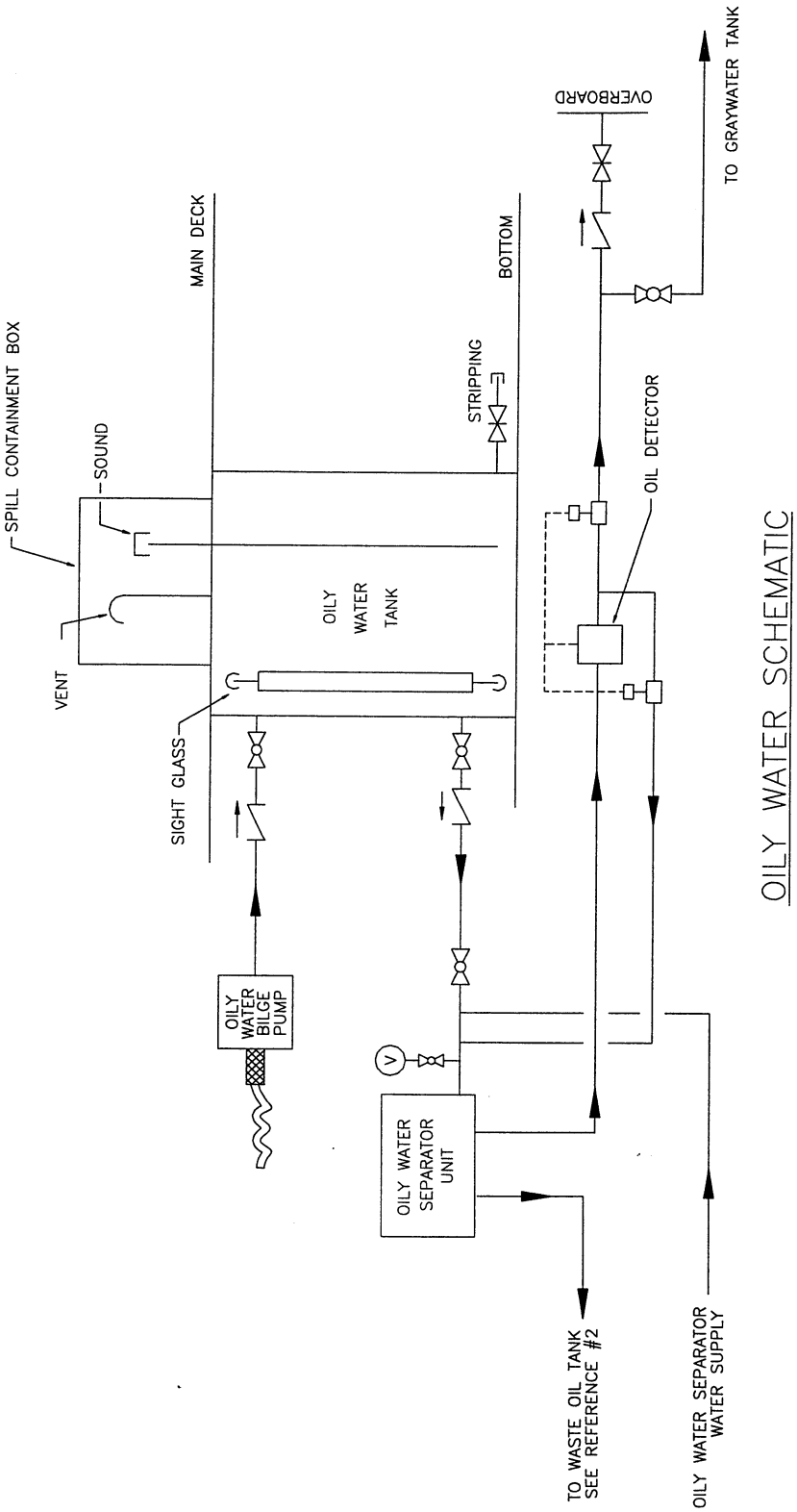
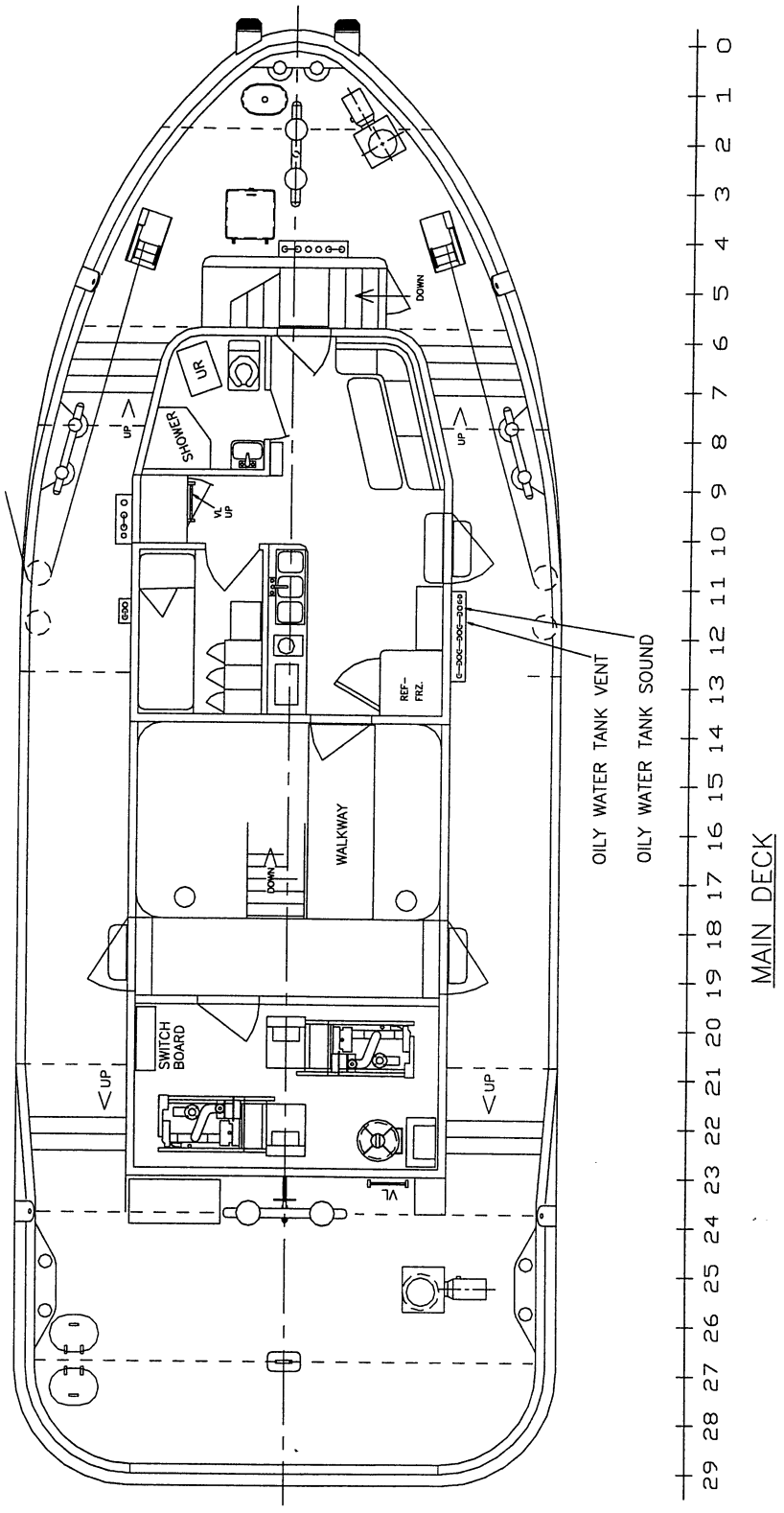
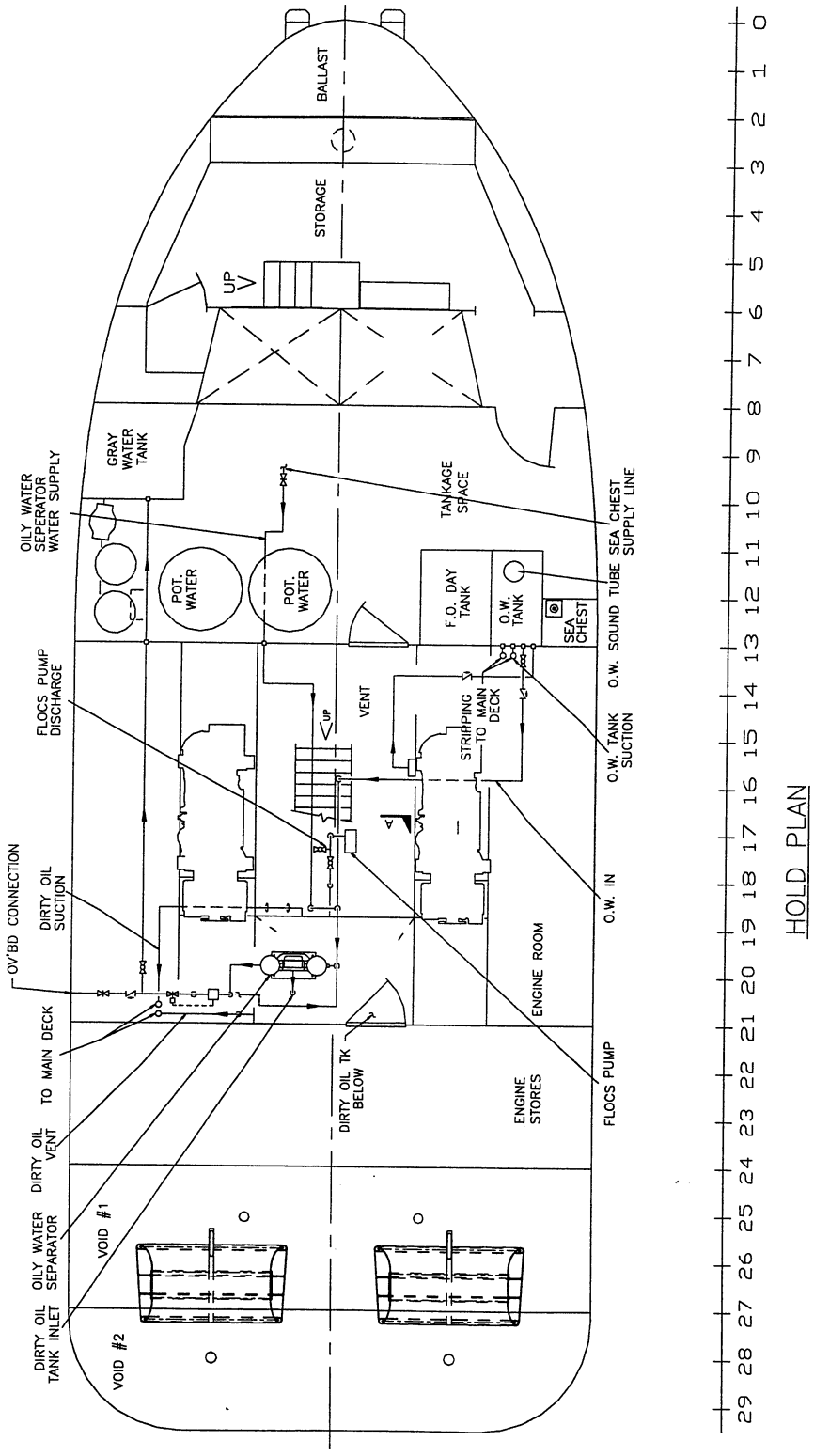


Figure 1-56. Oily Water System, Sheet 1 of 4.



Main Deck Arrangement

Figure 1-56. Oily Water System, Sheet 2 of 4.



Hold Deck Arrangement

Figure 1-56. Oily Water System, Sheet 3 of 4.

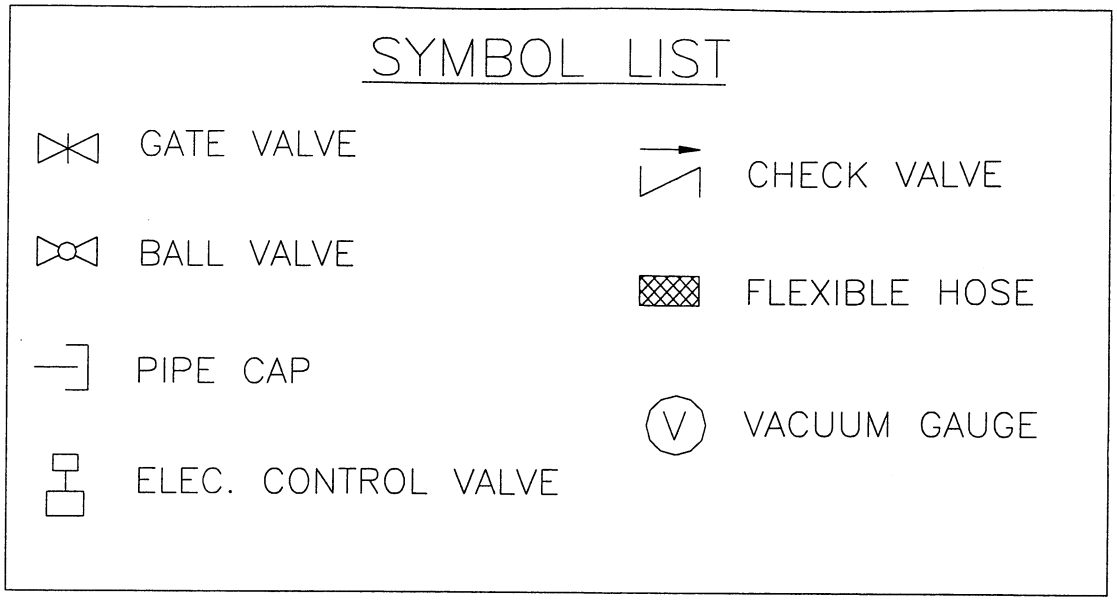


Figure 1-56. Oily Water System, Sheet 4 of 4.

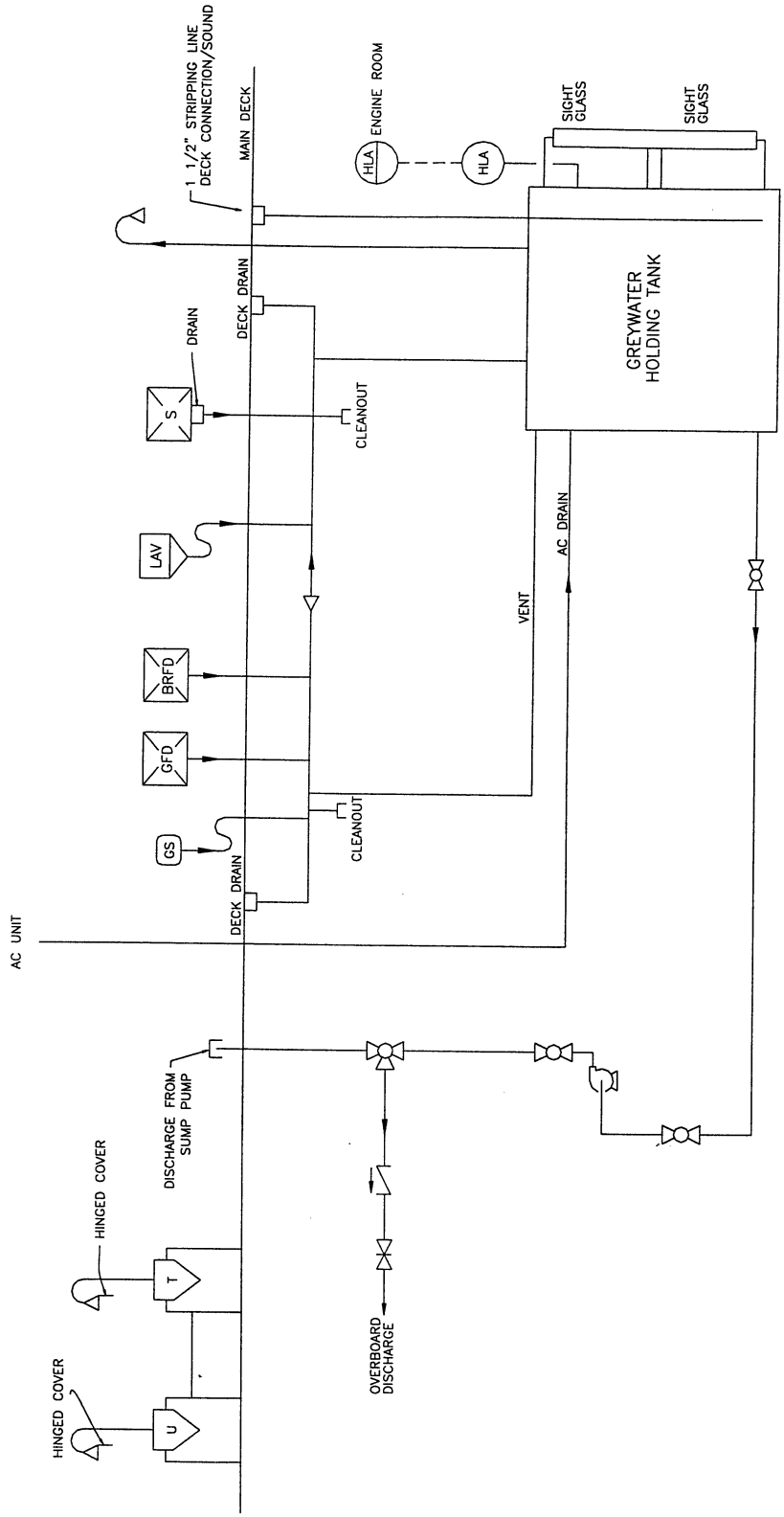


Figure 1-57. Grey Water System, Sheet 1 of 2.

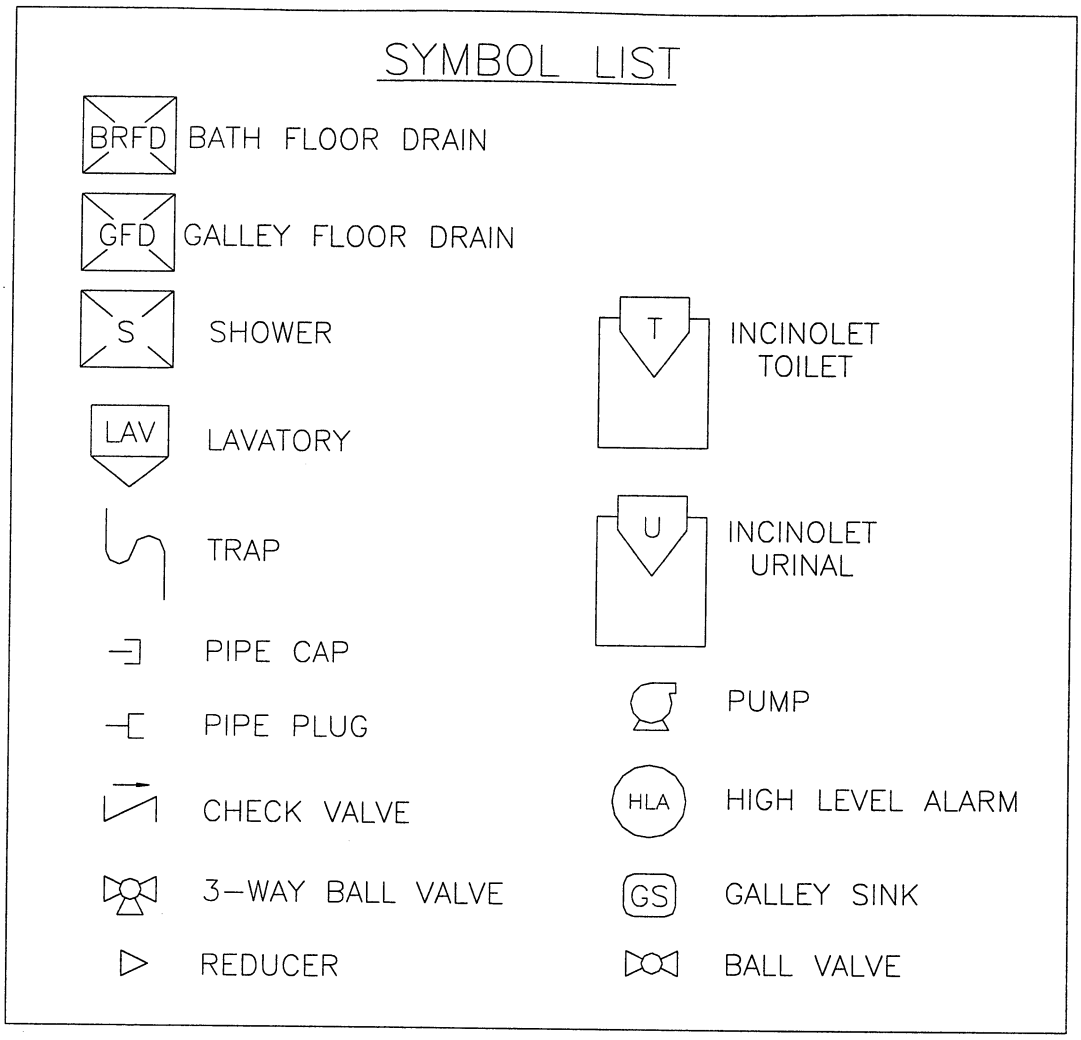


Figure 1-57. Grey Water System, Sheet 2 of 2.

1.16.14. Mooring/Anchor Handling System. Mooring equipment includes a towing pad, double bitts, roller chocks, ground tackle, and three point mooring system. The mooring arrangement is depicted in Figure 1-58. Each of these is discussed below:

a. Towing Pad. The towing pad is located aft centerline at Frame 24 and consists of a reinforced double bitt.

b. Double Bitts. Double bitts are of steel construction and enable the placement of anchor, mooring, and towing lines. Five 8-inch (0.2032 Meters) double bitts are located as follows:

(1) Starboard. One double bitt (aft quarter bitt) is located outboard between Frames 24 and 27. A second (forward quarter bitt) is located outboard between Frames 12 and 15.

(2) Port. One double bitt (aft quarter bitt) is located outboard between Frames 24 and 27. A second (forward quarter bitt) is located outboard between Frames 12 and 15.

(3) Forward. A double bitt is located forward centerline between Frames 1 and 4.

c. Roller Chocks (Buttons). Roller chocks are mounted in the tow rail and facilitate controlling rigging or mooring line. The roller chocks are located one each, port and starboard, between Frames 10 and 12.

d. Ground Tackle. Ground tackle includes NAV-X Fortress Model FX-125 anchor and 500 feet (152.4 Meters) of nylon line (with connecting links and swivel).

e. Three Point Mooring System. The ST utilizes a three point mooring system for anchoring the vessel. The anchor rope travels through the bull nose to the capstan and is stowed in the chain locker. The capstan may be used to hoist and/or lower the anchor.

1.16.15. Towing. The ST is configured with all deck equipment, fittings, chafing gear, guards and hardware required for barge work, barge towing, and assisting larger tugs in ship work. The barge displacement will range from light condition or empty to full load. Barge towing features include hip tow on one and both sides, stern tow, and pushing. Illustrations of typical towing configurations are provided in Chapter 2 Section III of this manual.

a. Towing Equipment. Specific towing equipment on the ST includes the following:

(1) Pushing. Port and starboard wire rope ratcheting 20-ton winch connection systems, including all associated deck fittings, face wires, and hardware; stern, backing, jockey, and other lines and associated deck fittings and hardware.

(2) Stern Tow. Facilities for stern towing include double bitt, towing padeye, gogging D-ring and caprail.

(3) Hip Tow. Facilities include port and starboard, aft, midship, and forward bitts.

(4) Line Handling. Line handling is accomplish using deck mounted capstans. One is located forward and one is located aft. Each of these is discussed below:

a. Aft Capstan. The aft capstan is located on the aft main deck and is capable of handling lines up to 6-inch (0.1524 meters) circumference. Features include an 18-inch (0.4572 Meters) gypsy head and a minimum 10,000 pound (4,535 Kilograms) pull at 30 feet (9.144 Meters) per minute. The unit is driven by a 10 HP electric motor operating on 450VAC, 3 phase, 60-hertz power. Motor brake and forward/stop pushbutton control station is provided locally at the capstan.

b. Forward Capstan. The forward capstan is located on the forward main deck and is capable of handling lines up to 4-inch (0.1016 Meters) circumference. Features include a 12-inch (0.3048 Meters) gypsy head and minimum 2,000 pound (907 Kilograms) pull at 43 feet (13.1064 Meters) per minute. The unit is driven by a 3 HP electric motor operating on

450VAC, 3 phase, 60-hertz power. A motor brake and foot pedal control is provided locally at the capstan.

(5) Lines. Lines provided are discussed below.

a. Towing Hawser. The towing hawser consist of 500 feet (152.4 Meters) of Spectron 12 single braid. The hawser is capable of being faked on deck and a thimble is provided at the tow end.

b. Miscellaneous Lines. Seven 100 foot (30.48 Meters) lengths of Spectron 12 single braid are provided. The lines have an eye at each end and all are capable of being faked on deck.

(6) Line Cutting. Axes are provided for line cutting. An ax is located, one each, on the port and starboard side of the deckhouse on the main deck at Frame 21.

1.16.16. Life Saving Equipment. This section provides an overview of the life saving equipment on the ST. Figure 1-59 provides a plan view of the life saving equipment.

a. Emergency Life Raft. The emergency life raft consists of an Elliot Viking Model Inflatable life raft. The raft is equipped with a manual quick release as well as an automatic hydrostatic release, each utilizing a self-inflating CO_2 system which is capable of fully inflating the raft in a matter of seconds. The raft is capable of throw-over release. The strength factor of the raft is such that survivors may jump onto the canopy from as high as 15 feet (4.572 Meters). The raft and cradle is located between Frames 19 and 22 on the starboard side of the 01 Deck.

b. Throwable Life Ring(s). Two throwable life rings are located on the main deck on the deckhouse, one each port and starboard. Two are also located port and starboard on the 01 Deck. Another life ring is located on the aft rail of the 01 Deck.

c. Personal Floatation Devices (PFDs). PFDs are stored in the PFD Locker located on the starboard side of the 01 Deck, just forward of the life raft cradle.

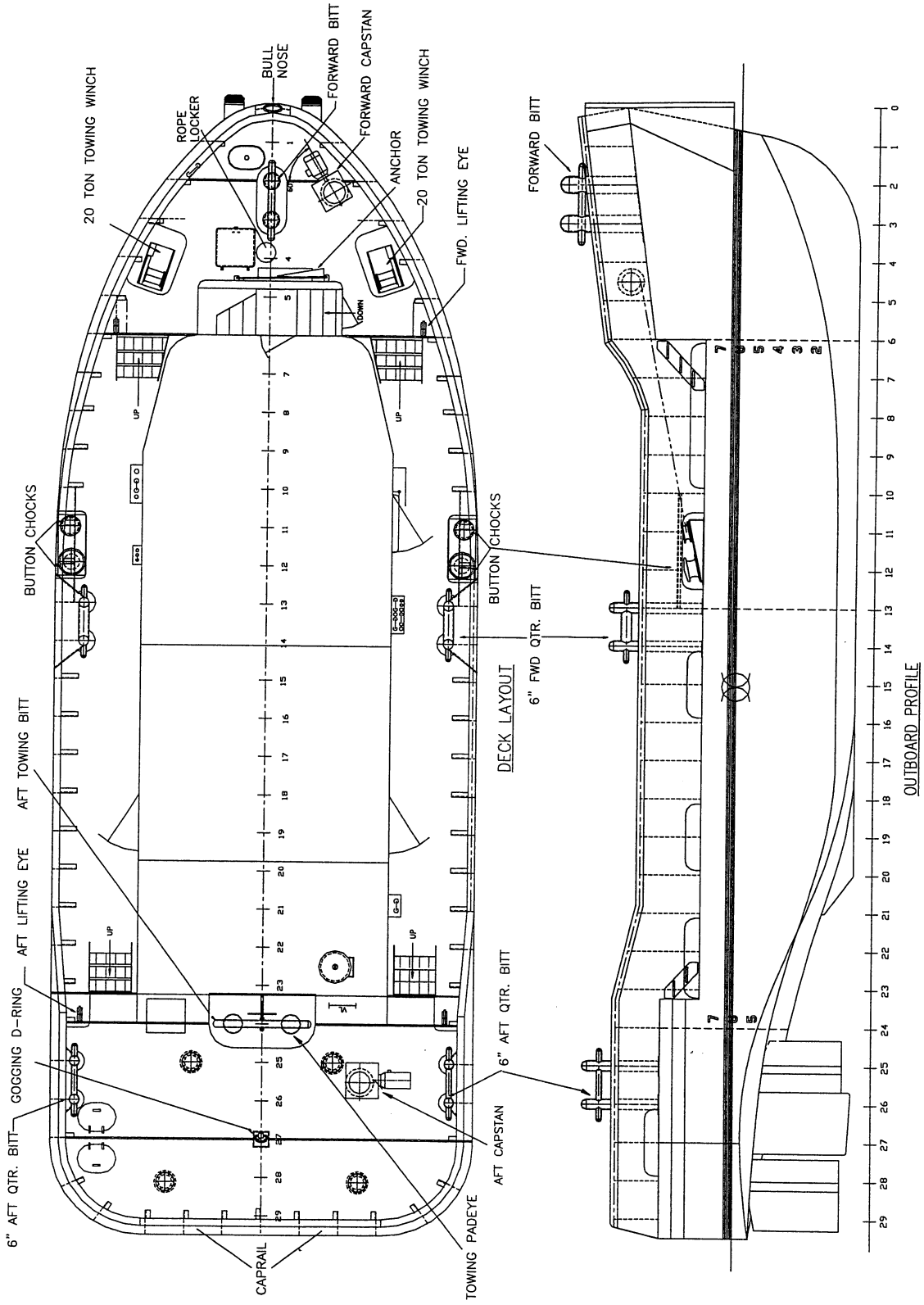
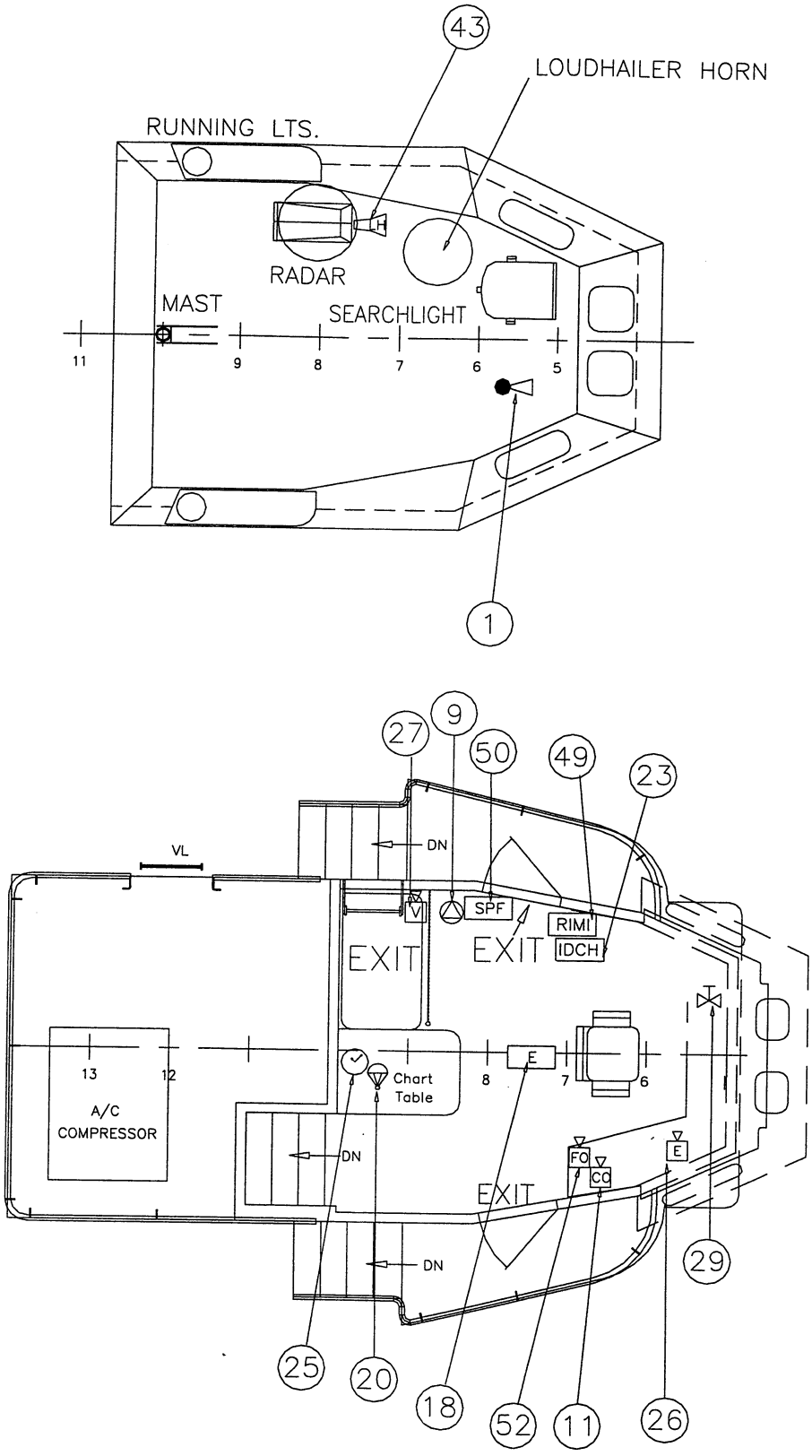


Figure 1-58. Mooring Arrangement

SYMBOL	FIND NO.	PART OR IDENTIFYING NO.	QTY REQ.	NOMENCLATURE OR DESCRIPTION
FO	52		1	REMOTE FUEL SHUTOFF (LOCATED ON PILOTHOUSE CONSOLE)
	51		1	LIFE RING
SPF	50	HMUM-IDCH	3	SOUND POWERED PHONE
RIMI	49	HMUM-RIMI	7	REMOTE INTERCOM STATION
	48	HMUM-ALVR	4	PA STROBE LIGHT
	47	HMUM-CISW	3	PA TALKBACK OUTLET - WATER PROOF
S	46	HMUM-SFIS	3	PA SPEAKER - INTERIOR TYPE
	45	HMUM-HSSR	2	PA SPEAKER - EXTERIOR TYPE
	44	HMUM-HSSR	2	PA SPEAKER - WITH TALKBACK
	43	HMUM-HSWR	1	LOADHAILER SPEAKER
PA	42	HMUM-HSSR	6	PA/ SPEAKER - INTERIOR TYPE
MICH	41	HMUM-MICH	1	LOAD HAILER MIKE
NO.2	40		1	FIRE STATION NO.2
NO.1	39		1	FIRE STATION NO.1
4	38		1	FOG APPLICATORS, 4 FT
DC	37		1	DAMAGE CONTROL LOCKER
P	36		1	P 100- PORTABLE DIESEL FIRE PUMP
	35		1	F.O. REACHROD ⊕ M.D.
B	34		4	EMERGENCY ME BATTERY SWITCH
	33		1	STOKES LITTER
	32		1	NEIL ROBERTSON STRETCHER
CO_2	31		1	CO_2 STORAGE BOTTLES
	30		1	CO_2 ALARM SIREN
	29		2	FIRE PUMP START/STOP
	28		1	BOAT HOOK
V	27		1	EMERGENCY VENTALATION SHUTDOWN (FANS)
E	26		1	EMERGENCY ENGINE STOP
	25		4	CLOCK
ESS	24		1	EMERGENCY STEERING SYSTEM
IDCH	23		1	INTERCOM CONTROL HEAD
BA	22		2	BREATHING APPARATUS - 30 MIN. CAPACITY
	21		2	FIREMAN'S OUTFIT
	20		1	EMERGENCY FLARES
FO	19		1	LOCAL FUEL SHUTOFF (ENGINE ROOM)
E	18		6	EMERGENCY LIGHTS
F	17		1	FIRE PUMP
	16		1	EMERGENCY POSITION INDICATOR RADIO BEACON
V	15		2	EMERGENCY AIR SHUT OFF STATIONS (GENERATOR ENGINES)
OBA	14		6	EMERGENCY ESCAPE BREATHING DEVICES
	13		5	EXPOSURE SUITS
	12		2	FIRE STATION; W/ 50' OF 1 1/2"ø FIRE HOSE, & NOZ.
CO	11		3	EMERGENCY PULL STATION FOR CO_2 SYSTEM
	10		2	FIRE AXES
	9		6	PORTABLE FIRE EXTINGUISHERS: 10# DRY CHEMICAL
	8		7	LIFE PRESERVERS: U.S.C.G. APPROVED VEST STYLE (SEE NOTE #1)
	7		4	RING BUOYS: 24" U.S.C.G. APPV'D LINE & LIGHT
	6		1	INFLATABLE LIFE RAFT: W/ HYDROSTATIC RELEASE - 16 PERSON
	5		1	24 UNIT FIRST AID KIT / MEDICINE CABINET
	4		1	ANCHOR; 65# W/12' OF 5/8" CHAIN & 500' OF NYLON LINE
R	3		1	ANCHOR ROPE HATCH - W/ 1 1/4" x 500' NYLON ROPE
	2		1	SHIP'S BELL
	1		1	ELECTRIC HORN: 24V DC, U.S.C.G. APPROVED

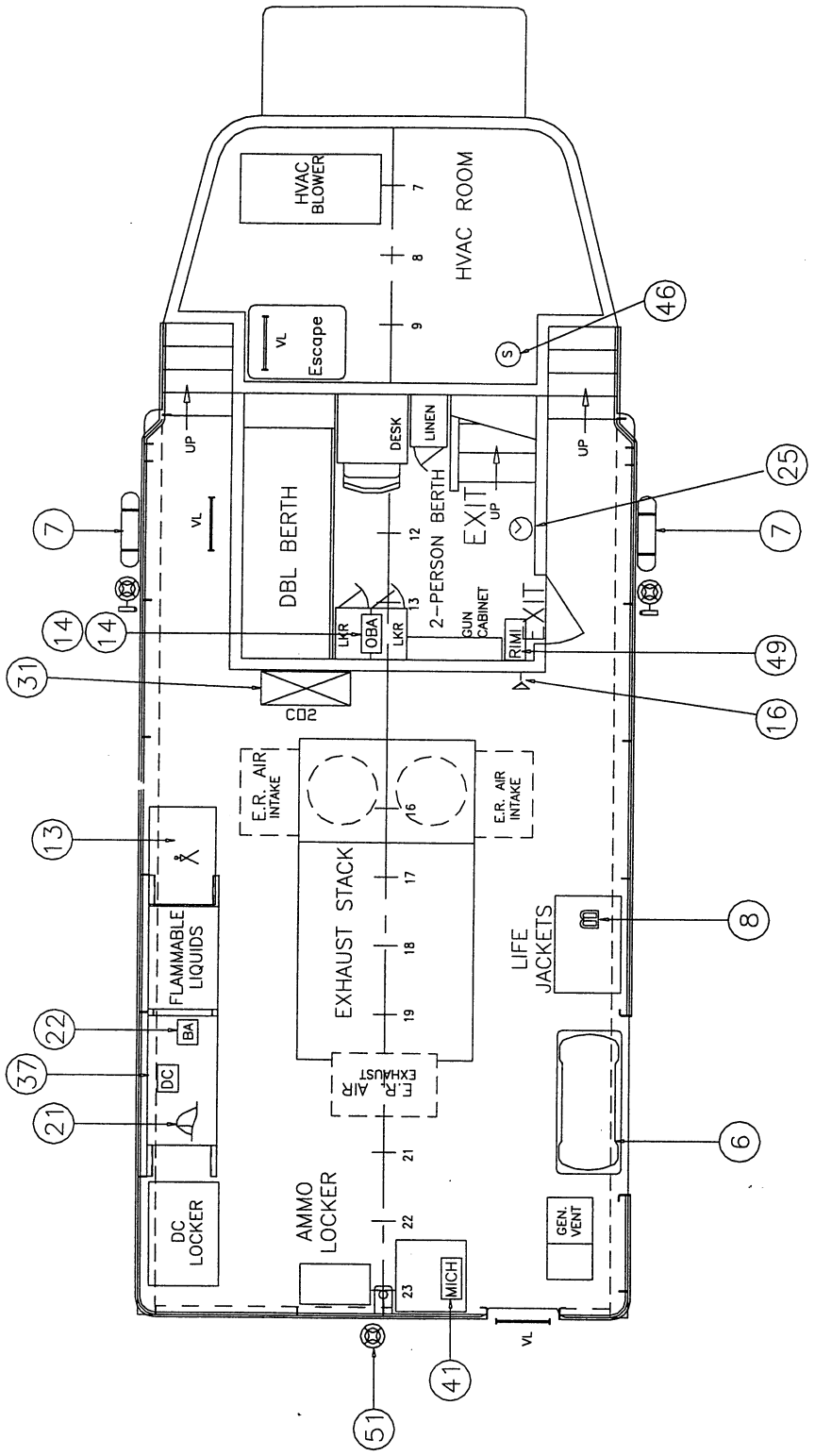
Drawing Key

Figure 1-59. Life Saving Equipment, Sheet 1 of 5.



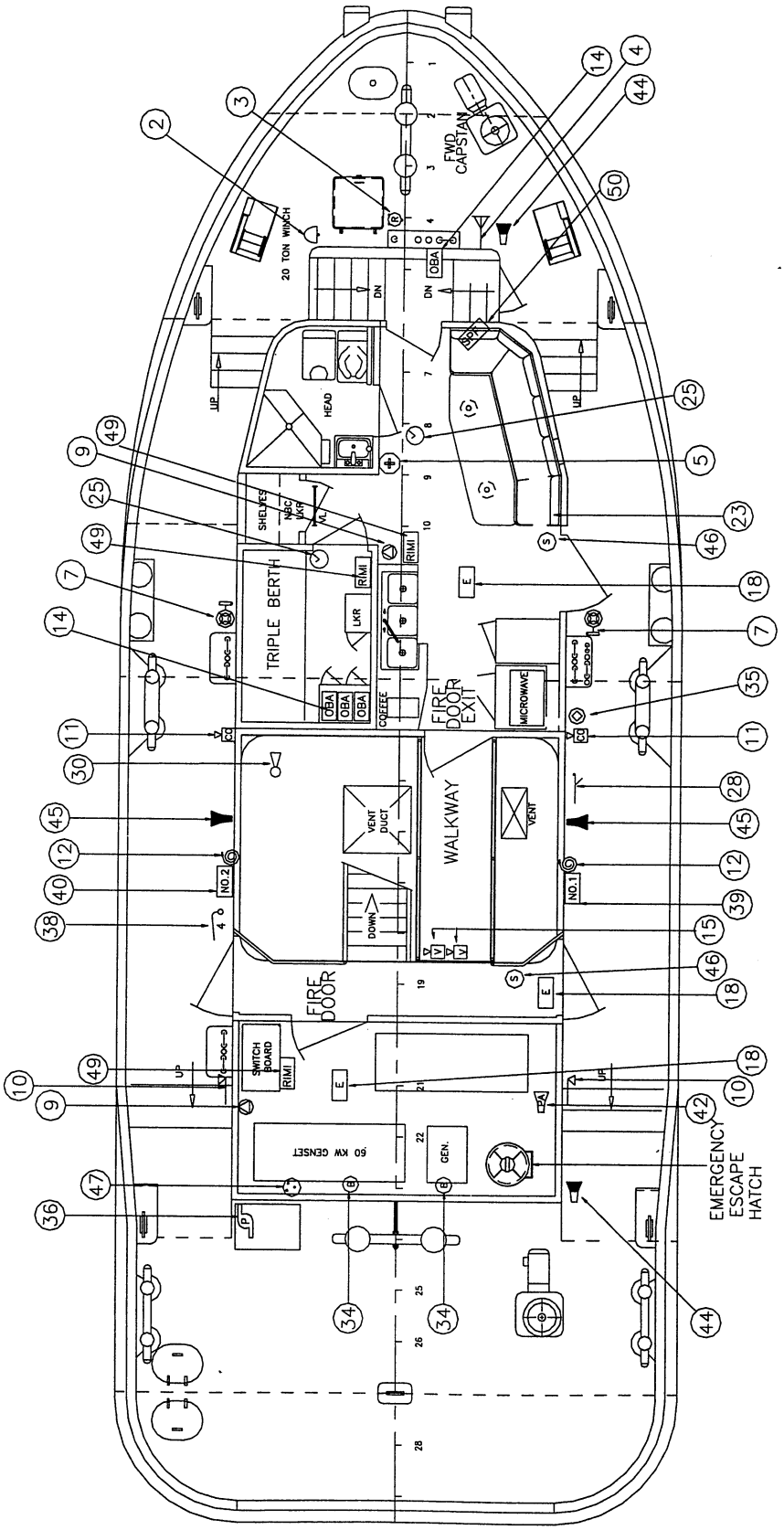
Pilot House Deck and Pilot House Overhead Arrangements

Figure 1-59. Life Saving Equipment, Sheet 2 of 5.



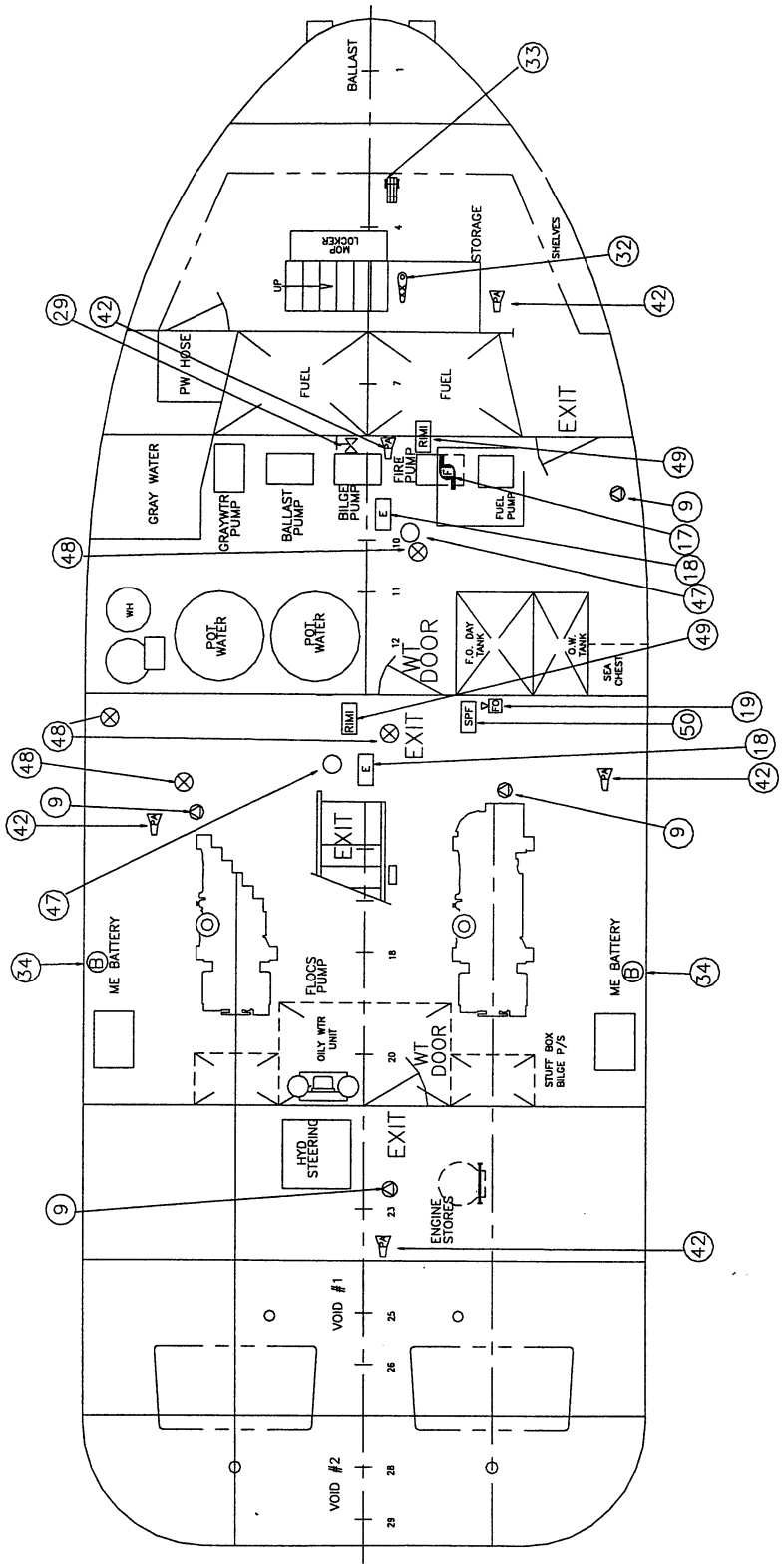
01 Deck Arrangement

Figure 1-59. Life Saving Equipment, Sheet 3 of 5.



Main Deck Arrangement

Figure 1-59. Life Saving Equipment, Sheet 4 of 5.



Hold Deck Arrangement

Figure 1-59. Life Saving Equipment, Sheet 5 of 5.

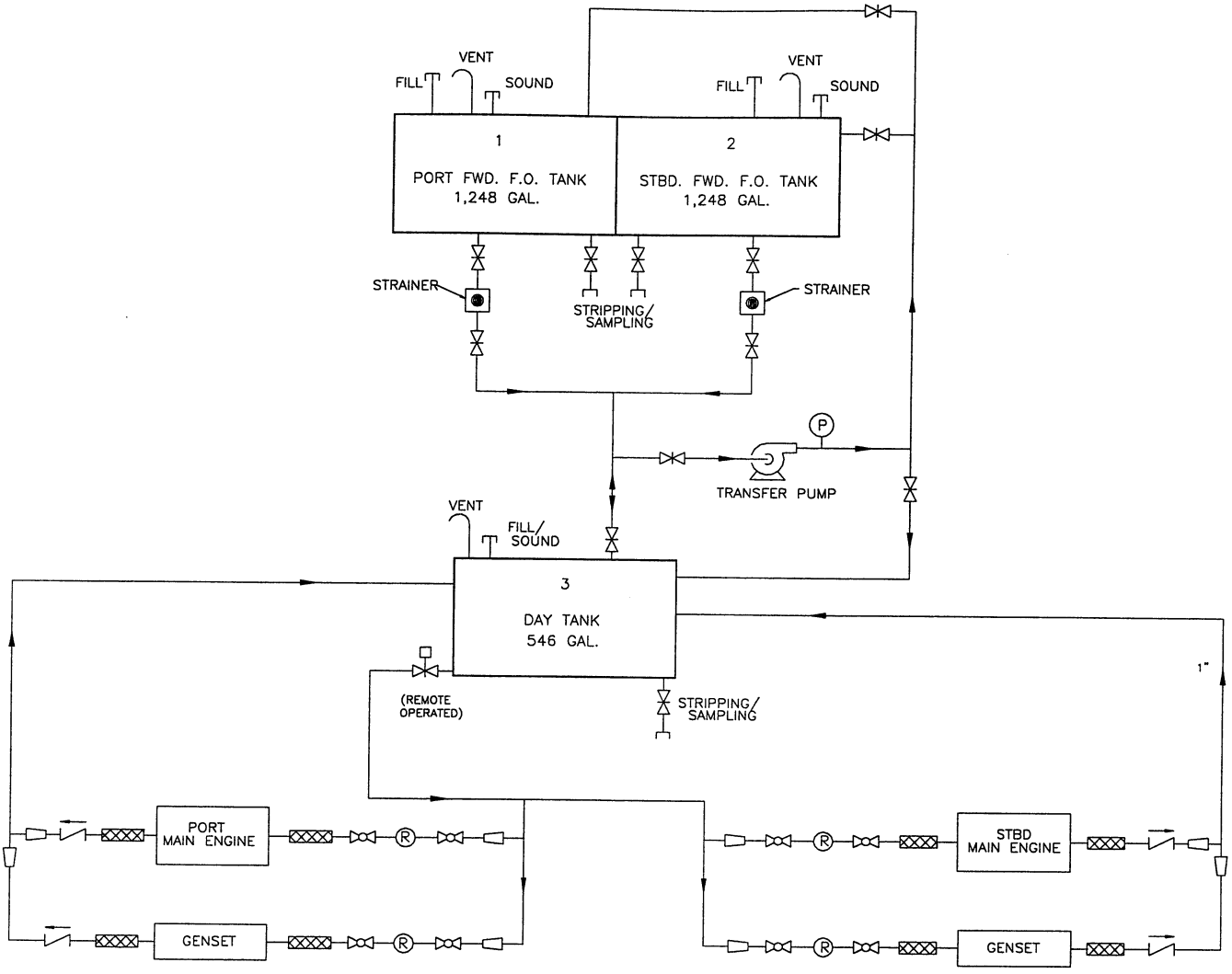
1.16.17. Fuel Oil Fill and Transfer Piping System. A plan view of the fuel oil fill and transfer piping system is provided in Figure 1-60. The fuel oil fill and transfer piping system replenishes the ST fuel oil tanks from deck discharge/fill connections. The system also replenishes fuel oil day tank (546 Gallon; 2,066.77 Liters) for the main engines and the generator diesel engine, by transferring fuel oil from the two 1248 gallon (4,724.05 Liters) storage tanks. System control is maintained through manifold transfer pump and a combination of valves. Fuel oil can be transferred from either storage tank to the day tank. Power to the fuel oil pump is supplied from the upper engine room power panel and controlled by a START/STOP push button and an emergency STOP switch located in the upper engine room. An emergency fuel shutoff valve pull cable is provided in the PilotHouse. Fuel oil purification is provided by the fuel oil filters/coalescer.

1.16.18. Lube/Gear Oil Fill and Transfer Piping System. A plan view of the lube/gear oil fill and transfer system is provided in Figure 1-61. The lubricating oil fill and transfer piping system supplies clean lubricating oil for proper operation of the main propulsion engines and the diesel generators. The system also transfers lubricating oil from the lube oil storage tank to the main engine and the diesel generators by means of the Fast Lube Oil Change System (FLOCS) pump. System alignment is maintained by a manifold and a combination of valves. The FLOCS allows dirty oil and sludge to be discharged from the engine sumps to the dirty oil tanks using a hand pump. Power for the lube oil pump is supplied from the upper engine room power panel. Each unit has a motor controller with push button adjacent to the unit. The lubricating oil system consists of lube oil tank (266 gallon; 1,066.88 Liters), FLOCS pump, dirty oil tank (350 gallon; 1,324.855 Liters), and associated vents, valves, and piping (fixed and portable). Waste oil is removed from engine(s) or generator set(s) by manually attaching flexible hose from appropriate connection to FLOCS pump suction end. The FLOCS pump pumps waste oil through fixed piping to the dirty oil tank. Replacing lube oil is done in the same manner, attaching flexible hose from the lube oil tank to suction end of FLOCS pump, and from the discharge end of FLOCS pump to appropriate machinery connection.

1.16.19. Single Point Hoisting Arrangement. A plan view of the single point hoisting arrangement is provided in Figure 1-62. The single point hoisting arrangement consists of four hoisting eyes located on opposing corners of the vessel. When connected to the single point hoisting arrangement sling, the eyes facilitate lifting of the ST to and from another vessel.

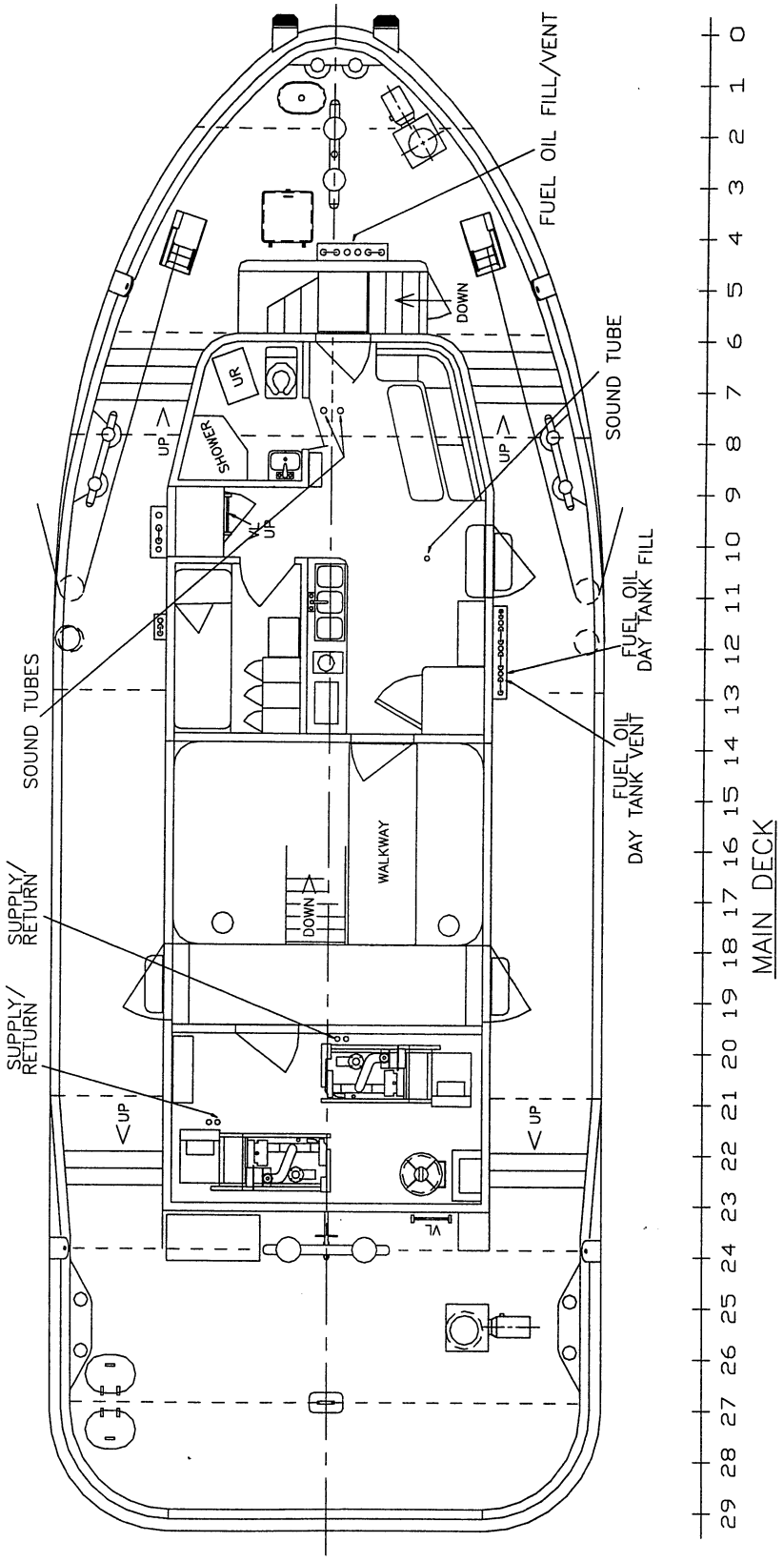
1.16.20. Cathodic Protection System. A plan view of the anodes is provided in Figure 1-63. Sacrificial zinc anodes (Corrthern Type M-24 and M-12) are installed for cathodic protection of the underwater hull and other susceptible surfaces. The system is designed to last a minimum of 3 years to conform with normally scheduled overhaul periods. Anodes are attached by bolt-on method with a 3/8-inch (0.009398 Meters) plate installed between the anode and the protected surface.

The anodes are equally divided into two rows, port and starboard; half are installed forward of midship, the other half aft of midship. The remaining one-third anodes are located along the centerline keel, just beneath the turn of the bilge and divided equally between port and starboard.



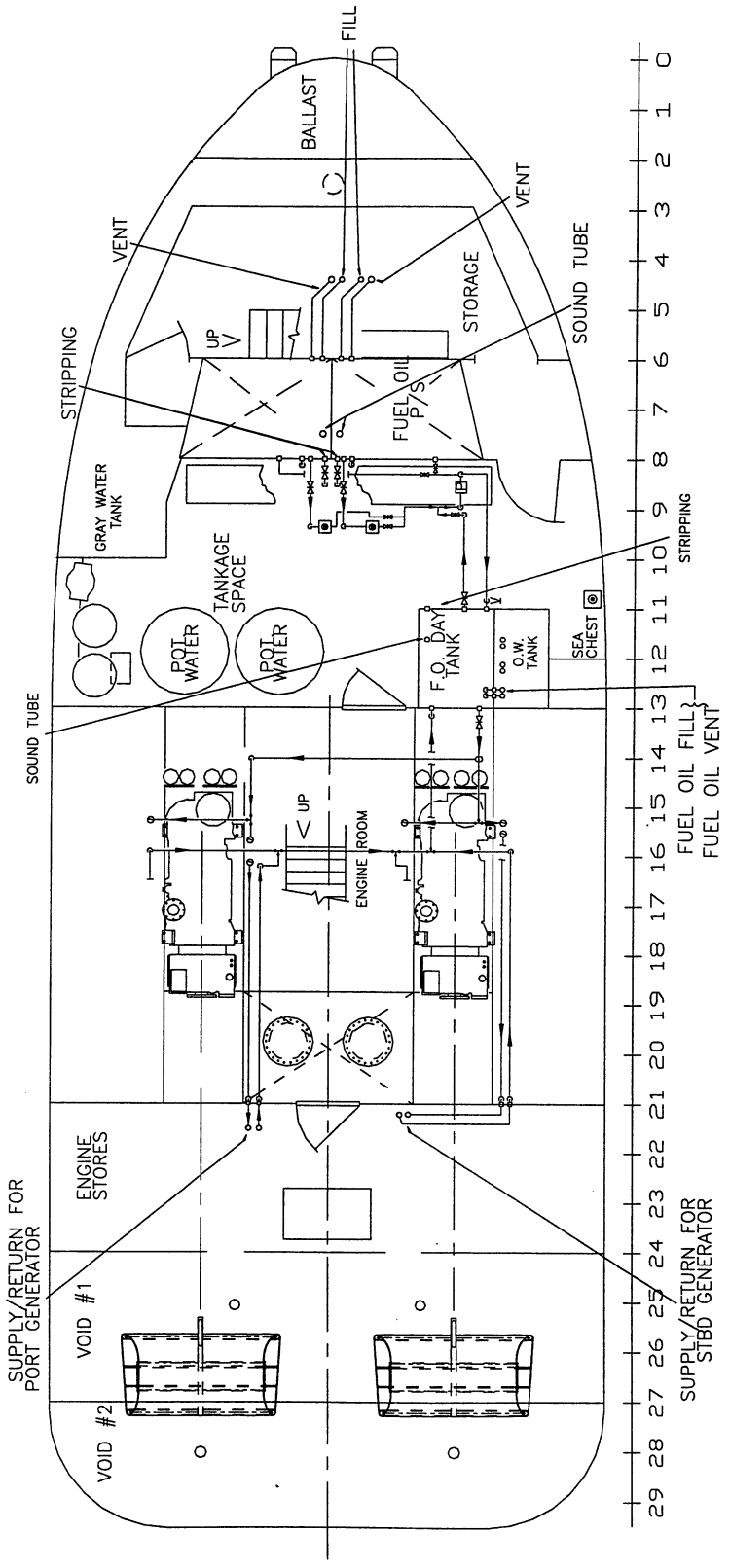
System Schematic

Figure 1-60. Fuel Oil Fill and Transfer Piping System, Sheet 1 of 4



Main Deck Arrangement

Figure 1-60. Fuel Oil Fill and Transfer Piping System, Sheet 2 of 4



Hold Deck Arrangement

Figure 1-60. Fuel Oil Fill and Transfer Piping System, Sheet 3 of 4

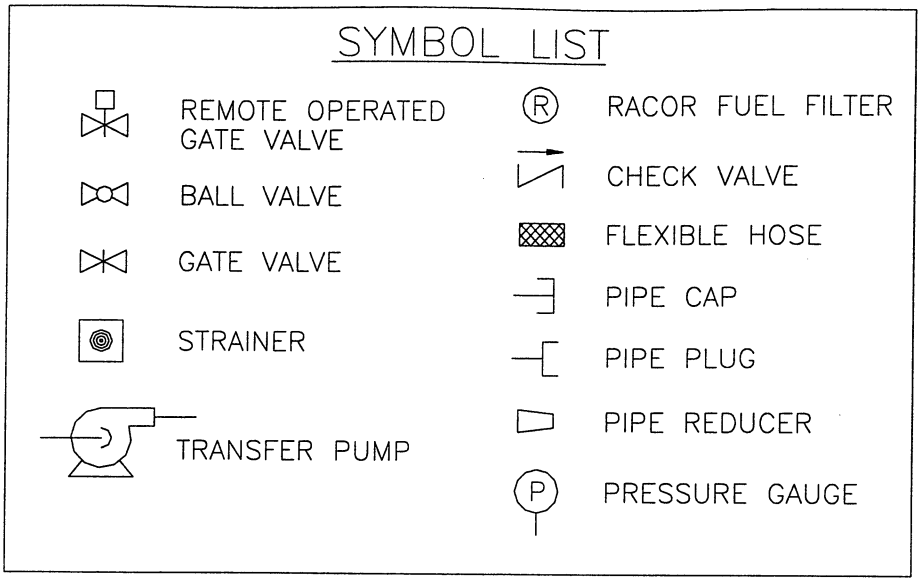
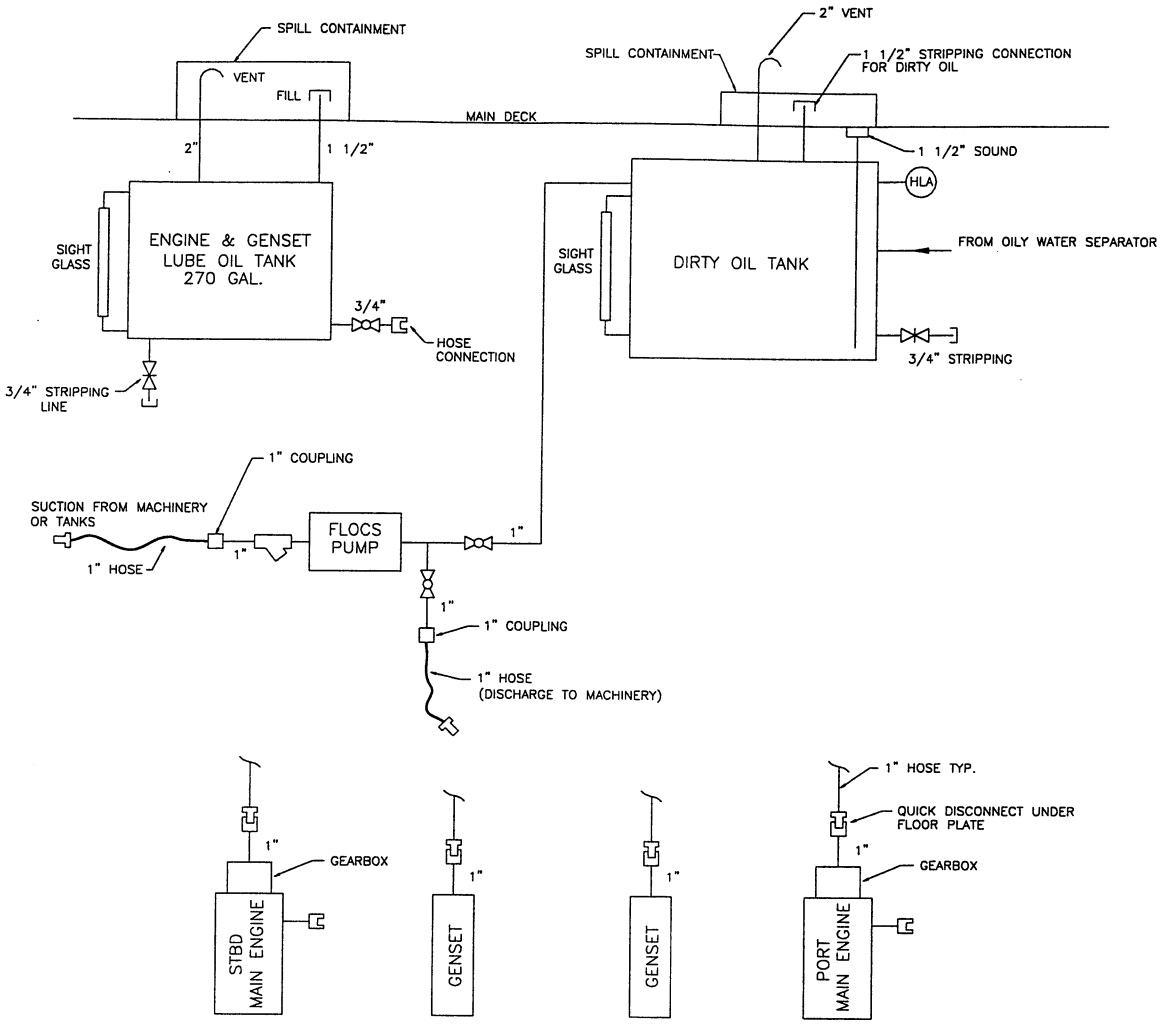
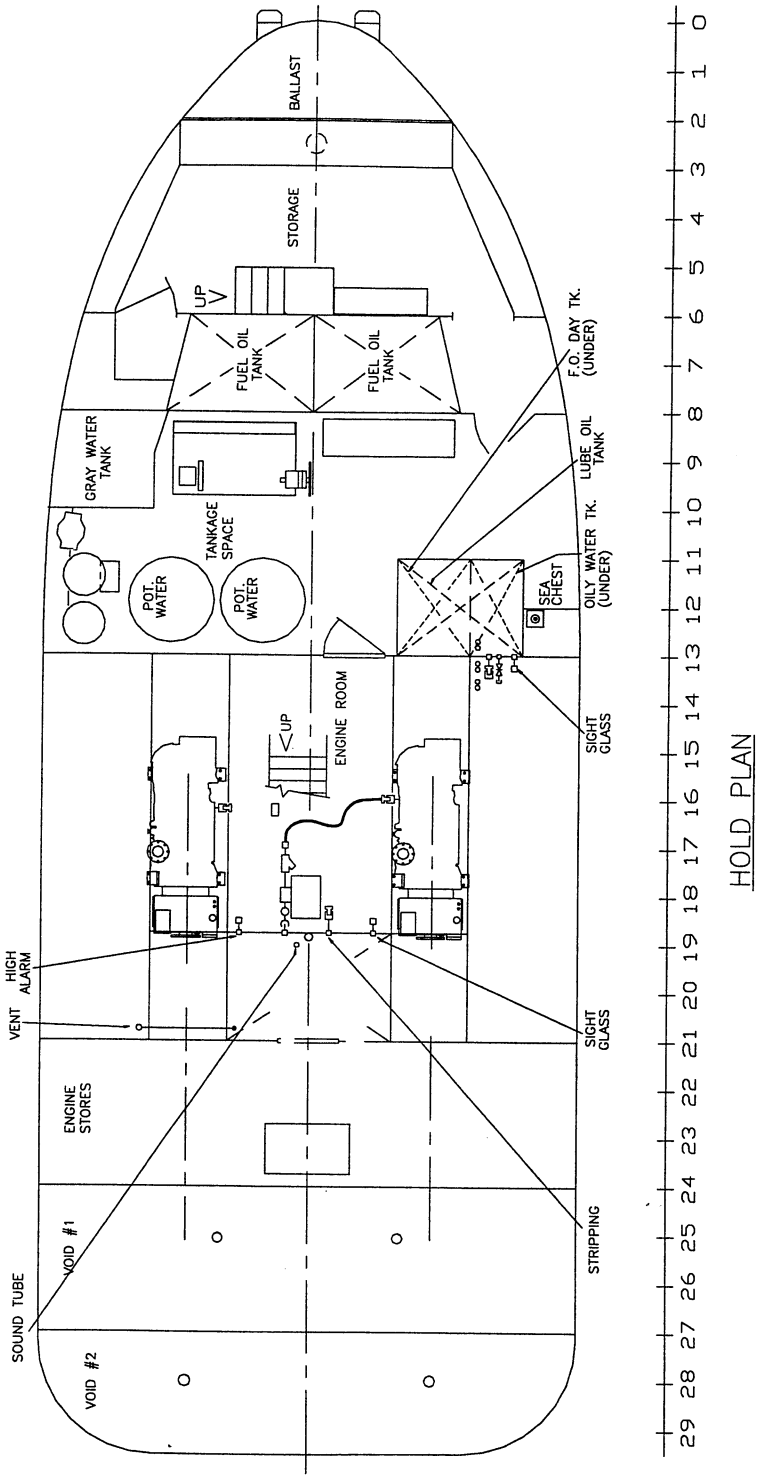


Figure 1-60. Fuel Oil Fill and Transfer Piping System, Sheet 4 of 4



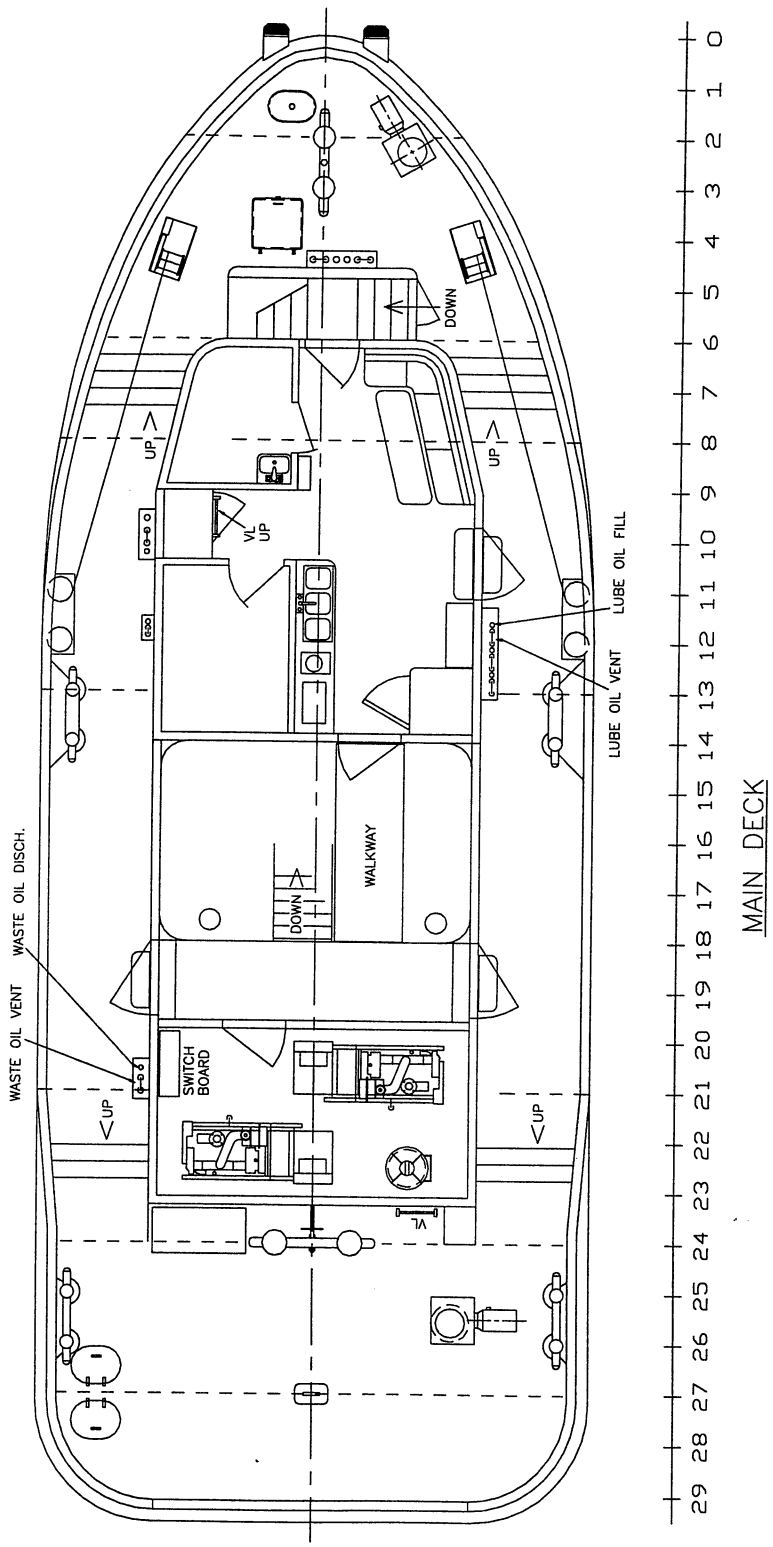
System Schematic

Figure 1-61. Lube/Gear Oil Fill and Transfer Piping System, Sheet 1 of 4



Hold Deck Arrangement

Figure 1-61. Lube/Gear Oil Fill and Transfer Piping System, Sheet 2 of 4



Main Deck Arrangement

Figure 1-61. Lube/Gear Oil Fill and Transfer Piping System, Sheet 3 of 4

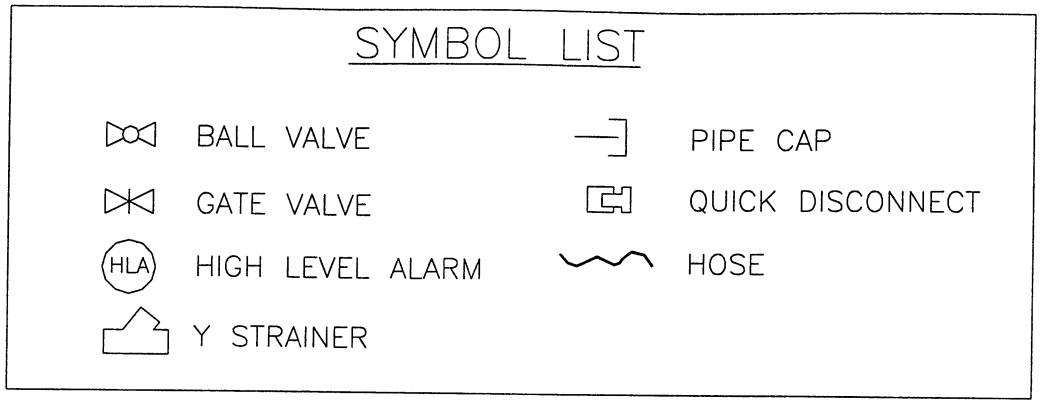


Figure 1-61. Lube/Gear Oil Fill and Transfer Piping System, Sheet 4 of 4

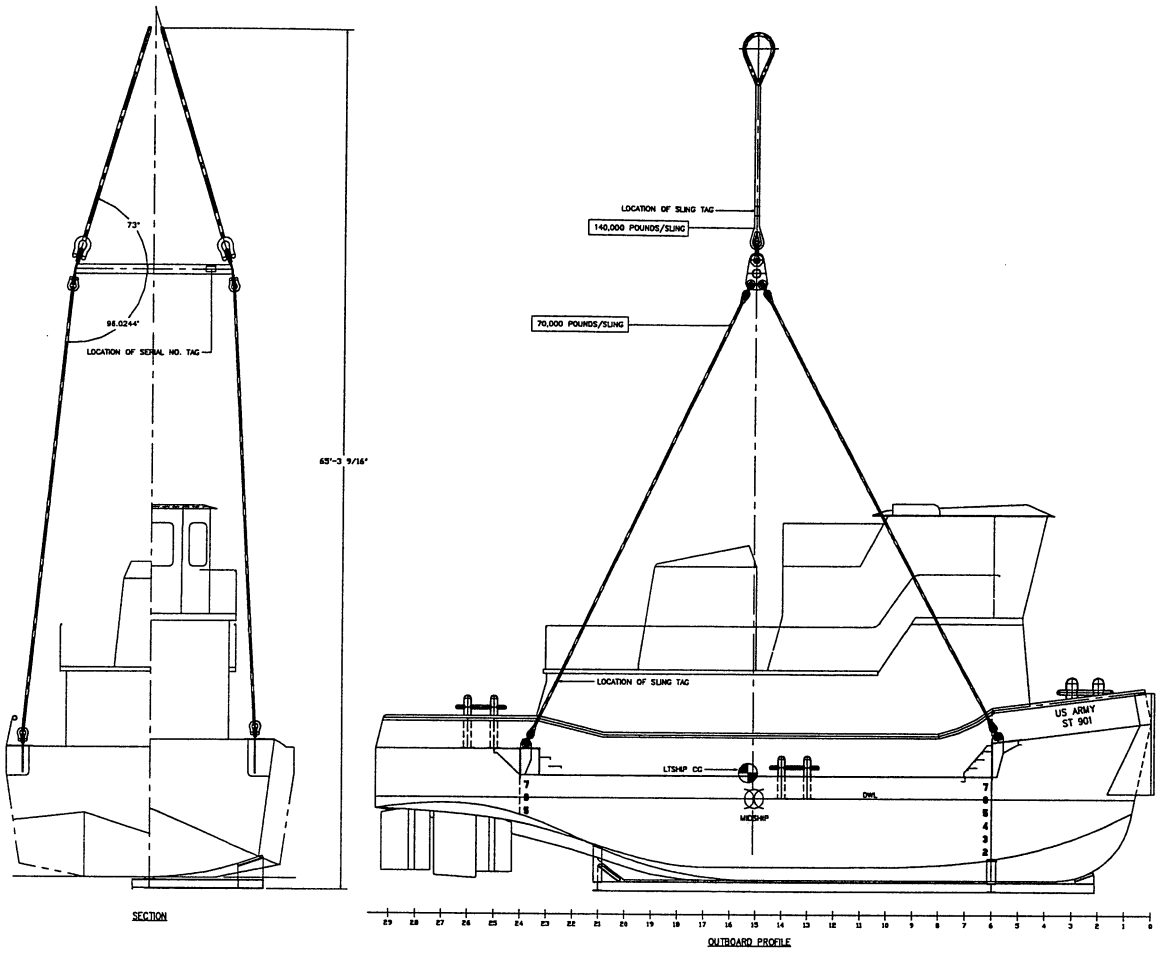


Figure 1-62. Single Point Hoisting Arrangement

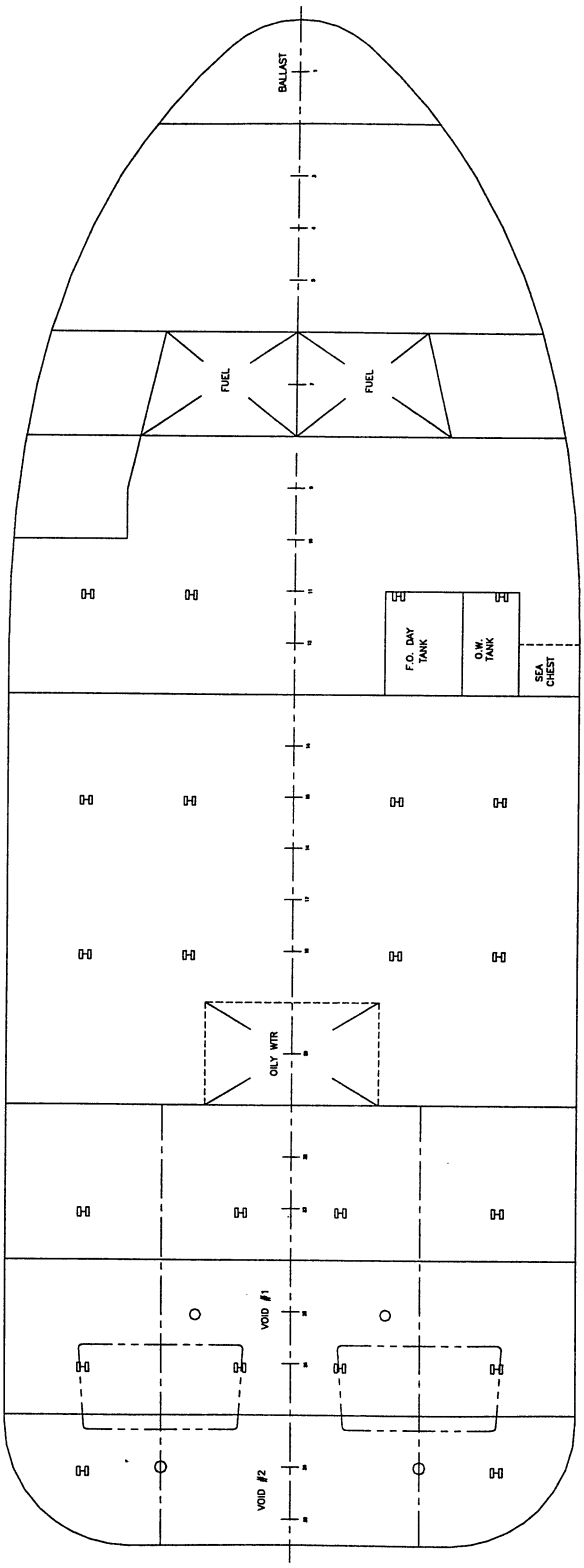


Figure 1-63. Anode Arrangement

CHAPTER 2

DIRECT SUPPORT (DS) MAINTENANCE INSTRUCTIONS

Chapter Index

Section I. Repair Parts, Tools, Special Tools, Test, Measurement, and Diagnostic Equipment (TMDE) 2-1
Section II. Direct Support Troubleshooting Procedures 2-1
Section III. Direct Support Maintenance Procedures 2-15

Section I.

REPAIR PARTS, TOOLS, SPECIAL TOOLS, TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE)

2.1. Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, or CTA 8-100, as applicable to your unit.

2.2. Special Tools, TMDE, and Support Equipment. For special tools and equipment, refer to Maintenance Allocation Chart (MAC) and Repair Parts and Special Tools List (RPSTL) TM55-1925-236-24P.

2.3. Repair Parts. Repair parts are listed and illustrated in Repair Parts and Special Tools List (RPSTL) TM 55-1925-236-24P.

2.4. Mandatory Replacement Parts. Reference should be made to Appendix D.

Section II.

DIRECT SUPPORT TROUBLESHOOTING PROCEDURES

2.5. General. This section provides information for identifying and correcting malfunctions that may develop while operating ST.

a. Before performing troubleshooting, read and follow all safety instructions found in the Warning Summary at the front of this manual.

b. This section cannot list all of the malfunctions/symptoms that may occur, nor all of the probable causes and corrective actions. If a malfunction/symptom is not listed, or is not corrected by the listed corrective actions, notify your supervisor. There are other malfunctions/symptoms that may occur to equipment listed in Table 2-1. These are related to topics that may be found by unit maintenance personnel.

c. When troubleshooting a malfunction/symptom:

(1) Find the troubleshooting procedure for the malfunction in question in Table 2-1. Headings at top of each page show how each troubleshooting procedure is organized: MALFUNCTION/SYMPTOM, PROBABLE CAUSE (in step number order), and TEST OR INSPECTION/CORRECTIVE ACTION.

(2) Perform in the order listed until the malfunction is corrected. DO NOT perform any maintenance task unless the troubleshooting procedure tells you to do so.

d. The columns in Table 2-1 are defined as follows:

1. MALFUNCTION. A visual or operational indication that something is wrong with the equipment.

a. PROBABLE CAUSE. A procedure that isolates the problem in a component or assembly.

(1) TEST OR INSPECTION/CORRECTIVE ACTION. A procedure to correct the problem.

Section II. Index

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Table 2-1. Direct Support (DS) Level Troubleshooting.

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.7 Fuel Oil Transfer Pump Motor Controller

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

NOTE

Before attempting any troubleshooting procedures, check to ensure that the appropriate breaker is not in the tripped position.

1. Controller will not start.

a. Heater(s) is/are blown(defective).

NOTE

To test controller while energized, ON-OFF switch must be in the OFF position to open controller door. With the door open, turn the ON/OFF switch activation rod to the ON position.

WARNING

High voltages present, extreme caution should be used during the following procedures which are to be performed with the power ON or else death or serious injury due to electrical shock could occur.

Using a volt/ohmmeter, check output terminals T1, T2, and T3 (of heaters) for 450-460V. If 450-460 V is not present on all heaters (terminals), check input side for 450-460V. If 450-460V present on input side, then replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter, check coil input terminals L1, L2, and L3 for 450-460V. If 450-460V is present check the output terminals of coil (T1, T2, and T3) for 450-460V. If 450-460V is not present then replace coil (refer to 2.20 in Direct Support level maintenance).

2. Pump tries to start but trips overload.

Defective pump or motor.

Remove shaft guards and attempt to rotate the pump motor shaft. If shaft is frozen then disassemble pump from motor (refer to 4.41 in unit level maintenance for procedures). Rotate motor and pump shaft independently to determine the faulty component. If the motor shaft is frozen then replace the motor. If the pump shaft is frozen then repair/replace the pump (refer to 4.41in unit level maintenance for procedures).

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.8 FIRE PUMP CONTROLLER

1. Fire pump will not start from the Pilot House but will start from the Tankage Space.

NOTE

Before attempting any troubleshooting procedures, check to ensure that the appropriate breaker is not in the tripped position.

Defective Start button.

Using volt/ohmmeter, check for continuity across start button leads. With start button depressed, meter should read "0". If high resistance reading is observed, then button is defective (refer to 4.44 in unit level maintenance).

2. Controller will not start.

a. Heater(s) is/are blown (defective).

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

Using volt/ohmmeter check output terminals T1, T2, and T3 (of heaters) for 450-460V. If 450-460V is not present on all heaters (terminals) check input side for 450-460V. If 450-460V is present on input side then replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2, and L3 for 450-460V. If 450-460V is present check output terminals T1, T2, and T3 of the coil for 450-460V. If 450-460V is present then replace coil (refer to 2.20 in Direct Support level maintenance).

c. Defective Transformer.

Using volt/ohmmeter check H1 and H4 for 450-460V. If 450-460V is present check X1 and X2 for 120V. If 120V is not present then replace transformer (refer to 2.20 in Direct Support level maintenance).

3. **Controller will not shut-off in Pilot House but will shut-off in Tankage Space.**

   Defective Stop button.

   WARNING

   High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

   Using volt/ohmmeter check for continuity across the stop button leads. With the stop button depressed, meter should read "0". If a high resistance reading is observed, then stop button is defective (refer to 4.44 in unit level maintenance).

4. **Controller will not shut-off in Tankage Space.**

   Defective Stop button.

   Using volt/ohmmeter check for continuity across the stop button leads. With the stop button depressed, meter should read "0". If a high resistance reading is observed, then stop button is defective (refer to 4.44 in unit level maintenance).

5. **Pump tries to start but continuously trips the overload.**

   Pump shaft frozen or motor defective.

   Replace pump or motor (refer to 4.42 in unit level maintenance for replacement procedures).

6. **Pump starts but runs at reduced efficiency.**

   a. Strainer is clogged by foreign debris.

      Check strainer and remove debris.

   b. Valve is not fully open (Discharge or Suction valve).

      Check all valves and ensure they are in open position.

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.9 BILGE/BALLAST PUMP CONTROLLER

NOTE

Before attempting any troubleshooting procedures, check to ensure that the appropriate breaker is not in the tripped position.

1. Controller will not start.

a. Heater(s) is/are blown (defective).

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

Using volt/ohmmeter check output terminals T1, T2 and T3 (of heaters) for 450-460V. If 450-460V is not present on all heaters (terminals) check input side for 450-460V. If 450-460V present on input side then replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2 and L3 for 450-460V. If 450-460V is present then check output terminals T1, T2, and T3 of the coil for 450-460V. If 450-460V is not present then replace coil (refer to 2.20 in Direct Support level maintenance).

2. Pump tries to start but continuously trips the overload.

Pump shaft frozen or motor defective.

Replace pump or motor (refer to 4.39 in unit level maintenance for replacement procedures).

3. Pump starts but runs at reduced efficiency.

a. Strainer is clogged by foreign debris.

Check strainer and remove debris.

b. Valve is not fully open (Discharge or Suction valve).

Check all valves and ensure they are in the open position.

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.10 GREY WATER PUMP CONTROLLER

NOTE

Before attempting any troubleshooting procedures, check to ensure that the appropriate breaker is not in the tripped position.

1. Controller will not start.

a. Heater(s) is/are blown (defective).

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

Using volt/ohmmeter check output terminals T1, T2, and T3 (of heaters) for 450-460V. If 450-460V is not present on all heaters (terminals) check input side for 450-460V. If 450-460V is present on input side replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2, and L3 for 450-460V. If 450-460V is present check output terminals of coil (T1, T2, and T3) for 450-460V. If 450-460V is present then replace coil (refer to 2.20 in Direct Support level maintenance).

c. Defective Start button.

Using volt/ohmmeter check for continuity across start button leads. With start button depressed the meter should read "0". If a high resistance reading is observed then the button is defective (refer to 4.44 in unit level maintenance).

d. Defective Transformer.

Using volt/ohmmeter check H1 and H4 for 450-460V. If 450-460V is present check X1 and X2 for 120V. If 120V is not present replace the transformer (refer to 2.20 in Direct Support level maintenance).

2. Controller will not shut-off.

Defective Stop button.

Using volt/ohmmeter check for continuity across stop button leads. With stop button depressed the meter should read "0". If a high resistance reading is observed then the button is defective (refer to 4.44 in unit level maintenance).

3. **Pump tries to start but continuously trips the overload.**

Pump shaft frozen of motor defective.

Replace pump or motor (refer to 4.43 in unit level maintenance for replacement procedures).

4. **Pump starts but runs at reduced efficiency.**

a. Strainer is clogged by foreign debris.

Check strainer and remove debris.

b. Valve is not fully open (Discharge and Suction valve).

Check all valves and ensure they are in the open position.

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.11 POTABLE WATER PRESSURE PUMP CONTROLLER

NOTE

Before attempting any troubleshooting procedures, check to ensure that the appropriate breaker is not in the tripped position.

1. Controller will not start in Auto Mode but will start in Hand Mode.

Defective Pressure Switch.

Replace Pressure Switch (refer to 3.35 in operator level maintenance for procedures).

2. Controller will not start in Hand or Auto Mode.

a. Heaters(s) is/are blown (defective).

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

Using volt/ohmmeter check output terminals T1, T2, and T3 of heaters for 450-460V. If 450-460V is not present on all heaters (terminals) check input side for 450-460V. If 450-460V is present on input side then replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2, and L3 for 450-460V. If 450-460V is present check output terminals T1, T2 and T3 of coil for 450-460V. If 450-460V is not present then replace coil (refer to 2.20 in Direct Support level maintenance).

c. Defective Transformer.

Using volt/ohmmeter check H1 and H4 for 450-460V. If 450-460V is present check X1 and X2 for 120V. If 120V is not present then replace transformer (refer to 2.20 in Direct Support level maintenance).

d. Defective Start button.

Using volt/ohmmeter check for continuity across start button leads. With start button depressed the meter should read "0". If a high resistance reading is observed then the button is defective (refer to 4.44 in unit level maintenance).

3. **Controller will not shut-off.**

Defective Stop button.

Using volt/ohmmeter check for continuity across stop button leads. With stop button depressed the meter should read "0". If a high resistance reading is observed then the button is defective (refer to 4.44 in unit level maintenance).

4. **Pump is inoperable.**

Pressure switch is out of adjustment.

Adjust pressure switch to desired high/low limit (refer to 3.35 in operator level maintenance for procedures).

5. **Pump runs but no water is available.**

a. Supply or Discharge valve is not fully open.

Open fully supply or discharge valve.

b. Potable water tanks are empty.

Fill potable water tanks.

6. **Pump tries to run but trips overload.**

Motor or pump is defective.

Replace pump or motor (refer to 4.40 in unit level maintenance for replacement procedures).

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.12 CAPSTAN CONTROLLERS

1. Capstan will not operate.

a. Breaker that powers safety switch is in OFF position.

Check breaker panel to ensure appropriate breaker is in ON position.

b. Safety switch is not in ON position.

Put safety switch in ON position.

c. Defective Start button (AFT) or Foot switch (FWD).

Using volt/ohmmeter check for continuity across start button leads. With the start button depressed or foot switch depressed the meter should read "0". If a high resistance reading is observed then the button or switch is defective (refer to 4.44 in unit level maintenance).

2. Controller will not start.

a. Heater(s) is/are blown (defective).

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

Using volt/ohmmeter check output terminals T1, T2, and T3 of heaters for 450-460V. If 450-460V is not present on all heaters (terminals) check input side for 450-460V. If 450-460V is present on input side then replace defective heater (refer to 2.20 in Direct Support level maintenance).

b. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2, and L3 for 450-460V. IF 450-460V is present check output terminals T1, T2, and T3 of the coil for 450-460V. If 450-460V is present then replace coil (refer to 2.20 in Direct Support level maintenance).

c. Defective Transformer.

Using volt/ohmmeter check H1 and H4 for 450-460V. If 450-460V is present check X1 and X2 for 120V. If 120V is not present then replace transformer (refer to 2.20 in Direct Support level maintenance).

3. Controller will not shut-off.

Defective Stop button.

Using volt/ohmmeter check for continuity across stop button leads. With stop button depressed meter should read "0". If a high resistance reading is observed then the button is defective (refer to 4.44 in unit level maintenance).

MALFUNCTION/SYMPTOM
PROBABLE CAUSE
TEST OR INSPECTION/CORRECTIVE ACTION

2.13 HYDRAULIC POWER UNIT CONTROLLER

1. Steering is inoperable from all locations.

a. Controller selector switch in OFF position.

Check selector switch and move to ON position.

b. Breaker panel is in OFF position.

Check breaker panel and move to ON position.

2. Controller will not start.

WARNING

High voltages present; before attempting any troubleshooting, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

a. Defective Coil.

Using volt/ohmmeter check coil input terminals L1, L2, and L3 for 450-460V. If 450-460V is present check output terminals T1, T2, and T3 of the coil for 450-460 V. If 450-460V is present then replace coil (refer to 2.20 in Direct Support level maintenance).

b. Defective Transformer.

Using volt/ohmmeter check H1 and H4 for 450-460V. IF 450-460V is present check X1 and X2 for 120V. If 120V is not present then replace transformer (refer to 2.20 in Direct Support level maintenance).

3. Controller motor starts but continues to trip.

a. Overload settings incorrect for motor amperage.

Set to correct amperage rating.

NOTE

Check name plate data on hydraulic motor to ensure proper settings of overloads.

b. Defective hydraulic motor or pump.

Remove shaft inspection cover and try to turn shaft. If shaft rotates then motor needs to be replaced. If shaft is frozen split pump and motor be removing motor mount bolts and remove motor by sliding forward. Attempt to rotate both the pump and motor shafts independently. If pump shaft is frozen then replace pump. If motor shaft is frozen then replace the motor (refer to TM# 55-1925-248-14&P).

Section III.

DIRECT SUPPORT MAINTENANCE PROCEDURES

Section III. Index

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2.18	Potable Water Pressure Tank	21
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2.20	Pump/Motor Controllers	27

2.14. General. Direct Support level maintenance instructions for vessel components and systems, as defined by the Maintenance Allocation Chart (MAC), are found in the references shown in the following.

2.15 BATTERY CHARGER.

This Task Covers: a. Replace

Tools: Electrician's Tool Kit

Equipment Condition: Isolated, de-energized and locked-out

Materials/Parts: Replacement Battery Charger

General Safety Instructions: See WARNING

a. Replace (Refer to Figure 2-1and Figure 2-2)

WARNING

High voltages present; before attempting any maintenance, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

(1) Turn appropriate selector switch (1) to the OFF position.

(2) Turn OFF corresponding breaker in breaker panel.

(3) Remove screw from front panel of defective battery charger and slide cover up.

(4) Remove and tag DC output leads (2) (right side) from charger.

(5) Remove and tag AC input leads (3) (left side) to charger.

(6) Remove four bolts from charger mounting bracket.

(7) Remove defective charger.

(8) Install new charger on mounting bracket using four bolts.

(9) Install AC input leads (3) as tagged.

WARNING

Ensure output leads are replaced as removed to ensure correct polarity.

(10)Install DC output leads (2) as tagged.

(11)Slide cover down and install cover screw in cover.

(12)Energize panel breaker.

(13)Turn appropriate selector switch (1) to ON position.

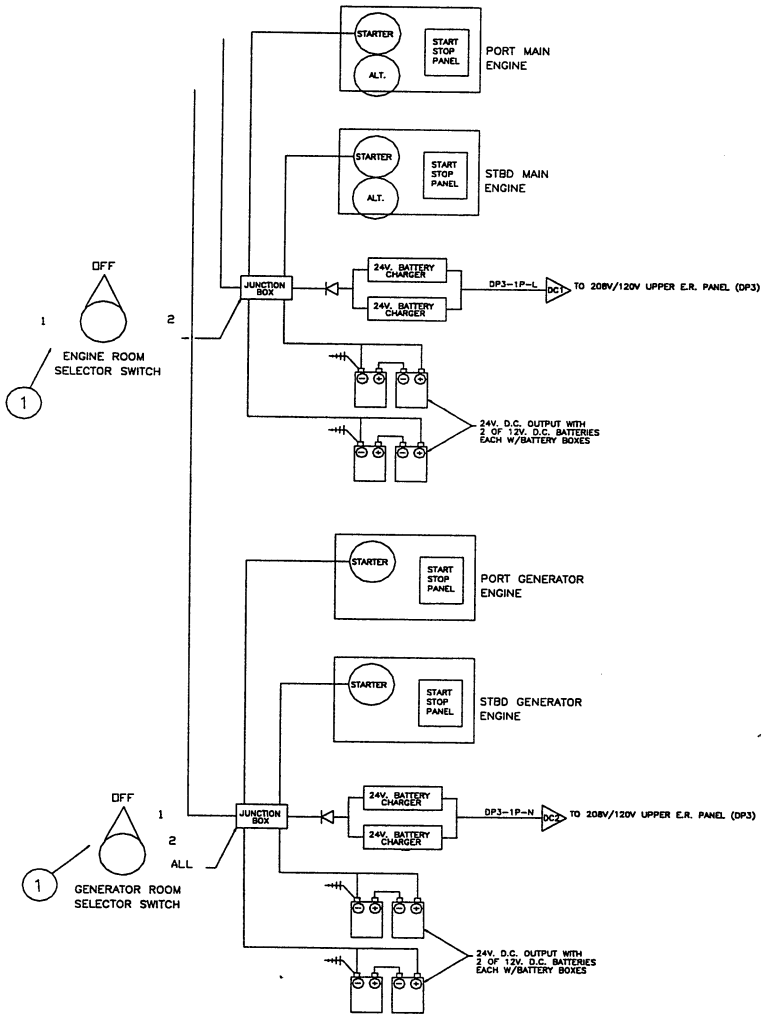

Figure 2-1. Battery Charger

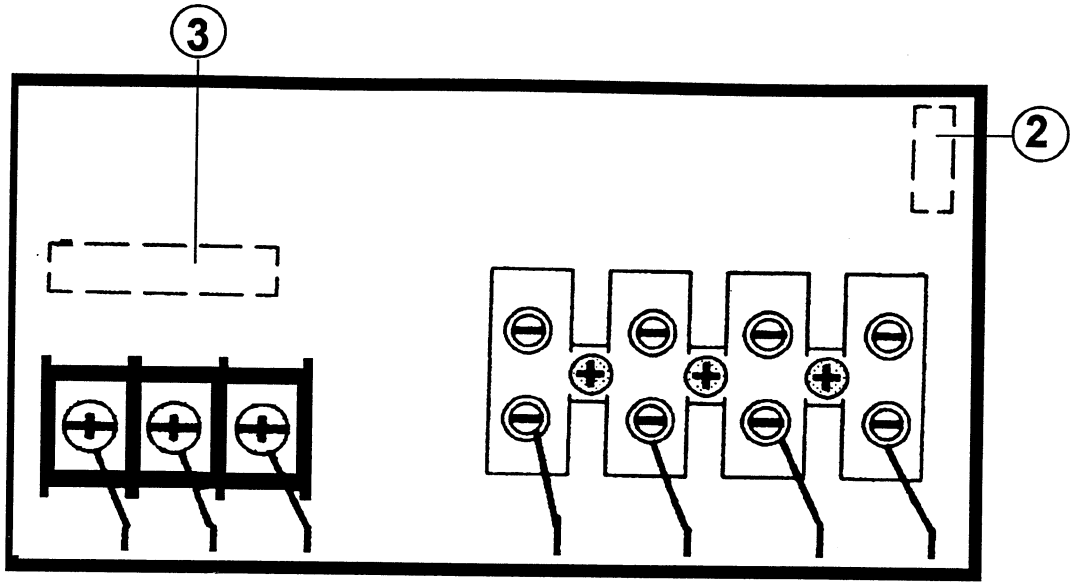

Figure 2-2. Battery Charger Fuses

2.16 DISTRIBUTION PANEL BREAKER.

This Task Covers: a. Replace

Tools: Electrician's Tool Kit

Equipment Condition: Isolated, de-energized and locked-out

Materials/Parts: Replacement breaker (as required)

General Safety Instructions: See WARNING

a. Replace

WARNING

High voltages present; before attempting any maintenance, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

(1) Turn off main switchboard supply breaker to applicable distribution panel.

(2) Tag and lock-out supply breaker.

(3) Remove distribution panel cover.

(4) Remove and tag leads to defective breaker.

(5) Remove (4) defective breaker mounting bolts.

(6) Remove defective breaker.

(7) Install new breaker using (4) breaker mounting bolts.

(8) Install leads as tagged.

(9) Install distribution panel cover.

(10) Energize panel and turn on supply breaker.

(11) Turn on new breaker and test for normal operation of equipment.

2.17 FLOCS PUMP.

This Task Covers: a. Replace b. Repair

Tools: General Mechanic's Tool Kit

Equipment Condition: Isolated, de-energized and locked-out

Materials/Parts: Replacement FLOCS Pump

General Safety Instructions: See WARNING

a. Replace (FLOCS Pump, Refer to Figure 2-2)

WARNING

High voltages present; before attempting any maintenance, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

(1) Turn off power to FLOCS pump system.

(2) Close suction and discharge valves.

(3) Remove switch box cover (1).

(4) Tag and disconnect all electrical leads.

(5) Remove flexible conduit from switch box (2).

(6) Remove switch box (2) from motor (3).

(7) Break union and rotate flow switch (4) 90^0 in the upwards position.

(8) Remove discharge piping and flow switch (4) from pump head.

(9) Remove suction piping and strainer (5) from pump.

(10) Remove pump motor mounting bolts from base of assembly.

(11) Remove pump and motor.

(12) Install new motor and pump assembly on mounting base.

(13) Install suction piping and strainer (5) on pump.

(14) Install discharge piping and flow switch (4) on pump head.

(15) Rotate flow switch (4) 90^0 in downward position to allow for installation of electrical connections.

(16) Install switch box (2) on motor (3).

(17) Install flexible conduit on switch box (2).

(18) Reconnect all electrical leads as tagged and install switch box cover (1).

(19) Open suction and discharge valves.

(20) Turn off power and test for proper operation.

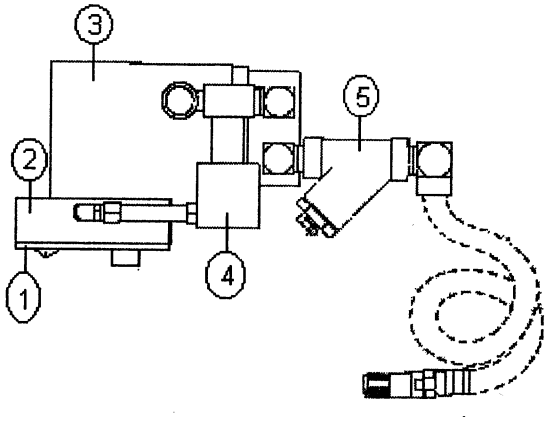

Figure 2-2. FLOCS Pump

b. Repair (Flow Switch Adjustment, Refer to Figure 2-3)

(1) Remove the black switch cover by loosening the two screws on the side and pull off the cover.

(2) If a small amount of oil remains in the crankcase after the pump shuts off, the adjusting screw should be turned counter-clockwise to decrease the sensitivity of the switch. DO NOT remove the screw completely or back it out so far as to cause interference with the replacement of the cover.

(3) If the pump stays on when no oil is flowing, the adjusting screw should be turned clockwise until the pump shuts off.

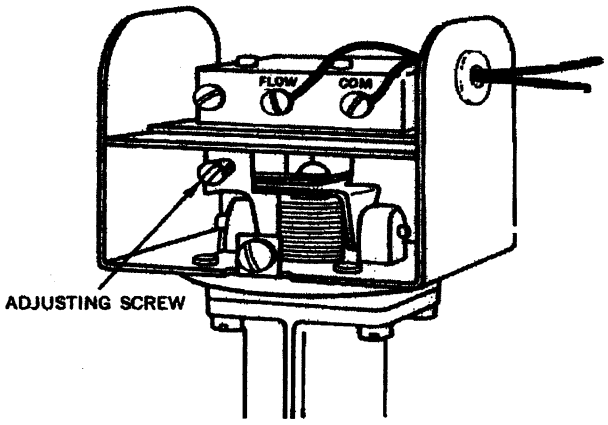

Figure 2-3. Flow Switch Adjustment (FLOCS)

b. Repair (Time Delay-Relay Switch Adjustment)

(1) To increase the time setting turn the adjusting screw clockwise.

(2) To decrease the time setting turn the adjusting screw counter-clockwise.

NOTE

A fraction of a turn will add or subtract 10-15 seconds time.

2.18 POTABLE WATER PRESSURE TANK.

This Task Covers: a. Replace

Tools: General Mechanic's Tool Kit

Pipe Wrench

Equipment Condition: Isolated, de-energized and locked-out

Materials/Parts: Replacement Tank

General Safety Instructions: See WARNING

a. Replace (Refer to Figure 2-4)

WARNING

High voltages present; before attempting any maintenance, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

(1) Turn off power to water system.

(2) Turn off the two valves to the hot water tank (1) and potable water tank (2).

(3) Turn off the power to the pump.

(4) Shut all valves (3); including the supply valves to the shower (3) located on the forward bulkhead overhead above the Bilge/Ballast controller.

(5) Drain the water from the pressure tank.

(6) Loosen the union (4) at the pressure tank.

NOTE

Some water remaining in the lines may drain out. If water under pressure is present stop procedure and check to ensure all valves are in the closed position.

(7) Remove the two bolts and retaining clamp from the top of the tank.

(8) Remove the tank from the mounting ring.

(9) Remove all piping from the defective tank (note configuration of piping).

(10)Install piping in new tank (note configuration of piping).

(11)Install new tank in mounting ring.

(12)Install retaining clamp and two bolts to top of tank.

(13)Connect union (4) to system piping.

(14)Open all valves (1,2, and 3).

(15)Turn on power to system.

(15)Turn on power to system.

(16)Adjust pressure switch if necessary (refer to 3.35 in operator level maintenance).

(17)Test for normal operation.

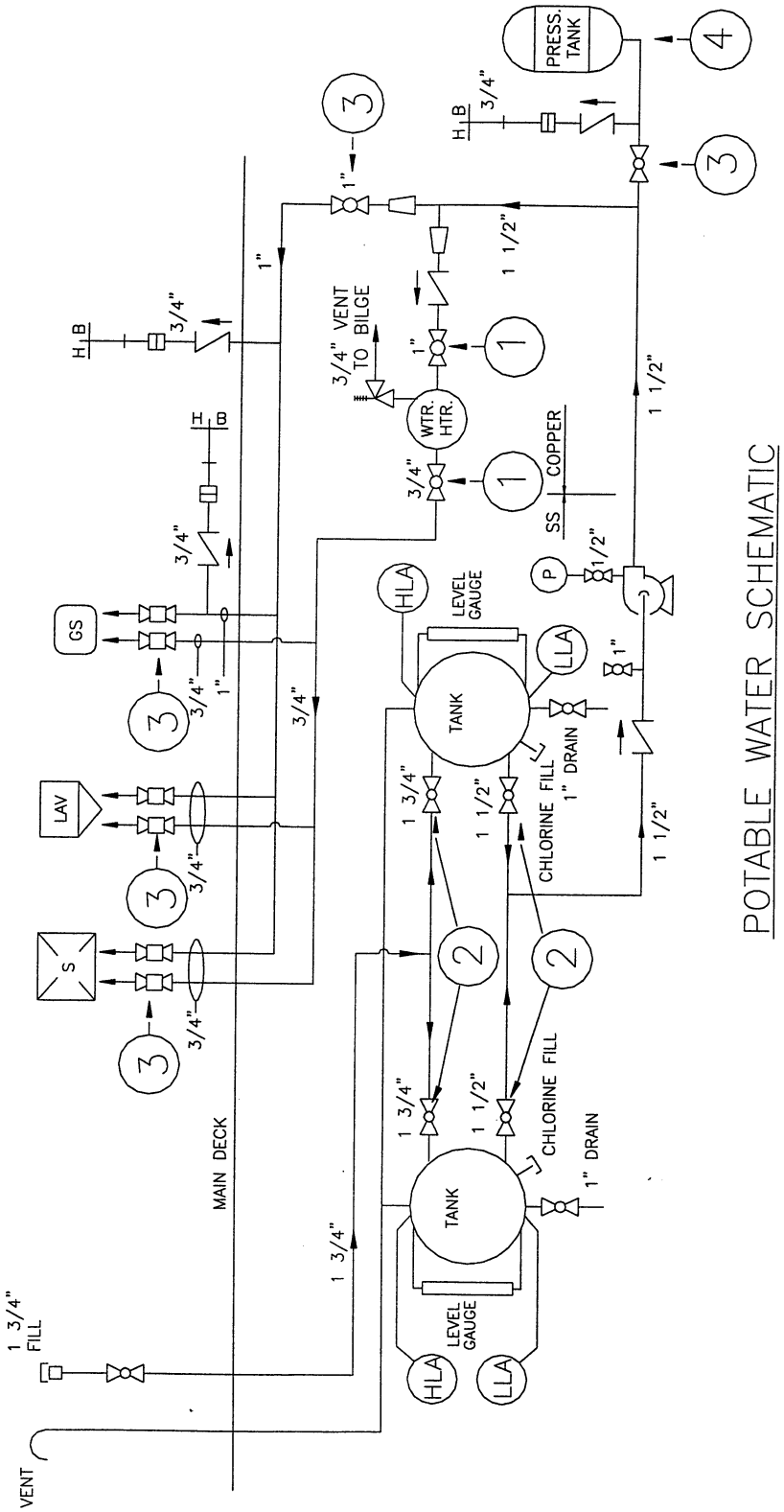

Figure 2-4. Potable Water Pressure Tank

2.19 WATER HEATER.

This Task Covers: a. Replace

Tools: General Mechanic's Tool Kit, Pipe Wrench

Equipment Condition: Isolated, de-energized, and locked-out

Materials/Parts: Replacement Water Heater

General Safety Instructions: See WARNING

a. Replace (Refer to Figure 2-5)

WARNING

High voltages present; before attempting any maintenance, ensure that power being supplied from distribution panel is turned off and locked out against unauthorized start-up or else death or serious injury could occur.

(1) Turn off power supply to water system and hot water heater.

(2) Close all valves (1, 2 and 3).

(3) Drain water heater tank by opening union at bottom of tank.

(4) Loosen union at top of tank on hot water supply side.

(5) Loosen union right above the hot water supply valve and remove that piece of piping.

(6) Loosen union at bottom of tank and at bottom of cold water supply valve and remove piping.

(7) Remove electrical cover.

(8) Tag and remove power leads.

(9) Remove safety pop-off drain line.

(10) Remove tank retaining clamp and two bolts.

(11) Remove defective tank.

NOTE

Additional piping may have to be removed in order to remove tank from mounting base.

(12) Install new tank in tank mounting ring.

(13) Line plumbing fittings on tank.

(14) Connect power leads and replace cover.

(15) Install supply piping to bottom of tank and tighten unions.

(16)Install discharge line to top of tank and to discharge piping and tighten unions.

(17)Install safety pop-off drain line.

(18)Install top retaining clamp with two bolts.

(19) Open all valves (1,2 and 3).

(20)Turn on power to the water system.

(21)Open hot water valve and bleed air from tank. When air is bleed, close valve.

(22)Turn on power to hot water heater.

(23)Test system for normal operation.

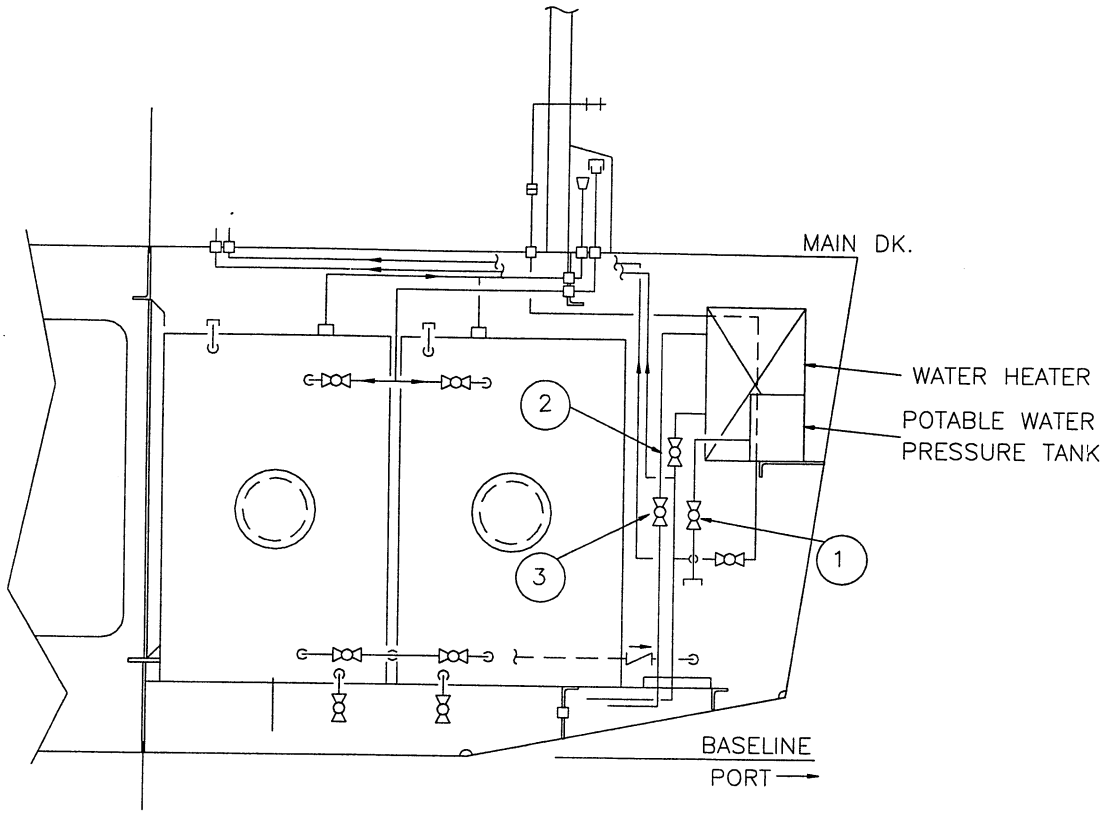

Figure 2-5. Water Heater Schematic

2.20 PUMP/MOTOR CONTROLLERS.

This Task Covers: a. Repair b. Replace

Tools: Electrician's Tool Kit

Equipment Condition: Isolated, de-energized, and locked-out

Materials/Parts: Replacement Controller or Components

General Safety Instructions: See WARNING

a. Repair (by replacement) (Refer to Figure 2-6)

WARNING

Before attempting any maintenance to the controller, ensure that the power supply has been disconnected and locked out against unauthorized accidental start-up or else death or bodily injury could occur.

1. Replace Heater.

   (a) Turn off power and lockout power supply to defective controller at power distribution panel.

   (b) Place controller in OFF position. Using volt/ohmmeter, test for power at power leads (line-side of controller; L1, L2, L3) and confirm controller is de-energized.

   (c) Disconnect and tag all wiring from defective heater to ensure proper re-installation.

   (d) Remove mounting screws (1) from defective heater.

   (e) Remove defective heater.

CAUTION

Ensure that replacement heater has the same rating as defective heater or damage to equipment could occur.

   (f) Install new heater with mounting screws (1).

   (g) Connect all wiring to proper contacts as tagged during removal.

   (h) Turn on controller at panel; turn on power to controller and test for proper operation.

2. Replace Coil (Item 2).

   (a) Turn off power and lockout power supply to defective motor controller at power distribution panel.

   (b) Place controller in OFF position. Using volt/ohmmeter, test for power at power leads (line-side of controller; L1, L2, L3) and confirm controller is de-energized.

   (c) Disconnect and tag all wiring from defective coil (2) to ensure proper re-installation.

   (d) Remove coil mounting screws (3) and defective coil (2).

CAUTION

Ensure that replacement coil has the same rating as defective coil or damage to equipment could occur.

(e) Install new coil (2) and secure with mounting screws (3).

(f) Connect all electrical leads to new coil as tagged during removal.

(g) Turn on controller at panel; turn on power to controller and test for proper operation.

3. Replace Controller Transformer (Item 4).

(a) Turn off power and lockout power supply to defective motor controller at power distribution panel.

(b) Place controller in OFF position. Using volt/ohmmeter, test for power at power leads (line-side of controller; L1, L2, L3) and confirm controller is de-energized.

(c) Disconnect and tag all wiring leads from controller transformer to ensure proper re-installation.

(d) Remove four mounting screws (5) and remove defective controller transformer (4).

CAUTION

Ensure that replacement transformer has the same rating as defective transformer or damage to equipment could occur.

(e) Install new/replacement controller transformer (4) with four mounting screws (5).

(f) Connect all wiring leads to controller transformer as tagged during removal.

(g) Turn on controller at panel; turn on power to controller and test for proper operation.

4. Replace Controller (Item 6)

(a) Turn off power and lockout power supply to defective motor controller at power distribution panel.

(b) Place controller in OFF position. Using volt/ohmmeter, test for power at power leads (line-side of controller) and confirm controller is de-energized.

(c) Disconnect and tag all external wiring leads to defective controller to ensure proper re-installation.

(d) Remove power leads from defective controller box.

(e) Remove mounting screws (7) from controller mounting brackets and remove defective controller (6).

CAUTION

Replacement controller must be configured identically to defective controller being removed or else damage to equipment could occur.

(f) Install new/replacement controller (6) to mounting bracket using mounting screws (7).

(g) Feed power leads into controller and connect all wiring leads as tagged during removal.

(h) Turn on controller at panel.

(i) Turn on power at controller and test for proper operation.

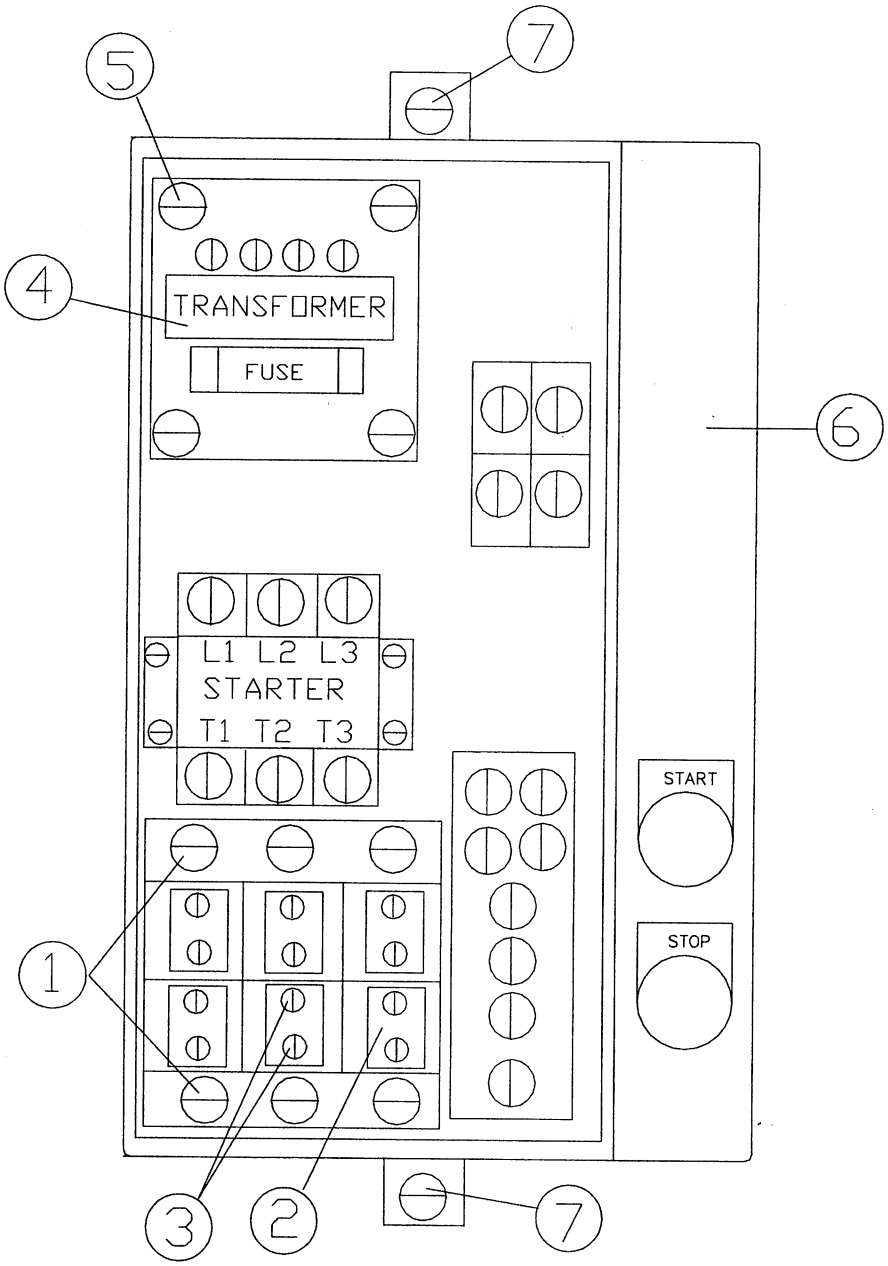

Figure 2-6. Typical Internal Components of Pump/Motor Controller

CHAPTER 3

GENERAL SUPPORT (GS) MAINTENANCE INSTRUCTIONS

Chapter Index

Section I.	Repair Parts, Tools, Special Tools, Test, Measurement, and Diagnostic Equipment (TMDE)	3-1
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Section I.

REPAIR PARTS, TOOLS, SPECIAL TOOLS, TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (TMDE)

3.1. Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, or CTA 8-100, as applicable to your unit.

3.2. Special Tools, TMDE, and Support Equipment. For special tools and equipment, refer to Maintenance Allocation Chart (MAC) and Repair Parts and Special Tools List (RPSTL) TM55-1925-236-24P.

3.3. Repair Parts. Repair parts are listed and illustrated in Repair Parts and Special Tools List (RPSTL) TM 55-1925-236-24P.

3.4. Mandatory Replacement Parts. Reference should be made to Appendix D of this manual.

Section II.

GENERAL SUPPORT (GS) LEVEL TROUBLESHOOTING

General Support Troubleshooting

The MAC identifies no General Support Troubleshooting tasks for components outside of those provided in Department of the Army Technical Manuals (Defined in Appendix A).

Section III.

GENERAL SUPPORT (GS) MAINTENANCE PROCEDURES

General Support Maintenance

The MAC identifies no General Support Maintenance tasks for components outside of those provided in Department of the Army Technical Manuals (Defined in Appendix A).

APPENDIX A

REFERENCES

A-1. SCOPE. This appendix lists all forms, field manuals, technical manuals and miscellaneous publications referenced in this manual and/or required for operation and maintenance.

A-2. FORMS.

Recommended Changes to Publications and Blank Forms ..... DA Form 2028
Recommended Changes to Equipment Publications and Blank Forms ..... DA Form 2028-2
The Army Maintenance Management System (TAMMS-A) ..... DA Pam 738-750
Product Quality Deficiency Report ..... SF 368
Warranty Information Logbook ..... DA Form 2408-9
Equipment Inspection and Maintenance Worksheet ..... DA Form 2404
Modified Table of Organization and Equipment ..... MTOE

A-3. FIELD MANUALS.

First Aid For Soldiers..... FM 21-11

A-4. TECHNICAL MANUALS.

Preservation of Vessels for Storage.....TB 740-97-4
Preposition Watercraft Preservation & Activation Procedures..... TB55-1900-231-15
Storage of Army War Reserve and Materiel Prepositioned Afloat TM 38-470
Operation and Maintenance Manual for Alarm Panels for Tank Level, Bilge Level, Carbon Monoxide and Watertight Doors ..... TM55-1925-246-14&P
Operation and Maintenance Manual for Main Generator Switchboard ..... TM55-1925-247-14&P
Operation and Maintenance Manual for Electro-Hydraulic Steering System ..... TM55-1925-248-14&P
Operation and Maintenance Manual for Manual Control Searchlight, Navigational Aids/Equipment.....TM55-1925-249-14&P
Operation and Maintenance Manual for Propulsion Plant ..... TM55-1925-250-14&P
Operation and Maintenance Manual for Oily Water Separator System ..... TM55-1925-251-14&P
Operation and Maintenance Manual for Heating, Ventilation and Air Conditioning System..... TM55-1925-252-14&P
Operation and Maintenance Manual for Marine Generator Set..... TM55-1925-253-14&P
Operation and Maintenance Manual for CO2 Fire Suppression System and Fire Alarm System..... TM55-1925-254-14&P
Operation and Maintenance Manual for Communication Equipment ..... TM55-1925-255-14&P
Operation and Maintenance Manual for Capstans and Winches..... TM55-1925-256-14&P
Operation and Maintenance Manual for Incinerator Toilet/Urinal, Galley Equipment, Electric Water Heater ..... TM55-1925-257-14&P

APPENDIX B.

EXPENDABLE AND DURABLE ITEMS LIST

SECTION I. INTRODUCTION

B -1. Scope. This appendix lists expendable/durable supplies and materials required to operate and maintain the ST.

B -2. Explanation of Columns.

Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material.

Column 2 - Level. This column identifies the lowest level of maintenance that requires the listed item.

C ..... Operator/Crew
O ..... Organizational Maintenance
F ..... Direct Support Maintenance
H ..... General Support Maintenance

Column 3 - National Stock Number (NSN). This is the standard National Stock Number assigned to the item.

Column 4 - Description. Indicates the Federal Item Name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parenthesis followed by the part number.

Column 5 - Unit of Measure (U/I). This column indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr, etc.).

SECTION II. EXPENDABLE AND DURABLE ITEMS LIST

ItemNumber	Level	NSN	Description	U/I
1	C	000826108	APRON,RUBBER,CHEM PROTECTION	EA
2	C	002815911	BASKET, WASTE PAPER	EA
3	C	000503280	BATTERY DRY,EMERGENCY LIGHT,6V	EA
4	C	008357210	BATTERY, FLASHLIGHT,SIZE D,ALK	PG
5	C	001000413	BATTERY, RING BUOY LIGHT	EA
6	C	006353824	BATTERY,FILLER,JUG TYPE,74-4	EA
7	C	011342531	BATTERY,STOR,ENGINE START,12V	EA
8	C	002918305	BROOM, UPRIGHT, CORN(12PERU/1)	EA
9	C	002672967	BROOM,RATTAN,16"(6PERU/1)SZ 11	EA
10	C	007725800	BRUSH, SANITARY, (12 PER U/1)	EA
11	C	002407174	BRUSH, SCRUB (36 PER U/1)	EA
12	C	002433407	BRUSH, SWEEPING, 18"(12PERU/1)	EA
13	C	002406358	BRUSH,DUSTING,BENCH,(12PERU/1)	EA
14	C	002915815	BRUSH,WIR,CURV HANDL(12PER UA)	EA
15	C	002930263	BRUSH,WIR,ROTARY WHL,1/2"ARBOR	EA
16	C	001600438	CAN, GARBAGE	EA
17	C	002405503	CLIP BOARD	EA
18	C	005764934	CURTAIN, SHOWER, 48" X 72"	EA
19	C	008804454	DISHWASHING COMPOUND, HAND	BX
20	C	008106396	DISINFECTANT (FOOD SERVICE)	DZ
21	C	002248308	DUST PAN	EA
22	C	002666432	GLOVES, BATTERY SVC CHEM PROTE	PR
23	C	006344658	GLOVES, CABLE HANDLING	PR
24	C	002687859	GLOVES, WELDERS	PR
25	C	012679661	GLOVES,ANTI-FLASH	EA
26	C	013357903	GLOVES,FIRE FIGHT,MEDIUM,LARGE	EA
27	C	013357904	GLOVES,FIRE FIGHT,MEDIUM,X-LRG	EA
28	C	013357902	GLOVES,FIRE FIGHTERS, MEDIUM	EA
29	C	001906432	GOGGLE,IND,NO VENTS(CHEM SPLAS	EA
30	C	013288268	GOGGLE,SAFETY,WIND,DUST SAND	EA
31	C	001906432	GOGGLES, BATTERY SERVICE	EA
32	C	000523776	GOGGLES,IND,PLASTIC SAFETY	PR
33	C	002875419	GUN,FLUID,DIR DELIVERY,30 OZ.	EA
34	C	002244111	HAMMER HAND, 1 LB.	EA
35	C	008925485	HAMMER,HAND CARPENTER, 1 LB.	EA
36	C	002432957	HAMMER,HAND,SLEDGE,10 LB.	EA
37	C	001906442	HAMMER,PNEUMATIC, PORTABLE	EA
38	C	002630328	HANDL,ACME THRD END (12PERU/1)	EA
39	C	001415452	HANDL,CIRC TAP END (12PER U/1)	EA
40	C	002051170	HANDLE, MOP, WOOD (12 PER U/1)	EA
41	C	002937874	HOSE ASSY,NONMETALL,1/2FTX50FT	EA
42	C	002026482	HOSE ASY,NONMET WAT,3/4FTX50FT	EA
43	C	012206648	HOSE,DSCHG 4"X50FT,F/P-250PUMP	EA
44	C	007760657	HOSE,EXH,ENGIN,2FTID X 20FT LG	EA
45	C	011310249	HOSE,FIR1-1/2FTX50,ORG,40ND615	EA
46	C	012488822	HOSE,PORT WAT,1-1/2FTX50,BLUE	EA
47	C	007259234	HOSE,SUCT,3"IDX10FTLG,592223	EA
48	C	001611150	LID, CAN, GARBAGE	EA

EXPENDABLE AND DURABLE ITEMS LIST-CONTINUED

ItemNumber	Level	NSN	Description	U/I
49	C	001711148	MOPHEAD, COTTON	EA
50	C	005303770	PAPER, TOILET	BX
51	C	002050442	POWDER, SCOURING	CN
52	C	002051711	RAG, WIPING, 50 LB BALE	BE
53	C	010124093	SANITIZER TEST KIT(CHLOR,IODIN	KT
54	C	001290803	SOAP, TOILET, SALT WATER	BX

APPENDIX C.
ILLUSTRATED LIST OF MANUFACTURED ITEMS

This section does not apply.

APPENDIX D.

MANDATORY REPLACEMENT PARTS

This Appendix is not applicable to the Small Tug system manual. However, mandatory replacement parts may be required when maintenance is performed on vessel equipment. These parts, if required, will be identified in the individual equipment technical manuals accompanying the vessel.

APPENDIX E.

TORQUE VALUES

Introduction

Bolt torquing should be accomplished within equipment manufacturer's recommendations.

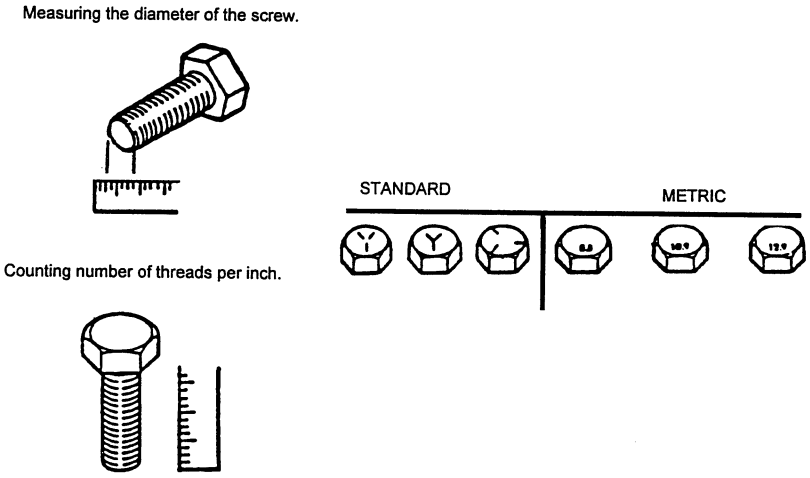
NOTE

The torque tables provided below should be used only in the absence of official manufacturer's recommendations.

In the absence of manufacturer's instructions, follow the procedures below:

a. Measure the diameter of the screw and count the number of threads per inch or use a pitch gauge. See Figure E-1.

Figure E-1. Measuring Bolt Sizes



b. Use the diameter and number of threads to find the bolt size in the table.

c. To find the grade screw you are installing, match the markings on the head to the correct picture of Capscrew Head Markings shown in Figure E-2.

d. Look down the column under the grade until you find the torque limit for the diameter and threads per inch of the screw you are installing.

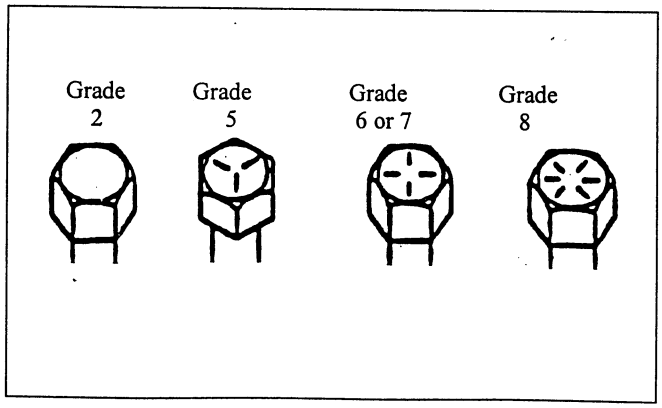


Figure E-2. Bolt Grades

Table E-1. Torque Table 1

Bolt Size	18-18 Stainless Steel	Brass	Silicon Bronze	Aluminum 2024 T4	316 Stainless Steel	Monel	Nylon*
	In.-Lbs.	In.-Lbs.	In.-Lbs.	In.-Lbs.	In.-Lbs.	In.-Lbs.	In.-Lbs.
2-56	2.5	2.0	2.3	1.4	2.8	2.5	.44
2-64	3.0	2.5	2.8	1.7	3.2	3.1	
3-48	3.9	3.2	3.6	2.1	4.0	4.0	1.19
3-56	4.4	3.5	4.1	2.4	4.6	4.5	
4-40	5.2	4.3	4.8	2.9	5.5	5.3	2.14
4-48	6.5	5.4	6.1	3.6	6.9	6.7	4.3
5-40	7.7	6.3	7.1	4.2	8.1	7.8	5.61
5-44	8.4	7.7	8.7	5.1	9.8	9.5	8.2
6-32	9.6	7.9	8.9	5.3	10.1	9.8	16.0
6-40	12.1	9.9	11.2	8.6	12.7	12.3	20.8
8-32	19.5	16.2	18.4	10.8	20.7	20.2	34.9
8-36	22.0	18.0	20.4	12.0	23.0	22.4	
10-24	22.5	18.6	21.2	13.8	23.8	25.9	
10-32	31.7	25.9	29.3	19.2	33.1	34.9	
¼" –20	75.2	61.5	68.8	45.6	78.6	85.3	
¼" –28	94.0	77.0	87.0	57.0	99.0	106	
3/16" –16	132	107	123	80	138	149	
3/16" –24	142	116	131	86	147	160	
3/8" –16	238	192	219	143	247	268	
3/8 –24	259	212	240	157	271	294	
7/16'-14	376	317	349	228	393	427	
7/16'-20	400	327	371	242	418	451	
½" –13	517	422	480	313	542	584	
½" –20	541	443	502	326	565	613	
9/16"-12	632	558	632	415	713	774	
9/16-18	752	6515	697	486	787	855	
5/8"-11	1110	907	1030	715	1160	1330	
5/8"-16	1244	1018	1154	796	1301	1492	
¾"-10	1530	1249	1416	980	1582	1832	
¾"-16	1490	1220	1382	958	1556	1790	
7/8"-9	2328	1905	2140	1495	2430	2775	
7/8"-14	2378	1895	2130	1490	2420	2755	
1" –8	3440	2815	3185	2205	3395	4130	
1"-14	3110	2545	2685	1995	732	3730	
	Ft.–Lbs.	Ft.–Lbs.	Ft. – Lbs.	Ft. –Lbs.	Ft. –Lbs.	Ft. – Lbs.	
1 1/8"-7	431	413	383	265	432	499	
1 1/8"-12	390	390	361	251	408	470	
1 ¼" –7	523	523	485	336	546	627	
1 ¼" –12	4810	490	447	306	504	575	
1 ½"-5	588	588	822	570	930	1054	
1 ½" -12	703	703	851	450	732	840	

Table E-2. Torque Table 2

Fastener	Grade Designation	Minimum Tensile Strength	Material	SCREW, STUD, OR BOLT DIAMETER															
				6	**8**	**10**	**1/4**	**5/16**	**3/8**	**7/16**	**1/2**	**9/16**	**5/8**	**3/4**	**7/8**	**1**	**1 1/8**	**1 1/4**	**1 3/8**	**1 1/2**
Cap Screw	SAE 2 ASTM A307	64,000 psi	Low Carbon Steel				6	11	19	30	45	66	93	150	202	300	474	659	884	1057
Cap Screw	SAE 5 ASTM A449 GR5	105,000 psi	Medium Carbon Steel or Low Alloy Heat Treated				9	18	31	50	75	110	150	250	378	583	782	1097	1461	1748
Cap Screw	ASTM A325	150,000 psi	Medium Carbon Alloy Quenched Tempered								100		200	355	525	790	1060	1495	1960	2600
Cap Screw	SAE J429 GR8	150,000 psi	16-6				13	28	46	75	115	165	225	370	591	893	1410	1964	2633	3150
Cap Screw	ASTM A364-BD A490		316 Series						55	90	138	198	270	444	709	1071	1692	2360	3159	3780
Cap Screw and Machine Screw	Stainless Steel		CU63 ZN37	9.6 in-lbs.	20 in-lbs.	23 in-lbs.	75 in-lbs.	132 in-lbs.	20 in-lbs.	31	43	57	92	124	194	259	390	480		703
Cap Screw and Machine Screw	Stainless Steel	50,000 psi	1010 Etc. Not Heat Treated	10 in-lbs.	21 in-lbs.	24 in-lbs.	79 in-lbs.	138 in-lbs.	21 in-lbs.	33	45	59	97	130	202	271	408	504		732
Cap Screw and Machine Screw	Yellow Brass	55,000 psi		8 in-lbs.	16 in-lbs.	19 in-lbs.	62 in-lbs.	107 in-lbs.	16 in-lbs.	26	35	47	76	102	158	212	318	394		575
Machine Screw	Steel			11 in-lbs.	20 in-lbs.	32 in-lbs.	75 in-lbs.	140 in-lbs.												

Note: The torque values listed in this table are for permanent fastenings on steel structures.
Torque figures are in foot pounds unless otherwise noted.

GLOSSARY

SECTION I. ABBREVIATIONS

#	Number
%	Percent
°	Degrees
@	At
'	Feet
"	Inches
A	Amps
AC	Alternating Current
BHP	Brake Horsepower
BIIL	Basic Issue Items List
BTU	British Thermal Units
C	Centigrade/Celcius
CFM	Cubic Feet Per Minute
CL	Centerline
CO_2	Carbon Dioxide
COTS	Commercial Off-The-Shelf Manual
CPC	Corrosion Prevention and Control
CU-FT	Cubic Feet
DA	Department of the Army
DE	Diesel Engine
DP	Distribution Panel
EIR	Equipment Improvement Recommendation
F	Fahrenheit
FLO/FLO	Float On/Float Off
FLOCS	Fast Lube Oil Change System
FM	Frequency Modulated
FPM	Feet Per Minute
FS	Fire Station
Ft	Feet
FWD	Forward
GAL	Gallon
GPM	Gallons Per Minute
GPM	Gallons Per Minute
GPS	Global Positioning System
HP	Horsepower
HR	Hour
HVAC	Heating, Ventilation, and Air Conditioning
KVA	Kilo Volt Ampere
KW	Kilo Watt
LB	Pound
LIT	Liter
LP	Lighting Panel
LPM	Liters Per Minute
LRU	Lowest Replaceable Unit
MAC	Maintenance Allocation Chart
MM	Millimeter
NBC	Nuclear, Biological, and Chemical
No	Number
PA	Public Address
PMCS	Preventive Maintenance Checks and Services

SECTION I. ABBREVIATIONS-CONTINUED

PPM	Parts Per Million
PSF	Per Square Foot
PSI	Pounds Per Square Inch
PWR	Power
RPM	Revolutions Per Minute
STBD	Starboard
TEFC	Totally Enclosed Fan Cooled
UL	Underwriter's Laboratories
V	Volts
VAC	Volts Alternating Current
VDC	Volts Direct Current
VHF	Very High Frequency
W	Watts
W/	With
WOT	Wide Open Throttle

SECTION II. DEFINITIONS

Aft	Near or at the stern
Amidships	In the center, the center portion of the vessel
Ballast	Additional weight placed low in the hull to improve stability, may be either internal or external.
Beam	The width of a vessel
Bilge	The lowest portion of a vessel's interior hull
Bitt	A strong post on the deck, bow or stern, to which anchor, mooring, or towing lines may be fastened
Bow	The forward part of the vessel
Bulkhead	A transverse wall in the hull; the interior compartmentalization of the hull; may be watertight
Capstan	A vertical winch on deck, used for hauling anchor line and so forth
Chock	A rigging fitting, essentially shape like a "U" or an "O", normally mounted on the deck or in the toe rail to control a rigging or mooring line
Coaming	A raised edge, as around part or all of a hatch that prevents seawater from entering the vessel
Fender	A cushioning device hung between a vessel and a pier or other vessel
Galley	The kitchen on a vessel
Hatch	A deck opening providing access to the space below
Holding Tank	Storage tank for wastewater, slop oil, or sewage so that it will not be discharged overboard
Inboard	Toward the center of the vessel
Mooring	Permanent ground tackle
Outboard	Opposite or away from a vessel's hull ; opposite of inboard
Port	Left side of the vessel looking forward
Scupper	Drain holes on deck, in the toe rail, or in bulwarks, or (with drain pipes) in the deck itself
Sheave	A grooved wheel or pulley over which rope or rigging wire runs
VHF Radio	A very high frequency electronic communications and direction finding system
Windlass	A special form of winch, a rotating drum device for hauling a line or chain

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. APD V4.00

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

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These are the instructions for sending an electronic 2028

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17, and 27.

From: "Whomever" <whomever@avma27.army.mil>
To: **amsta-ac-nml@ria.army.mil**

Subject: **DA Form 2028**

1. ***From:*** Joe Smith
2. **Unit:** home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 55-2840-249-23
9. ***Pub Title:*** TM
10. ***Publication Date:*** 04-JUL-85
11. **Change Number:** 7
12. **Submitter Rank:** MSG
13. ***Submitter FName:*** Joe
14. **Submitter MName:** T
15. ***Submitter LName:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. **Page:** 1
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. ***Text:***

This is the text for the problem below line 27.

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
1 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
1 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 temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN: 077637-000